THE RELATIONSHIP OF TEACHER QUALITY AND STUDENT ACHIEVEMENT IN ELEMENTARY SCHOOLS FROM THE NEW YORK CITY

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Presented to the Faculty of the College of Education
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In Educational Leadership

By
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This dissertation, written by

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Submitted to the Faculty of TUI University in partial fulfillment of the requirements for the degree of

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BIOGRAPHICAL SKETCH

Roberto Alvarez earned a Bachelor degree in Business Administration from San Simon University (1989), a Professional Diploma in Social Projects Management from CESU (1991), a Master degree in International Commerce from NUR University (1998) and a Master Degree in Higher Education from San Simon University (2002).

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DEDICATION

I dedicate this dissertation to my wife Raquel and my children Paola, Andres and Noelia. They encouraged me to take the time to complete the process not only by giving me love and support, as I moved to achieve this important goal in my life, but also by sacrificing family time for me.

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LIST OF ABBREVIATIONS

USDOE – United States Department of Education

NCES – National Center for Education Statistics

NYCDOE – New York City Department of Education

NBPTSC – National Board for Professional Teaching Standard Certification

SASS – Schools and Staffing Survey

EB – Educational Background

CT – Certification and Training

PD – Professional Development

ELA – English Language Arts

SA – Student Achievement

SD – Standard Deviation

UC – Unstandardized Coefficient

SC – Standardized Coefficient

CS – Correlational Statistics

ABSTRACT

THE RELATIONSHIP OF TEACHER QUALITY AND STUDENT ACHIEVEMENT IN ELEMENTARY SCHOOLS FROM THE NEW YORK CITY

The present study sought to examine the relationship between teacher quality and student achievement in public elementary schools in a community district school of the New York City. It has 23 elementary schools, more than 7,600 students and around 350 teachers. For this study, participants consist of a sample of 117 full-time teachers who were working in third, fourth and fifth grade during the 2006-2007 school year.

By recognizing the link between quality teaching and student achievement, this study addressed the broad question: “What is the relationship between teacher quality and student achievement?” Methodologically, data collection was based on a standardized questionnaire developed by the National Center for Education Statistics (NCES). The survey used here was adapted by the researcher to explore three specific teacher quality characteristics: educational background, certification & training status, and professional development programs.

This study was designed to test the Total Quality Management (TQM) theoretical propositions relating quality inputs to quality outputs. Data analysis and the relationship between quality teaching and student achievement were examined through two main statistical tests: the multivariate analysis of variance (MANOVA) and the multiple regression analysis tests.

As this study attempted to explain how observable teacher characteristics are related to the student achievement, this study concluded that some observable teacher quality characteristics such as the educational background, certification & training status and professional development activities are significantly related to the student achievement.

Particularly, this study verified that teachers' educational background characteristics such as highest degree earned, major field of study and the pre-teaching tests are significantly related to the student achievement. In the same way, this study confirms that teachers' certification area is significantly related to the student achievement.

Also, this study confirms that teachers' professional development components such as participation in professional development activities, support received, rewards gained and collaboration activities are statistically related to the student achievement in Math and ELA test.

As these findings are consistently constructed based on rigorous statistical analysis, they could have important and practical implications. In effect, such information can be particularly valuable in guiding policies regarding how to hire, whom to reward, to retain the best teachers and how to distribute available teachers across schools and classrooms. Furthermore, they could guide strategic decisions, mostly those referred to implement policies to improve teacher quality as well as other education policies to motivate high-quality teaching in elementary schools.

CHAPTER 1: INTRODUCTION

The main purpose of this study was to analyze the relationship between teacher quality and student achievement in elementary schools. According to the United States Department of Education (USDOE) "The nation's economic and social health depends on the quality of its schools. If students are not taught the values and social skills necessary to be economically productive then the schools have not succeeded in their mission" (USDOE, 2000, p. 3). This is the main reason why a structural reform such as No Child Left Behind (NCLB) Act, signed into law by president George Bush on January 8, 2002, became a major issue in school improvement movements. Researchers and school leaders widely agree that teacher quality is a major issue in the current movement of education reforms and school improvement (USDOE, 2003). Accordingly, in recent years, the topic of teacher quality has continued to attract the attention of not only researchers but also of educators' professional organizations and policymakers.

Although literature about teacher quality is really broad there is a little consensus regarding its precise definition. Some definitions have a preferred focus on teacher qualifications, others on the teaching processes and still others on the school environment where the teacher works, among other approaches.

In this study, teacher quality concept refers to a professional who recognizes the students' educative needs, possesses specific teaching skills and knows how to assist student learning needs. In this sense, observable characteristics, such as educational background, certification & training status, and professional development activities, were identified as reliable indicators of quality teacher characteristics (USDOE, 2004).

Although teacher quality is a critical factor to assess education quality, many of these research and the USDOE's reports, focused attention on student achievement as a direct result of

teacher performance. In effect, over the years, numerous studies have been conducted in an effort to examine the relationship between teacher quality characteristics and student achievement considering this variable as a final outcome of the educative process (Darling-Hammond, 2000, Gallager, 2004, Vandevoort, 2004; Bormann et al, 2005, Haitmann, 2006). On the other hand, researchers and policymakers have considered student achievement as a logical component to measure the school quality and the teacher performance (USDOE, 2003; Vardevoort, 2004; Sptephens, 2003).

In this study, student achievement, sometimes called learning outcomes, is defined as the learning standards which are determined according to high-quality education requirements (see appendix F for precise definitions). These quality-learning standards include both content standards which describe what student should know, understand and be able to do, and the performance standards which define levels of student achievement pertaining to content. Both teacher quality and student achievement variables were analyzed based on a total quality management concept, which allows us to conceive schools as social-quality systems.

According to the previous statement, schools must be examined as social organizations that are interacting actively with their environment. As they have a clear sense of what is their social goal, they are working on the basis of specific quality education standards to respond effectively to the current and potential social educative needs (Sparkes, 1999, Tarter and Hoy, 2004). Consequently, this study attempted to examine the variable of student achievement related to the variable of teacher quality. It was developed based on a standardized questionnaire develop by the National Center for Education Statistics (NCES). Data gathered was analyzed using the following statistical tools: the correlation analysis, the MANOVA test, the standard and the hierarchical multiple regression analysis.

Since this study was specifically designed to analyze how teacher quality is related to the student achievement, other variables such as teacher's content knowledge, teachers' experience, teaching processes, teacher-students interactions and classroom resources, among others, were beyond the scope of this study.

This study is distinct from others because attempted to analyze how a set of observable characteristics (educational background, certification & training status, and professional development) of teaching quality are related to the student achievement where achievement which is measured as the class performance average of citywide and statewide tests in mathematics and ELA subjects. Other available studies are focused on either examining only one of these aspects or none of them.

Final results of this study can contributes to the current effort to better understand education quality and teaching quality issues by demonstrating that specific factors such as the teachers' highest degree earned, pre-teaching tests, involvement in professional development activities and rewards gained are consistent factors in predicting the class performance average in Math and ELA tests in elementary schools.

CHAPTER 2: PROBLEM ANALYSIS

General Overview

According to the Commission on Quality Education (CQE), when the president signed the NCLB law, he sent a message that every child has a right to a quality education. The law says all children must achieve high standards in school, and there must be measured each year by assessing the student progress (CQE, 2003). The NCLB law identifies a number of indicators designed to measure the academic achievement of all students and hold states and school accountable regarding school success. They must produce both annual state and school district report cards to inform parents and community organizations about state and school progress (USDOE, 2004). For that reason, based on NCLB's purposes, departments of education at federal, state and local levels are looking for a high-quality education for all students by closing the achievement gap and providing the best education (Gibson, 2003; Archibald, 2007)

The USDOE has established four key priorities[1]. First, ensuring students are learning; that is raising overall achievement and closing the achievement gap. Second, making the school system accountable; that is, including all students and districts in the state; ensuring all students are part of a state's accountability system; and providing data on student achievement by subgroup. Third, ensuring information is accessible and parents have options; that means informing parents in a timely manner about the quality of their child's school and their school choice options; identifying schools and districts that need to improve; developing specific activities and services to improve the school quality; and creating easily accessible and understandable school and district report cards. Fourth, improving teacher quality, that is providing parents and the public with accurate information on the quality of their local teaching

[1] These priorities define, in a summary manner, the current concerns about how school quality topics must be analyzed

force; implementing a rigorous system for ensuring teachers are highly qualified; and making aggressive efforts to ensure all children are taught by highly-qualified teachers (USDOE, 2004).

In addition, there is a wide consensus among researchers and policy makers that teacher quality is an essential component of school quality, perhaps the key component (USDOE, 2003; Vandervoort, 2004; Stephens, 2003; Rugraff, 2004; Laczko-Kerr, 2002; Rockoff, 2003). Thus, teacher quality becomes a most important issue in current movements of education reform and school improvement (Darling-Hammond, 2000; Rockoff, 2003; Heitmann, 2006).

By recognizing the connection between quality teaching and student achievement, researchers and policy makers have refocused their efforts in developing different approaches to properly understand the teacher quality concept. Some researchers focus on teacher personalities, traits, behaviors, attitudes, values, abilities, competences and many other personal characteristics (Laczko-Kerr, 2002). Some other researchers are more concerned with the teaching process that includes factors such as teaching styles, teacher-students interactions, and classroom resources (Rockoff, 2003)

Furthermore, other studies are focused on teaching outcomes including factors such as learning outcomes, personal development and learning experiences. Each of them contributes in developing knowledge on this topic by emphasizing different and specific aspects of teacher quality concept. Although it is difficult, if not impossible, to arrive at generally accepted conclusions, all of these studies agree that the single most important factor in student achievement is the teacher (Cheng, 1996; Gallagher, 2002; USDOE, 2003; Stephens, 2003; Rugraff, 2004; Rockoff, 2003).

Because quality teachers are critical for improving student achievement and success, local, state and federal government are expending considerable effort and resources to promote

and expand the knowledge regarding teaching effectiveness (USDOE, 2005). As the teacher quality issue becomes an important national priority, research efforts are focusing on understanding of the key components of teaching effectiveness. For example, the director of the Department's Institute of Education Sciences, Grover Whitehurst (2002), stated that current research on teacher quality is insufficient yet and there is a real demand for new knowledge that allows us to close the significant gaps in the present knowledge of what an effective teacher must be. A better research-based understanding regarding teaching quality can allow the policy makers to identify specific cognitive abilities to the teaching profession, design suitable pre-service and in-service training programs, and provide an adequate institutional support for the teachers' work (USDOE, 2005; Kirkpatrick, 2002; Rugraff, 2004; Gibson, 2003).

In the context of this intense activity surrounding teacher quality, it makes sense to turn to the evidence on which teacher attributes are related to teacher effectiveness in order to guide policy decisions about hiring, compensation, and distributions with respect to teachers (King, 2003). In this way, while there is consistent evidence that teacher performance contributes to student achievement there is less information about specific teacher attributes that lead to increasing student achievement (Kirkpatrick, 2002; Laczko-Kerr, 2002; Stephens, 2003)

As can be seen, some questions such as what must a high-quality teacher be? What traits or credentials are related to increasing student achievement? The teacher's educational background or general intelligence? The teacher's subject matter knowledge? Full certification? Academic degrees? must be answered. More precisely, what specific teacher characteristics are related to student achievement? This is a fundamental question that should be clarified to guide policy discussions concerning what kinds of characteristic and qualification must be promoted in

aspiring teachers, how to recruit and hire, how to distribute teachers across different types of schools and classrooms to achieve successfully social and educative goals (USDOE, 2003).

The U.S. Department of Education has confirmed the need for continuing research on teaching saying: "while it is important to glean from existing research all that we can to improve teacher quality today, we should not rest on our journey towards a better understanding of the key components of teacher preparation. There are significant gaps in our knowledge of how would we know a high-quality teacher if you saw one" (USDOE, 2003 p. 13).

Kirkpatrick (2002) affirms that despite the interest in teacher quality and the relationship between specific teacher characteristics and student achievement, it is not clear how these variables are related to one another or how they collectively impact student achievement. In effect, variables such as formal education background, content knowledge, teaching practices, teaching experience has been widely studied, but more evidence is needed to establish the relationship among these variables and student achievement (Kirkpatrick, 2002; Gibson 2003; Rugraff, 2004)

Problem Analysis Restrictions

In a general way the academic achievement of students could be influenced by several factors. For instance, innate abilities may predispose students to perform better in particular subject areas, support at home and family environment could either cultivate or discourage learning, even neighborhood and peer influences may enhance or dissuade student achievement. Thus, when assessing the impact of certain factors on an outcome like student achievement unavoidably arise some measure limitations.

In fact, measure of this kind of relationship can be too complicated because of the potential upward bias in such estimates (Figlio, 1997). For example, high-quality teachers may

be more likely to teach in affluent schools with high-performing students. Thus, the relationship between teacher characteristics and student achievement could be overestimated if schools are not accounted for. In this case, considering that the demographic and socio economic status of the selected schools are relatively the same, (for example the eligibility for free lunch in the selected schools range between 60 and 79 %) this potential confounder aspect was not relevant to invalidate the final study conclusions.

At this point, Golhaber and Anthony (2003) considered that virtually all datasets have variables that are mismeasured to some degree. For example studies often determine a student's class size by dividing the total number of students enrolled in the school by the total number of teachers. However, it is clear that not every student has the same size classroom and not every teacher has a classroom with the same number of student. Thus, the variation in class size within schools means that the researcher may not have properly characterized the true class size for a group of students. Accordingly, in some cases including this study, class size becomes a potential confounder factor.

However, since factors such as school, class size, family support or even community commitment are outside the direct control of school teachers, this research attempted to analyze the relationship between teacher quality and student achievement by isolating three observable teacher characteristics (educational background, certification & training status and professional development programs) from other school or other student factors that could influence on student achievement.

Problem Statement

According to Mason (2005), since Coleman's Report, a conclusive understanding of school quality characteristics has already been reached. The need to identify, to assess, and to

monitor school quality was emphasized by the U.S. Department of Education during the late 1980s and early 90's. Furthermore, thirteen items of school quality were identified and reported on by the National Center for Education Statistics (NCES-USDOE, 2000). During the past 20 years a reform movement has identified school quality concept as synonymous with student achievement scores in Math, reading and writing. Since then "teacher quality" concept is being explored as an essential component to understand school quality and student achievement issues.

Policy makers and researchers agree that teaching quality is an essential component for enhancing student achievement, but specific teacher attributes or observable teacher characteristic to raise student outcomes remains mostly unknown (Hager, 2005; Kirkpatrick, 2002). In the same way, Lasley T., Siedentop D., and Yinger R. (2006) affirm that research of the past decade clearly demonstrates the significance of the teacher in fostering student growth and academic achievement; however, researchers, policy makers and school leaders have difficulty agreeing on what are essential characteristics of the teachers who create value-added learning and the ways in which professional development experiences need to be structured in order to foster and develop those critical teacher characteristics. Furthermore, Rockoff (2003) affirms that given this set of circumstances, it is clear that much research is still needed on how high quality teachers may be identified, recruited, and retained.

At this time, only a few studies have been developed to analyze teacher quality and student achievement. For example, Tanners' (2000) and Heitman's (2006) studies can be cited as the most important within elementary schools of the State of New York. While Tanners' research was focused on the teacher/students relationship as a predictor of elementary school students' performance, Heitmans' study examined the connection between mathematics professional development, instructional leadership, and student learning in mathematics.

Beyond the State of New York, latest researches analyzed this topic from different point of views. For example, Bowers (2006), analyzed teacher practices, personality and behavior as teacher quality indicators to enhance the student achievement in elementary, middle and high schools. Theisen (2005) examined some teacher characteristics such as instructional strategies, motivation, communication and professional development related to fifth grade student achievements. Lowe (2005) was interested in analyzing how much the student achievement is related to the highly qualified teacher rather than to some other variables.

Accordingly, based on an extensive literature review, it is fair to conclude that to date no research has examined observable teachers characteristics such as educational background, certification & training status and professional development as predictors of student achievement in elementary schools.

Consequently, by recognizing the connection between quality teaching and student achievement, this study attempted to respond the broad question: what is the relationship between teacher quality and student achievement? This question was addressed through three specific research questions:

a. How is teachers' educational background related to the student achievement?
b. How is teachers' certification & training status related to the student achievement?
c. How is teachers' professional development programs related to the student achievement?

This study attempted be markedly different from previous cited research because it sought to provide an explanation how specific observable characteristics of teaching quality, such as educational background, certification & training status, and professional development may be directly connected with student achievement in public elementary school of the New York City.

CHAPTER 3: LITERATURE REVIEW

Historically, teacher quality concept has its roots in the Coleman's Report, developed in 1966, which analyzed issues related to equality and educational opportunities. Since then other authors both support and refute the Coleman's findings. As result of this debate, concepts such as school quality and teacher quality became the main components of the subsequent studies.

The content of this chapter is divided into three main parts. The first part describes the Coleman's findings about equity and educational opportunity. The second part reviews literature that explored school and student achievement connection. Finally the third part examines contributions focused on the relationship between teacher quality and student achievement.

The Coleman's Contribution

The debate about school quality concept was started by Coleman's "Equality of Educational Opportunity" (Coleman, 1966) better known as the Coleman Report. This large national study used aggregated measures of school inputs in terms of average teacher characteristics of schools and average student population characteristics, to investigate the effects of schools on students' educational achievement. The report showed that schools' average student characteristics, such as poverty and attitudes towards schooling, had a greater impact on students' achievement than teachers and schools. In other words, it concluded that measurable characteristics of teachers and schools are not significantly related to student achievement. However, by using only aggregate data, Coleman eliminated variation within schools and, therefore, Coleman's study design did not allows him to analyze at individual teachers' effects (Gallagher, 2002). Additionally, according to Dreeben (2000), Coleman did not investigate the

mechanisms by which any properties of schools or classrooms determine the student achievement.

Later studies both support and reject Coleman's finding. For example, Jencks et al (1972) claimed that schools do not make a significant difference. However, the most comprehensive support of Coleman's conclusions and the most widely-cited is Hanushek's (1986) review of the finding of 38 quantitative studies about the effects on student achievement. These studies analyzed the impact of the teacher/pupil ratio, teacher experience, salary, and educational level; expenditures per pupil, administrative inputs and facilities. According to Hanushek's conclusions, "there appear to be no strong or systematic relationship between school expenditures and student performance" (Hanushek 1986 p. 1,162). Other researchers do not accept Hanushek's findings. For example, Hedges et al (1994) argue that his findings lay on inappropriate statistical methods and poor data. Accordingly, they re-analyzed studies used by Hanushek and found a positive relationship between dollars spent on education and educative outcomes (Hedges et al, 1994)

School and Student Achievement

Always, based on the Coleman's report, studies that followed tried to analyze more in-depth potential relationships between school characteristics and student performance (Sparkes, 1999; Hoy K. Wayne, Tarter C. John & Hoy W. Anita, 2006). For instance, Cremers (1994) perceived two dimensions to analyze school effectiveness, namely quality and equity. According to this point of view, effective schools were thought of as organizations in which students fare well on standardized tests and in which optimal use is made of resources to ensure that such outcomes are achieved (Sparkes, 1999, Lowe Michael R., 2005).

Various models have surfaced in the literature attempting to explain the quality-equity relationship by identifying individual variables and studying their effects on students' achievement. Five factors in particular appeared with such frequency that was identified as the "five-factor model". This model was comprised of the following correlates of educational achievement: strong educational leadership, high expectation of student achievement, emphasis on basic skills, a safe and orderly climate, and frequent evaluation of pupil progress (Cremers, 1994). Although many researchers were receptive to this model, at least for a period of time, other critics questioned whether or not these correlates could be definitively regarded as cause rather than effect and whether or not they are discrete. For example, is a "safe orderly climate" an independent variable or is it the result of "strong educational leadership" (Sparkes, 1999)

Another model emerged from the field of economics. This model, known as "production model", describes the educative process as linear and unidirectional (Purkle & Smith, 1983) where the outputs (school results) are contingent upon components brought into the process. School results (outcomes) depend on what kind of inputs is applied and how these inputs are processed (the throughputs). Although the production model presents a concise picture of what happens in schools and has made valuable contributions to this topic, disappointment has been expressed about the narrowness and rigidity of the template and the difficulty with applying laws of economics to the operation of schools (Bezeau, 1983). Critics of this model argue that school process is neither a unidirectional process, nor is it comprised of variables that are easily distinguishable from each other or have clearly defined cause-effect relationship. Furthermore, the laws of economies of scale are not easily applied to schools, in general, or to the learning experiences of students in particular (Bezeau, 1983; Sparkes, 1999)

A third model, developed by other researchers tried to capture a more multilevel and multifactor image about school quality. For example, Scheerens and Creemers (1989), include a level of school organization and management, a teacher and classroom level, and a level of student performance and background. Other literature, in this area, was focused on what happens in the classroom. Accordingly, taking an "inside-out" notion of schooling, the effective school is one where we would expect to find an effective classroom (Hoy K. Wayne, Tarter C. John. & Hoy Anita W., 2006) Since from this point of view, what is closest to the student as far as their school experience is concerned would have the most profound effect on what they accomplish there (Haertal and Walberg, 1993). In this way, quality of instruction and classroom climate has been receiving much attention, particularly in relation to its impact upon learning outcomes (Sparkes, 1999).

Teacher Quality and Student Achievement

Another important body of literature is focused on teacher importance. Many researchers have argued that teacher quality is a powerful predictor of student performance (Cheng, 1996; Stephens, 2003; Gibson, 2003; Rugraff, 2004). Some researchers focus on teacher personalities, traits, behaviors, attitudes, values, abilities and competences among others characteristics. Other authors are more concerned with the teaching process (teaching styles, teacher-students interactions, classroom management, etc) or teaching outcomes such as students' academic achievement, personal development, learning experiences, etc.

According to the critics' point of view, studies that try to measure the relationship between teacher characteristics and student achievement have produced "little consistent" evidence that students perform better when their teacher has more desirable characteristics (Kirkpatrick, 2002). In fact, measures of this kind of relationship are too complicated because of

the potential upward bias in such estimates. For instance, according to Figlio's views, teachers with better credentials may be more likely to teach in affluent districts with high-performing students (Figlio, 1997).

Medley (1982) suggested that teacher competence refers to the set of knowledge, abilities and beliefs that a teacher possesses. Ornstein (1991) affirms that every teacher has his/her own teaching style, which reflects personality and philosophy, evident by behavior and attitudes. Rubin (1986) argues that through their style, teachers integrate a specific pedagogy background that defines practices that they adopt in the classroom. Some literature on student achievement and measures of teachers' intelligence have concluded that there is little evidence to support a possible relationship between teachers' measured intelligence, generally measured by IQ, and their students achievement (Laczko-Kerr, 2002).

Cheng (1993) and Rugraff (2004) suggest that teachers' teaching processes influence students' learning experience and outcomes, and student learning outcomes are usually recognized as a result of learning processes in terms of cognitive, affective and behavioral change and development. Therefore, taking those three domains (cognitive, affective and behavioral) into consideration, the nature and characteristics of teacher quality must be analyzed at multi-domains and multi-levels. Following this line of thinking, Cheng concludes that teaching quality is inevitably related to teachers' teaching processes and students' learning processes. Consequently, the concept of teaching quality supposes three domains of change and development (cognitive, affective, and behavioral) with two main actors (teacher and students) at three different levels (individual, class and school).

Based on these arguments, several authors concluded that some teachers' characteristics are a reliable predictor of student performance. For example, Darling-Hammond (2000) reports

that measures of teacher preparation and certification are by far the strongest correlates of student achievement in reading and mathematics, both before and after controlling for student poverty and language status. She contends that measures of teacher quality are more strongly related to student achievement than other kinds of educational investments, such as reduced class size, overall spending on education, and teacher salaries.

Other authors like Theisen (2005), Stephens (2003) and Gibson (2003) conclude that, while teacher quality may be important, variations in teaching quality is driven by characteristic that are difficult or impossible to measure. Accordingly, reliable identification of teacher fixed effect requires matched student-teacher data where both teacher quality and student achievement must be analyzed over several years. Unfortunately, this type of data has not been readily available to researchers (Rockoff, 2004). In this sense, although these kinds of studies show that student achievement is affected by the quality of their teachers, almost all of the empirical difficulties are related to data quality. For instance, in several of these studies teacher effect cannot be separated from other classroom factors because teachers can be observed with only one class of students (Rockoff, 2004).

Because the researcher is not able to separate some school factors such as class size or pedagogical resources, the present study was focused on analyzing teacher quality and student achievement relationship, using matched class-teacher data in order to provide more accurate estimates of how individual teachers can affect the achievement of their students. Other classroom factors such as class size, student characteristics or individual test scores are considered important but not relevant enough to this study since these factors are independent from the teacher quality variable. For example, only a small number of studies have found

significant variation in test scores taking into account classroom factors such student characteristic or class size (Rockoff, 2003)

More recent investigations report valuables contributions in analyzing the relationship between teacher quality and student achievement. A growing body of research indicates that highly qualified teachers are hugely important factor affecting the student achievement in the classroom (Plecki, M. et. al., 2006). For example, Kellman (1997) found a significant positive linear relationship between teacher qualification and student achievement. According to Kellman's conclusions, teachers who possessed a teacher certificate with the Bachelor degree were found to significantly influence their students' academic achievement. Phillips' research (2002) examines both the impact of teacher competence on student achievement and practices that support quality in classroom. According to Philips' study, teacher competence and teaching practices in classrooms are related to the teaching force policies. This research concludes that the quality of the teaching force is critical to maximizing student achievement. For example, Philips found that teacher force policies such as training and professional development, support and evaluation of teacher, and innovative compensation plans linking pay performance, can enhance students' success.

Gallagher (2003) examined the validity of a performance-based teacher evaluation system by analyzing the relationship between teacher evaluation scores and student achievement at elementary schools. Findings suggest that this relationship is stronger in reading than mathematics because both teacher and evaluators have more pedagogical knowledge and better alignment to standards and assessment in reading than mathematics. Wright (2004) compares and contrasts the motivational techniques of a veteran fourth grade teacher and a novice fourth

grade teacher. The result of this study found that the veteran teacher provided a more motivating learning environment than the novice teacher.

Teachers' credentials such as certification status were considered by other authors. For example, Stephens (2003) analyzed the relationship between the National Board Certification for Teachers and the student achievement. Stephens found that there was no significant impact on scores (student achievement) of students served by National Board Certified Teachers and equivalent students served by non-National Board Certified teachers.

Kirpatrik (2003) examined a conceptual model relating teacher quality variables and their effect on student achievement in mathematics. According to Kirpatrik's findings, teachers' use of instructional practices recommended by the National Council of Teachers of Mathematics (NCTM) do appear to have a positive impact on student achievement. This research supports prior research which indicated that more use of the NCTM-recommended instructional practices is associated with higher student achievement.

Latest studies, such as Gibson's (2004) and Heitmann's (2006), examined the relationship between professional development and student achievement. On the one hand, Gibson's conclusions revealed that professional development, as an indicator of teacher quality, can affect positively on student achievement in mathematics and reading. On the other hand, Heitmann's analysis reported the importance of both internal and external support to enhance both teacher quality and student learning.

Rugraff (2004) analyzed how teachers' salaries, teachers' level of education, and teachers' years of experience affect student achievement and student dropout rates. This study showed significance in how teachers' salaries and teachers' level of education affect student

achievement and dropout rates. Additionally, Rugraff's findings demonstrated that the years of experience of teachers has not a significant effect on student achievement.

Despite all of these above-described studies, it is difficult, if not impossible; to arrive at generally accepted conclusions. However, according to the latest investigations, there is a wide consensus among researchers that teacher quality is a key component of school quality (USDOE, 2003; Heitmann, 2006). In effect, there is consistent evidence that the individual teacher contributes to student achievement, though there is less information about specific teacher's attributes that can increase student achievement (USDOE, 2003; Gibson, 2003; Stephens, 2003; Vandervoort, 2004; Rockoff, 2004)

Summary and Critical Analysis

Researchers have been challenged to explore numerous topics in the search to identify characteristics that make a difference in student achievement. Based on Coleman's findings about school equity and opportunity, authors focus their research in two main directions. While some authors decide to explore school characteristics and student achievements connections, other authors prefer to examine the relationship between teacher quality and student achievements. Both of them made important contributions to the construction of the current framework regarding school quality concept.

Although the two research-trends have been developed in order to explain how student achievement is affected by certain factors, there is little consensus about what these factors are specifically. This study considered the teacher quality concept as an essential component to enhance the student achievement within elementary schools. Consequently, this study is aligned to the research-trend focused on the relationship between teacher quality and student achievement.

Contemporary understandings of teacher quality consider teaching outcomes in light of student learning as measured by student achievement indicators. Thus, researchers have been looking for causal relationship between teachers' characteristics (such as degree, content knowledge, instructional practices, experience, certification status, among others) and measured student achievement on standardized tests. However, teacher quality standards are related to a wide range of knowledge, skills, abilities and attitudes that a competent teacher must possess and demonstrate in the classroom.

Thus, researchers tend to agree that teacher quality is an essential factor that influences student outcomes but little consensus exists regarding the relationship between specific teachers credentials (such as experience, degree levels, certification status, content knowledge, etc.) and teacher effectiveness (Owings A. William et al, 2006). Since this study is aligned to the research-trend that considers teacher quality as an essential component in predicting student achievement outcomes, there are two similarities and a significant difference between this research and those that explored teacher quality impact on student achievement.

First, this study agrees with others that teacher quality unmistakable matter. It is widely supported by many studies that confirmed positive relationship between specific teacher credentials, individual characteristics or instructional practices and student outcomes. While researchers broadly agree that teacher quality is an important factor to explain student achievements, at present, no research definitively answers the question of what specific teacher characteristics are more relevant than others. Therefore, there is a missing aspect in the current literature that must be examined.

Second, although this topic is extensively explored and research continues to affirm that teacher quality is the most important factor influencing student learning, a lot of them do not

consider a multiple perspective of teacher characteristics. In effect, many of these studies are focused only on specific teacher characteristics such as educational background, training, instructional practices, experience, certification status, among others. In order to address what is missing in the current knowledge regarding this topic, this study attempted to identify a new construct that is based on three observable teacher characteristic such as educational background, certification & training status, and professional development, to explain how these factors can impact students' learning.

With this in mind, this study tried to make particular contributions to the current effort to understand school quality topic by including a multiple perspective on teacher characteristics to provide new and reliable information about how teachers impact on the student learning. More specifically, how observable teacher quality characteristics such as educational background, certification & training, and professional development, can predict student achievement in elementary schools.

Theoretical Background

The present study relies on total quality management (TQM) theory. Schools can be considered as open social systems, because they are social structures and cannot survive without continuously exchanging resources and information with their environment. It means that they have interacting matter and energy with other systems outside themselves. On the other hand, schools as open social systems must define appropriate internal components such as organizational structure, procedures and resources to achieve specific educative goals. Thus, all of these components interact together in order to produce the best outcomes to assure the organizational success. This last element relates to total quality management theory.

The Total Quality Management (TQM)

Total quality management is an approach to improving the effectiveness and flexibility of organizations as a whole. It is essentially a way of organizing and involving the whole organization: every department, every activity, every single person at every level (Oakland, 1989). It provides a framework for transforming manufacturing and service industries into efficient organizations able to develop effective quality operations aimed at satisfying the present and future needs of the customers. This concept provides an organizational paradigm for the expansion of the quality culture in all kind of organizations, which implies the notion of shared attitudes, behaviors, values and assumptions within the organization (Geoff, 1997). Consequently, TQM is based on change towards the development of quality values which might include a customer focus, teamwork, safety for all stakeholders, total involvement, intimacy, integrity, consensus and excellence (Hart and Shoolbred, 1993).

The concept of TQM requires that schools are perceived as service organizations designed to fulfill the needs of their clients or customers. Thus, the emphasis for TQM could be on transforming teaching, curriculum, organizational and management processes within schools in a way which serves student, parent, and community interests (Geoff, 1997). The key task of a service organization, like a school, is to build effective processes to respond efficiently to the present and future social-educative needs. Based on this notion, schools can be analyzed as systems and sub-systems which function as a unified whole, with emphasis on the quality interface between the various elements of the organization as much as on the nature of the elements themselves.

In this case, schools under TQM not only must develop the capacity and competences to maintain current levels of performance but also generate continuous improvement to reach high

levels of performance (Cuttance, 1994; Fitzgerald, 2004). Consequently, TQM in schools implies two main levels. First, it requires a system to assure that the organization carries out its function of developing all aspects of education services. Second, the system must be developed to ensure that a consistent approach is taken by all stakeholders in the delivery of a quality service to their students.

The first element above-mentioned refers to the need for the school to be a quality organization at the macro level through the development of standards according to other educational organizations performance. The second refers to the development of internal quality management processes to enable the school to achieve its mission. Both levels require schools to develop a quality management approach which permeates the whole organization. Accordingly, TQM provides to schools a standard framework for the analysis and development of the quality culture necessary for the provision of educational services to continually meet the emerging needs of its students (Geoff, 1998)

This study is focused on one particular aspect of TQM theory, the relation between teachers and students. Thus the two levels can be restricted for this study's limited focus. The first level assumes in this study that the organizational structure on this relationship is captured systematically by standardized test scores and the NYCDOE's hiring practices. The standardization process is consistent across schools and stands as a proxy for this level. The hiring practices would be reflected in the educational background and the teachers' credentials. The second level would be reframed for this study as: the system must be developed to ensure that a consistent approach is taken by all teachers in the delivery of a quality service to their students. Although this level is beyond the scope of this study, the outcomes of examining the

first level may provide insight into future research to more fully examine the second level of consistent instructional practice by teacher in the classroom.

Considering the teaching/learning process as one of the most critical within the schools organization, teacher quality becomes a fundamental aspect of the school quality concept, because the quality management processes in schools concentrates on the relationships between teacher and students in the learning process. In this sense, teachers are encouraged to accept responsibilities for the quality of their work ensuring emotional, physical and psychological conditions for appropriate leaning environment (Gossen and Anderson, 1995).

Conceptual Framework

Betts (1992) affirms that nearly a century of changes, current approaches to solving problems in education are the same ones used by generations of educators and are stoutly defended as having working in the past. But we can see clearly that the environment within which education is embedded has been changing since early 1900. Furthermore, after 1950 the magnitude of changes became more evident and stimulated a series of reforms. At this time, a Total Quality Management philosophy to improve the school quality through a whole-system approach is essential to analyze the education environment: “Our piecemeal change effort of the last decade have taught us a valuable lesson about Total Quality Management: we must seek improvement through systemic change” (Betts, 1992, Pg. 38).

On the basis of the theoretical background above-described, this study considers public elementary schools as developing organizational resources to achieve goals and objectives based on specific high-quality educative standards and social requirements. Consequently, schools should affect student achievement through the talent and teacher practices, what goes on in the classroom, and the overall culture and atmosphere of the school (Tarter and Wayne, 2004).

Teacher quality is an essential component to improve learning outcomes expressed as student achievement (NCES, 2000). Furthermore, according to the USDOE (2003), teacher quality is a key component of school quality.

Schools as quality systems supposes an organizational structure based on specific form of culture which includes a long-term process of continuous improvement towards perceived standards of excellence within the context of core ethical values and of planned organizational change (Geoff, 1997; Tarter and Wayne, 2004). Teacher quality can be measured at both levels of the TQM system.

At the first level, teacher quality can be measured through data collected through hiring practices, e.g. educational background, training, etc. At the second level the teacher quality can refer to someone who recognizes the students' educative needs, possesses specific teaching skills and knows how to assist their learning. Accordingly, teachers become the most important resource to improve the learning outcomes express as student achievement.

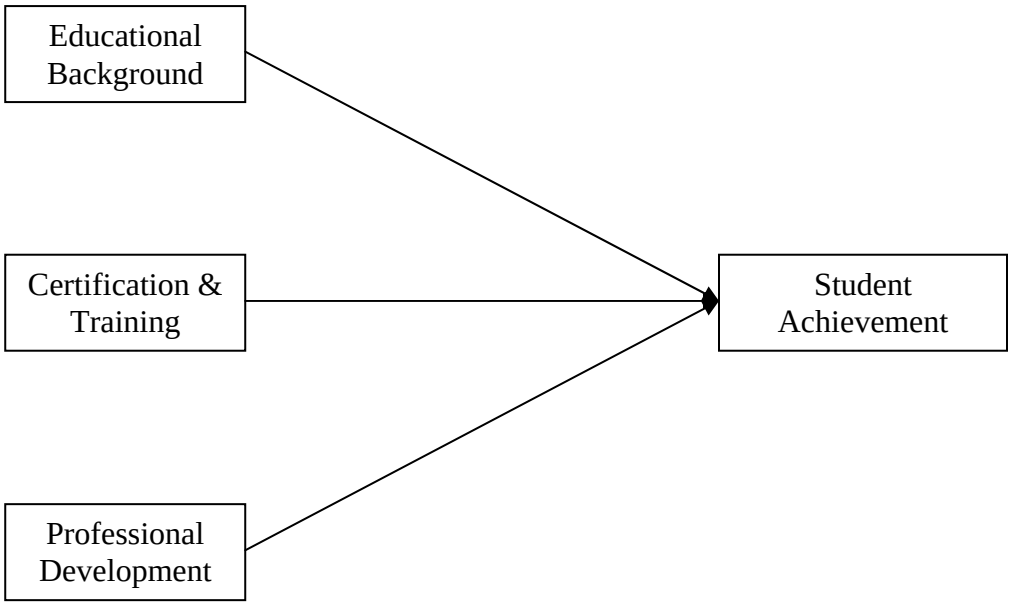
This study was focused on the first level construct and data, remarking that the outcomes from this study may give insight into how to study the second level. At the first level, student achievement is defined as learning standards which include both content standards which describe what students should know, understand and be able to do, and the performance standards which define levels of students' achievement pertaining to content (NYSDOE, 2003).

Both of these standards are designed according to educational quality standards and currently are used as evaluation tools to assess school quality levels (USDOE, 2003). At the second level, student achievement data would likely focus on individual grade reports, observational data, among other local indicators. However, this aspect of the theory and its

investigation are beyond the scope of this study. Graphically the, conceptual framework for this study can be displayed in Figure 1.

Figure 1

Conceptual Framework



High Teacher Quality Standards	Continuous Improvement Process	High Student Performance Level
Total Quality Management Premises		

This study was focused on quality standards as an essential input of the educative process related to student achievement which is considered by researchers and policymakers as the most important output of this process (USDOE, 2003). Based on previous research findings, indicators for both input and output were identified as following: educational background, certification and training, and professional development as teacher quality indicators. Citywide mathematics test, citywide English Language Art (ELA) test, statewide mathematics test, and

statewide ELA test as student achievement indicators. Precise definitions for each of the above-mentioned indicators are displayed in the methodological design.

In this study the feedback component will not directly be measured because it is beyond the scope of this study. However, the results and conclusions of this research can serve as feedback resource to both community school districts and future similar research.

Hypotheses

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

"There is no statistically significant impact on the student achievement based on some observable teachers' characteristics such as the educational background, certification & training status and professional development ", which was tested against the alternative hypothesis (Hi): "There is a statistically significant impact on the student achievement based on some observable teachers' characteristics such as the educational background, certification & training status and professional development"

In order to test it properly, there were three specific null hypotheses in this study. Each of them attempts to examine specific indicators of teacher quality concept (independent variable) related to the student achievement (dependent variable). They follow:

a. There is no significant difference in the class performance average in Math and ELA test based on the teachers' educational background.
b. There is no significant difference in the class performance average in Math and ELA test based on the teachers' certification & training status
c. There is no significant difference in the class performance average in Math and ELA test based on the teachers' professional development activities.

CHAPTER 4: METHODOLOGY

Research Design

The purpose of this study was to analyze how observable teacher characteristics affect student achievement. In order to accomplish this purpose, both independent and dependent variables were defined as follows: educational background (EB), certification & training status (CT) and professional development (PD) as independent variables and class performance average in Mathematics and English Language Arts tests as dependent variables. Methodologically, this study was defined as a cross sectional research study that uses a survey distribution at one point in time to gather the independent variable data and uses students' standardized test scores as the dependent variable data.

In order to respond the study's hypothesis, data analysis was divided into two phases. In the first phase, descriptive statistics were performed for each teacher quality characteristics. It allows the researcher to describe the basic features of the study's data. In the second phase, multivariate analysis of variance (MANOVA) and the multiple regression analysis tests were performed according to the type of data for each variable. These inferential statistical tools were used to explore potential interaction effects between independent and dependent variables.

Ethical Safeguards

Data collection process was performed in view of rigorous ethical principles to conduct a social research. In this case, specific ethical procedures was defined by the TUI University's IRB office and the NYCDOE's Division of Assessment and Accountability which independently reviewed and approved data collection procedures for the present research.

In addition, to guarantee confidentiality, no direct contact by the researcher with teachers survey-respondents was allowed, all responses related to individual characteristics were used only for statistical purposes and no individual data links to participant's name, address or telephone number was included in any statistical reports. A sample of both the request letter and the consent form to participate in research, sent to the participant teachers, are displayed in appendices G and H.

Study Population

The site location for gathering data was the public elementary schools from a NYCDOE's community school district located in Queens, New York. This District has 23 elementary schools, more than 7,600 students and around 350 teachers. For this study, population target consists of a sample of 117 full-time teachers who were working in third, fourth and fifth grade during the 2006-2007 school year. Part time, itinerants, substitutes, special education and special subject teachers were excluded from this study. In addition, to avoid include teachers from any blended or mixed classroom only homeroom teachers, who are in charge to teach Math and ELA subjects in a unique classroom, were included. In other words, the research sample consists of only one teacher per class and one class per teacher.

Recruiting and sampling procedures

According to the NYCDOE's policies to collect data in public schools, an application requesting authorization to conduct a research in a community district school was sent to the NYCDOE's Division of Assessment and Accountability (DAA). Once it was processed and finally approved, a letter to the schools' Principals was sent in order to request consent to survey full-time teachers in their schools.

Although all 23 elementary schools of the district were invited to participate in this study, 13 schools accepted, 7 of them denied authorization and 3 of them did not respond to the researcher's request. In some cases it was necessary to send the request letter by mail twice or even send a reminder e-mail. Next, participant school's principals were contacted to explain data collection procedures and to schedule activities avoiding any disruption in the teachers and student activities. In some cases planning activities were discussed with Assistant Principals.

The selection of teachers to serve as sample for this study was defined according to specific requirements. The most significant considerations to select participant teachers were: 1) teacher needed to be a full-time, 2) be from third, fourth and fifth grade, 3) be in charge to teach Math and ELA subjects and 4) be teaching in a single classroom during the 2006-2007 school year.

Based on the information provided by participant schools, 203 teachers fulfilling the research's sampling requirements were identified. Next, individual invitation letters were sent to all 203 selected teachers. Only 117 teachers, among 203 teachers available, accepted to participate in this study (around 57 % rate of acceptance). The table below shows the numbers about the schools and teachers contacted for this study.

Table 1.

Schools and potential survey respondents contacted

Description	**Schools**	**Teachers**
Total available	23	203
Invited	23	203
Accept invitation	13	117
Reject invitation	7	15
Ignore invitation	3	71
Rate of acceptance	56 %	57 %

Data collection process begun early September and it finished late November 2007. In order to assure confidence and anonymity, participant teachers were identified by codes using the school number, grade and class number. Additional information about participant schools that teachers came from is displayed in appendix I.

Sample size

A priori sampling procedure was applied to calculate the minimum sample size required for an inferential statistical analysis. By specifying the alpha level, the number of potential predictors in the independent variables, the anticipated effect size and the desired statistical power level, the minimum sample size was determined as shows the table below:

Table 2.

A-priori sample size

Parameters	Value
Alpha level	.05
Predictors	6
Desired statistical power level	.9
Anticipated effect size (f2) (medium)	.15
Minimum sample size required	111

Power analysis

Based on the a-priori sample size display above, a post-hoc power analysis was calculated according to the following regression model:

$$Y=B1X1 + B2X2 + B3X3$$

Where: Y = Student achievement
Bs = Regression weights values
X1 = Teachers' educational background

X2 = Teachers' certification & training status
X3 = Teachers' professional development activities

According to Soper (2006) the alpha level also known as the p value must be less or equal to .05 to claim statistical significance. By convention, effect size of .02, .15 and .35 are considered small, medium and large respectively. The desired statistical power level should be greater or equal to .80. With these premises in mind, a post-hoc power analysis was calculated for the multiple regression tests. According to the data displayed in table 3 below, the sample size (n=117) yields a statistical power of .93 at the .05 level of significance.

Table 3.

Post-Hoc power analysis calculation

Statistical Test	Sample	Factors	Alpha	Effect	Power
Multiple Regression	117	6	.05	.15	.93

Data Collection Tools

Data collection process regarding teacher quality (independent variable) was executed based on a standardized questionnaire, which was adapted from the "teacher questionnaire" of the School and Staffing Survey (SASS) 2003-2004. This nationwide-survey was elaborated for the National Center for Educational Statistics (NCES) of the US Department of Education (USDOE). It was designed to obtain a profile of the quality of the nation's teacher by examining two broad elements: teacher preparation/qualifications and teacher practices. The first component refers to the educational background and continuing learning. The second component refers to the actual behaviors and practices that teacher exhibit in their classrooms (NCES, 1999).

In this study, the questionnaire was divided into three main components: educational background, certification and training status and professional development. Educational background included aspects such as highest degree earned, major field of study, and pre-

teaching preparation tests. The second component included aspects such as certification status, certification area, certification grades, preparation for teaching activities and teachers' induction programs. The third component included participation in professional development activities, specific activities focused on mathematics/Arithmetic, specific activities focused on English language arts, types of support received, rewards gained and participation in other professional development activities. The adapted teacher questionnaire is fully displayed in appendix A.

Data collection process regarding student achievement (dependent variable) was gathered based on aggregated data from the NYCDOE's database which is available to graduate student and researchers according to specific research purposes. According to the "Proposal Guidelines" to conduct a research in New York Public schools, a previous request was evaluated and approved by the NYCDOE's Division of Assessment and Accountability to process and customize the demanded information conforming to this research's student data needs.

Questionnaire's Validity and Reliability

General and specific measures were adopted by the NCES to guarantee the schools and staffing survey (SASS)'s validity and reliability. This survey has been conducted four times between 1987 and 2000: round 1 in 1987-88, round 2 in 1990-91, round 3 in 1993-94 and round 4 in the 1999-2000 school years. At each round the NCES reviewed the survey content to assess reliability and validity issues. On the other hand, before each round, the NCES enlisted the help of many experts and specialist to examine in-depth the SASS content and methods to propose changes in order to improve it in future rounds.

In addition, the advisory council on education statistics (the advisory panel for NCES), reviewed the SASS design at each round and met regularly to discuss and to provide a complete evaluation of the plans for survey, design, analysis and reporting.

Other measures were also adopted by the NCES to assure the SASS' validity and reliability. For example, a program of re-interviews was performed at each round in order to identify items with high response variance; thus, many of these items have been revised in later round to reduce the response variance. A systematic record check was adopted to examine measurement errors. In this case, the teacher transcript record was study in order to evaluate the reliability of the data from selected SASS questions by determining true values with which the survey responses could be compared.

Other specific measures such as an in-depth interviews program and comparison with other sources were applied. In the first case, this program was applied to obtain true values for a subset of key items with extensive questioning and encouragement to respondents to consult records. For example, the number of full-time-equivalent (FTE) teachers in the school. It was particularly useful to identify the sources of error, such as counting a part-time teacher as a full-time teacher. In the second case, some comparisons of SASS estimates were compared with estimates from other sources were to afford an overall evaluation of the SASS estimates.

Aggregate comparisons that have been made in rounds 1 to 3 of SASS have been useful in drawing attention to some major discrepancies, but have generally not been able to identify the causes of the discrepancies. The estimated reliability value for the SASS questionnaire, at round four (1999-2000 school year), was reported at .92, which reflects an adequate level of reliability (USDOE, 2005)

Independent and Dependent Variables

In this study, the independent variables included three observable teacher characteristics: educational background, certification & training status 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 ordinal or categorical data and they were analyzed as potential predictors of student achievement. The table below displays how the independent variables were disaggregated.

Table 4.

Independent Variable Indicators

No.	Teaching Quality Area	Variables and indicators
1	Educational Background	Highest degree earned (Associate; Bachelor; Master; and Ph.D.) Major field of study (Elementary education; English language arts; Mathematics/Arithmetic; other field of study) Pre teaching tests (Test in reading; test in mathematics; skill test in writing; subject assessment in ELA; subject assessment in math; the NBPTSC's test; other skill/knowledge test)
2	Certification & Training Status	Current certification status (full state certification; probationary / provisional / temporary / emergency certificate; no process certification completed) Certification area (English language arts; Mathematics/Arithmetic; both mathematic and English language arts; other content area) Certification grades (elementary grades; middle and secondary education; undergraduate level) Teaching practice (measured as the time spent in teaching practice) Preparation for teaching activities (coursework how to select/adapt instructional material; coursework in learning theory; observation of other classroom teaching; formal feedback in her/his teaching) Teacher Induction Program (participation in teaching induction program; working with a master or mentor teacher; training and/or continuing education program)
3	Professional	Participation in PD activities (taken university level courses; observational visit to other schools; workshops/conferences as presenter)

Development	
	Specific PD activities focused on Mathematics/Arithmetic
	Specific PD activities focused on English language arts
	Types of support received (release time from teaching; stipends, received; reimbursement of college tuition; reimbursement for daily and travel expenses)
	Rewards gained (additional credits to advance or re-certification; increases in salary or other pays; recognition or higher rating in teaching evaluation)
	Collaboration activities (participation in individual/collaborative research; collaboration activities with other teachers; acting as a coach or mentor to other teachers)

On the other hand, student achievement was defined as the dependent variable. Since Mathematics and English language arts (ELA) are two main subjects in elementary education curriculum, standardized test results were identified as reliable parameters to reflect student achievement. In this case, class performance average in Mathematics and English language arts (ELA) tests were selected as student achievement indicators because they should be a more clear representation of what student has learned from a specific teacher (NYCDOE, 2003). These data were defined as continuous variables and they were analyzed as the variables 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 elaborated as shown on next paragraphs.

As the table 5 shows, the educational background predictor was assessed to respond the question: How can the teachers' educational background impact the student achievement? It was performed based on the following independent variables: highest degree earned (Associate,

Bachelor, Master, Ph.D) as an ordinal variable; major field of study (English, Math/Arithmetic, elementary education, other fields), as a categorical variable; the pre-teaching tests (reading, Mathematics, English, the NTPTSC's test and the other skill/knowledge teaching tests) as an ordinal variable. The effects of these variables on the dependent variable (class performance average in Math and ELA tests) were assessed by using both the MANOVA and the multiple regression analysis tests.

Table 5.

Educational Background Measurement

Variables	Data Type	Codes/Score Range	Survey Question
Highest degree earned	Ordinal	0=None 1=Associate 2=Bachelor 3=Master 4=Ph.D.	4
Major field of study	Categorical	1=Elementary education 2=English language arts 3=Mathematics/Arithmetic 4=Has combined majors (fields 1,2 and 3) 5=Other field of study	5
Pre teaching tests	Ordinal	0= Not taken at all 1=Has taken/passed one pre-teaching test 2=Has taken/passed two pre-teaching tests 3=Has taken/passed three pre-teaching test 4=Has taken/passed more than three pre-teaching tests	8

A complete table specifying the frequencies of the survey items for this variable is displayed in appendix B.

The variable certification & training status was designed to answer the question: How can teachers' certification & training status impact the student achievement? It was addressed by taking into account the following independent variables: current certification status (full standard

certification, provisional/temporary certification and no certification process completed) as an ordinal variable; certification area (English language arts, Math/Arithmetic, both Math and English areas and other content areas) as a categorical variable; certification grades (elementary grades, middle/secondary grades and undergraduate level) as a categorical variable; teaching practice (no practice at all, less than 20 hours, less than 40 hours, less than 60, less than 80 and more than 80 hours); preparation for teaching activities (course works how to select/adapt instructional material, coursework in learning theory, observation in other class and formal feedback); teacher induction programs (participation in teacher induction activities, working with a mentor and continuing education programs) as an ordinal variable.

In order to measure their effects on the dependent variable, this is student achievement, the MANOVA and the multiple regression analysis tests were performed. The table below displayed how the variable certification & training status was tested.

Table 6.

Certification and Training Status Measurement

Variables	Data Type	Codes/Score range	Survey Question
Current certification status	Ordinal	0=No process certification completed 1=Has a waiver/emergency, temporary, probationary or provisional certification 2=Has a full state certification	9
Certification area	Categorical	1=English language arts (ELA) 2=Mathematics/Arithmetic 3=Includes both Math and ELA contents 4=Other content area	10
Certification grades	Categorical	1=Elementary grades 2=Middle and/or secondary grades 3=Undergraduate level	11
Teaching practice	Ordinal	0=No practice at all 1=Between 1 and 20 hours 2=Between 21 and 40 hours 3=Between 41 and 60 hours	12

		4=Between 61 and 80 hours 5=More than 80 hours	
Preparation for teaching (PT) activities	Ordinal	0=Not at all 1=Has one PT activity 2=Has two PT activities 3=Has three PT activities 4=Has four PT activities	13
Teacher Induction Program	Ordinal	0=Lacks teaching induction program activities 1=Has one teaching induction program activity 2=Has two teaching induction program activities 3=Has three teaching induction program activities	14 – 16

A complete table specifying the frequencies of the survey items for this variable is displayed in appendix C.

The construct professional development was tested to answer the question: How can teachers' professional development activities impact the student achievement? It was addressed based on the following independent variables: participation in professional development activities (university level courses, observational visits to other schools, workshop/conferences as presenter) as an ordinal variable; specific activities focused on Math subject as a categorical variable; specific activities focused on ELA subject as a categorical variable; types of support received (release time from teaching, stipends received, reimbursement of college tuition, reimbursement for travel/daily expenses) as an ordinal variable; rewards gained (additional credits towards re-certification, increase in salary or other pays and recognition in teaching evaluation) as an ordinal variable; participation in collaboration activities (participation in individual/collaborative research, collaboration with other teachers, observe or be observed by other teachers, acting as a coach or mentor) as an ordinal variable.

The effects of these variables on dependent variables were measured through the multivariate analysis of variance and the multiple regression tests. The table below display how this variable was tested.

Table 7.

Professional Development Measurement

Variables	Data Type	Score Range	Survey Question
Participation in PD activities	Ordinal	0=Lacks PD activities 1=Has one PD activity 2=Has two PD activities 3=Has three PD activities	20
Activities focused on ELA	Categorical	0=No 1=Yes	22
Activities focused on Math	Categorical	0=No 1=Yes	23
Types of support received	Ordinal	0=Not at all 1=Received one type of support 2=Received two types of support 3=Received three types of support 4=Received four types of support	24
Rewards gained	Ordinal	0=Not at all 1=Has one reward gained 2=Has two rewards gained 3=Has three rewards gained	25
Collaboration activities	Ordinal	0=Not at all 1=Participated in one collaboration activity 2=Participated in two collaboration activities 3=Participated in three collaboration activities 4=Participated in four collaboration activities	26

A complete table specifying the frequencies of the survey items for this variable is displayed in appendix D.

The student achievement, expressed as the class performance average in Math and ELA tests were defined as continuous variables. As dependent variables, they were tested along with each independent variable (educational background, certification & training status and professional development programs). The table below shows how these variables were measured. A complete table specifying the frequencies for this variable is displayed in appendix E.

Table 8.

Class Performance Average in Math and ELA tests Measurement

Variables	Data Type	Score Range	Source
Class performance average in Math Test	Continuous	470 - 770	NYCDOE
Class performance average in ELA test	Continuous	475 -780	NYCDOE

A complete table specifying the frequencies for this variable is displayed in appendix E.

Statistical Analysis

Data collected from teachers and student were matched by using codes, which were determined taking into account three aspects: school number, grade and class number. Both teacher survey responses and class performance average in Math and ELA tests were entered into statistical software (SPSS Version 12.0) to convert individual data in statistical information.

Based on the teacher-survey responses and the needs of information regarding student outcomes a full data chart was elaborated to display the frequencies of the survey items (see appendices B, C, D and E). Additionally, the data analysis system (DAS) developed by the US Department of Education's National Center for Education Statistics (NCES) to process

information of the schools and staffing survey (SASS), was used as a reference to classify and organize the research information

The data analysis process was divided into three phases. In the first phase, descriptive statistics was used to describe the basic features of the data. It allows the researcher to summarize data about the sample and the measures. In the second phase, a bivariate correlation analysis was performed to assess the strength of individual relationship between and among the variables. In the third phase, inferential tests such as the MANOVA, the standard and the hierarchical multiple regression analysis tests were performed. These tools were used to analyze the interaction effects between independent and dependent variables.

First phase: Descriptive Statistics

Descriptive statistics was used to summarize the relevant sample-background information. Frequencies were used to obtain descriptive statistics for categorical and ordinal variables such as highest degree earned, major field of study, certification area, certification grades, types of support received and specific activities focused on ELA, among others. Mean and standard deviation was used for continuous variables such as class performance average in Math and ELA tests.

Second phase: Bivariate Correlation Analysis

Bivariate correlation analysis was performed to examine the strength of individual relationships between and among the main variables. Accordingly, the strength and direction of relationship between two variables were explored by using the correlation Spearman's rho coefficient. Accordingly, a variables correlation matrix was elaborated for each independent variable: educational background, certification & training status and professional development activities.

Third Phase: Inferential Statistics

In order to explore potential relationship between the independent and dependent variables, three statistical tools were applied: the multiple regression analysis, the hierarchical multiple regression analysis and the MANOVA test. Multiple regression analysis was used to assess how well some specific teacher-quality characteristics were able to predict class performance average in Math and ELA tests. Furthermore, it was useful to identify the variable coefficients and their relative contribution predicting the student achievement. The following variables were assessed by applying multiple regression analysis: highest degree earned, pre-teaching tests, current certification status, teaching practice, preparation for teaching activities, teacher induction activities, participation in professional development activities, types of support received, rewards gained and participation in collaboration activities.

Additionally, based on the most significant predictors previously identified, hierarchical multiple regression analysis was performed to assess the ability of the three main independent variables: educational background, certification & training status and professional development programs to predict the class performance average in Math and ELA tests.

On the other hand, multivariate analysis of variance (MANOVA) was used to assess the mean differences between groups. It was useful to analyze significant differences between groups. Additionally, it also provided the univariate results for each of the dependent variable (class performance average in Math test and class performance average in ELA test). The following variables were tested by applying the MANOVA test: major field of study, certification area, certification grades, specific activities focused on Math subject and specific activities focused on ELA subject.

Statistical Procedures for Testing Hypotheses

The first research question: "how is teachers' educational background related to the student achievement?" was addressed by testing three specific variables. Each identified variables was directly associated to the teachers' educational background characteristics (highest degree earned, major field of study and taken/passed the pre-teaching tests). According to the nature of the data for each variable, a particular statistical tool was identified. As can be seen in the table below, multiple regression analysis and the MANOVA test were selected to examine the identified variables.

Table 9

Statistical Analysis for Educational Background

Hypothesis: "There is no significant difference in the class performance average in Math and ELA test based on the teachers' educational background."

Teaching Quality Area	Independent Variables	Dependent Variable	Statistical Method
Teachers' Educational Background	Highest degree earned	Class Performance average in Math and ELA Tests	Regression
	Major field of study	Class Performance average in Math and ELA Tests	MANOVA
	Passing pre teaching tests	Class Performance average in Math and ELA Tests	Regression

The second research question: "how is teachers' certification & training status related to student achievement?" was examined based on six independent variables: current certification status, certification area, certification grades, teaching practice, preparation for teaching activities and teaching induction activities. As the student achievement is expressed as the class performance average in Math and ELA tests, they became the dependent variables. According to

the data type involved in each case, either the multiple regression analysis or the MANOVA test was selected as statistical procedures. The table below displays how each variable was tested.

Table 10.

Statistical Analysis for Certification & Training Status

Hypothesis: "There is no significant difference in the class performance average in Math and ELA test based on the teachers' certification & training status."

Teaching Quality Area	Independent Variables	Dependent Variable	Statistical Method
Teachers' Certification & Training Status	Certification Status	Class Performance average in Math and ELA Tests	Regression
	Certification Area	Class Performance average in Math and ELA Tests	MANOVA
	Certification Grades	Class Performance average in Math and ELA Tests	MANOVA
	Teaching Practice	Class Performance average in Math and ELA Tests	Regression
	Preparation for Teaching Activities	Class Performance average in Math and ELA Tests	Regression
	Teaching Induction Program	Class Performance average in Math and ELA test	Regression

The third research question "how is teachers' professional development programs related to the student achievement?" was analyzed based on six independent variables: participation in professional development activities, activities focused on Math, activities focused on ELA, support received, rewards gained and participation in collaboration activities. In order to explore potential relationship among variables and to analyze statistically significance difference

between groups the MANOVA test and the multiple regression analysis were used. The table below shows how the variables were tested in each case.

Table 11.

Statistical Analysis for Professional Development Programs

Hypothesis: “There is no significant difference in the class performance average in Math and ELA test based on the teachers’ professional development activities.”

Teaching Quality Area	Independent Variables	Dependent Variable	Statistical Method
Teachers’ Professional Development Programs	Participation in PD Activities	Class Performance average in Math and ELA Tests	Regression
	Activities focused on Math subject	Class Performance average in Math and ELA Tests	MANOVA
	Activities focused on ELA subject	Class Performance average in Math and ELA Tests	MANOVA
	Support Received	Class Performance average in Math and ELA Tests	Regression
	Rewards gained	Class Performance average in Math and ELA Tests	Regression
	Collaboration activities	Class Performance average in Math and ELA Tests	Regression

CHAPTER 5: FINDINGS AND PRESENTATION OF RESULTS

Since the main purpose of this study was to test the core null hypothesis: "There is no statistically significant relationship between teaching quality characteristics and the student achievement." It was addressed through three specific hypotheses: 1) there is no significant difference in the class performance average in Math and ELA test based on the teachers' educational background; 2) there is no significant difference in the class performance average in Math and ELA test based on the teachers' certification & training status; and 3) there is no significant difference in the class performance average in Math and ELA test based on the teachers' professional development activities.

In this way, this chapter presents the main statistical analysis outputs. Both, data results and data analysis are described individually. Each research hypothesis includes a descriptive statistic results followed by an inferential statistical analysis and a summary of findings.

Site Location

The site location for gathering data was a community district school located in Queens, New York. According to the NYCDOE's data, this district has around 7,600 students enrolled in elementary schools, 16 % White, 32 % African Americans, 25 % Hispanics and 27 % Asian and others; 52 % male and 48 % female (NYCDOE, 2006). For all statistical tests applied in this study the sample size was the same. A total of 117 full-time teachers from those elementary public schools were surveyed.

Descriptive Statistics

In order to accomplish the study's main purpose, a total of 117 teachers from 13

elementary public schools were surveyed. It included 43 third-grade teachers, 39 fourth-grade teachers and 35 fifth-grade teachers.

In regards to the participants' educational background, as it is shown in table 12, around 82 % of them (96 teachers) reported a Master degree, 16 % (19 teachers) a Bachelor degree. The most frequent major field of study declared by participant teachers was "elementary education", it was reported by 59 teachers (50 %); 34 teachers (29 %) reported a combined major (elementary education and/or English and/or Math). Around 97 % of the surveyed teachers took and passed at least one pre-teaching tests.

Table 12

Descriptive Statistic, Educational Background

Characteristics	n=117	%	Cum. %
Highest Degree Earned			
Bachelor's	19	16.2	
Master's	96	82.1	
Ph.D.'s	2	1.7	100.0
Major Field of Study			
Elementary education field	59	50.4	
English language art field	2	1.7	
Mathematics/Arithmetic field	6	5.1	
Has combined majors (at least two previous fields)	34	29.1	
Other field of study	16	13.7	100.0
Taken and Passed the Pre-teaching Tests			
Not at all	3	2.6	
Has taken/passed one pre-teaching test	31	26.5	
Has taken/passed two pre-teaching tests	35	29.9	
Has taken/passed three pre-teaching test	7	6.0	

Has taken/passed more than three pre-teaching tests	41	35.0	100.0

In regards to the certification & training status, approximately 94 % (110 teachers) informed a full state certification status. The most frequent certification area included both Mathematics and English language arts content area declared by 89 teachers (76 %). 108 teachers held certification in elementary grades. Most of surveyed teachers (93 %) spent more than 40 hours in teaching practice activities. Around 95 % (111 teachers) has participated in at least one preparation for teaching activities. In the same way, around 94 % (110 participant teachers) has participated in at least one teacher induction activities. Descriptive statistics data are displayed in the table below.

Table 13.

Descriptive Statistics, Certification & Training Status

Characteristics	n=117	%	Cum. %
Current Certification Status			
No process certification completed	0	0.0	
Hold a provisional/temporary certification	7	6.0	
Hold a full state certification	110	94.0	100.0
Certification Area			
English language arts content area	8	6.8	
Mathematics/arithmetic content area	12	10.3	
Includes both Math and ELA content areas	89	76.1	
Other content area	8	6.8	100.0
Certification Grades			
Elementary level grades	108	92.3	
Middle and/or secondary level grades	6	5.1	
Undergraduate level grades	3	2.6	100.0
Teaching Practice			

Between 1 and 20 hours	2	1.7	
Between 21 and 40 hours	19	16.2	
Between 41 and 60 hours	43	36.8	
Between 61 and 80 hours	19	17.1	
More than 80 hours	34	29.1	100.0
Preparation for Teaching Activities (PTA)			
Not at all	6	5.1	
Has participated in one PTA	12	10.3	
Has participated in two PTAs	28	23.9	
Has participated in three PTAs	30	25.6	
Has participated in four PTAs	41	35	100.0
Teacher Induction Program (TIP)			
Lacks TIP activities	7	6.0	
Has participated in one TIP activity	13	11.1	
Has participated in two TIP activities	45	38.5	
Has participated in three TIP activities	52	44.4	100.0

In regards to the teachers' professional development, all surveyed teachers have participated in at least one professional development activity. Most of surveyed teachers were involved in specific activities focused on English language arts subject (93 %, 109 teachers) and Math subject (94 %, 110 teachers). 79 surveyed teachers (68 %) received some kind of support for participating in professional development activities. 71 participant teachers (61 %) gained some kind of rewards for completing professional development activities. Finally, 99 % (116 teachers) were involved in collaboration activities. Descriptive statistics related to the teachers' professional development activities are showed in table below.

Table 14

Descriptive Statistics, Professional Development Programs

Characteristics	n=117	%	Cum. %
Participation in Professional Development Activities (PDA)			
Has participated in one PDA	45	38.5	
Has participated in two PDAs	48	41.0	
Has participated in three PDAs	24	20.5	100.0
Participation in PD Activities Focused on ELA			
Lacks PD activities focused on ELA	8	6.8	
Has participated in PD activities focused on ELA	109	93.2	100.0
Participation in PD Activities focused on Math			
Lacks PD activities focused on Math	7	6.0	
Has participated in PD activities focused on Math	110	94	100.0
Types of Support Received for Participating in PDA			
Not at all	38	32.5	
Received one type of support	53	45.3	
Received two types of support	24	20.5	
Received three types of support	2	1.7	100.0
Rewards Gained for Participating in PDA			
Not at all	46	39.3	
Has one type of reward gained	47	40.2	
Has two types of rewards gained	21	17.9	
Has three types of rewards gained	3	2.6	100.0
Participation in Collaboration Activities			
Not at all	1	0.9	
Has participated in one collaborative activity	15	12.8	
Has participated in two collaborative activities	36	30.8	
Has participated in three collaborative activities	43	36.8	
Has participated in four collaborative activities	22	18.8	100.0

In regards to the student achievement data, a total of 117 classrooms were included. Around 36 % (43 classrooms) were from the third grade; 34 % (39 classrooms) were from the fourth grade and 30 % (35 classrooms) were from the fifth grade. More than 93 % (109 classrooms) accomplish the learning standards in Math and ELA tests. The table below displays the class performance average in Math and ELA tests

Table 15

Descriptive Statistics, Student Achievement

Characteristics	Min.	Max.	Mean	SD
Student Achievement				
Class performance average in Math test	650	715	684.45	12.14
Class performance average in ELA test	640	702	667.01	13.20

Bivariate Analysis

Bivariate correlation analysis was performed to examine the strength of individual relationships between and among the main variables. Accordingly, the strength and direction of relationship between two variables were explored by using the Spearman's rho correlation coefficient.

Correlational analysis: Educational Background

The main independent variable educational background was divided into three sub-variables: highest degree earned, major field of study and pre-teaching tests.

According to data displayed in table below, the dependent variable class performance average in ELA test was statistically related to the following variables: class performance average in Math test (r=.71, p=.01), taken/passed the pre-teaching tests (r=.39, p=.01 and the teachers' highest degree earned (r=.39, p=.01).

The dependent variable class performance average in Math test was found statistically significant related to the teachers' highest degree earned (r=.28, p=.01) and the variable taken/passed the pre-teaching tests (r=.29, p=.01).

Table 16.

Correlations Spearman's rho for Educational Background

	A	B	C	D	E
Teacher highest degree earned (A)	1.00	.06	.22(*)	.28(**)	.39(**)
Major field of study (B)		1.00	.09	.06	.08
Taken / passed pre-teaching tests (C)			1.00	.29(**)	.39(**)
Class average in Math test (D)				1.00	.71(**)
Class average in ELA test (E)					1.00

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Correlational analysis: Certification & Training Status

According to the data displayed in table 17, the dependent variable class performance average in ELA test had a statistically significant relationship with the class performance average in Math test (r=.71, p=.01). The dependent variable class performance average in Math test had a statistically significant relationship with the variable preparation for teaching activities (r=.18, p=.05).

On the other hand, the variable teacher induction activities was found statistically related to the teaching practice (r=.33, p=.01) and current certification status (r=.22, p=.05). The variable preparation for teaching activities was statistically related to the teaching practice (r=.19, p=.05).

The variable certification grades was related to the certification area (r=.20, p=.05) and the variable certification content area was statistically related to the current certification status (r=-.20, p=.05).

Table 17

Correlations Spearman's rho for Certification and Training Status

	A	B	C	D	E	F	G	H
Certification status (A)	1.00	-.20 (*)	-.06	.10	.00	.22 (*)	.15	.14
Certification content area (B)		1.00	.20 (*)	-.04	.14	.08	-.03	-.06
Certification grades (C)			1.00	.05	.18	-.06	.13	.02
Teaching practice (D)				1.00	.19(*)	.33 (**)	.01	.18
Prep. for teaching activities (E)					1.00	-.01	.18 (*)	-.00
Teacher induction program (F)						1.00	.03	.08
Class average in Math test (G)							1.00	.71 (**)
Class average in ELA test (H)								1.00

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Correlation analysis: Professional Development Activities

In this case, the dependent variable class performance average in Math test was statistically significant related to the following variables: class performance average in Math test (r=.71, p=.01), participation in collaboration activities (r=.24, p=.01), rewards gained (r=.27, p=.01) and support received (r=.38, p=.01). The dependent variable class performance average in ELA test was significantly related to the following variables: participation in collaboration activities (r=.22, p=.05), rewards gained (r=.36, p=.01), support received (r=.35, p=.01) and participation in professional development activities (r=.18, p=.05).

On the other hand, the variable participation in collaboration activities was found statistically related to the teachers' support received (r=.32, p=.01) and participation in professional development activities (r=.37, p=.01). The variable, rewards gained was statistically related to other two variables: support received (r=.31, p=.01) and participation in professional development activities (r=.21, p=.05). A complete correlation for the variable professional development activities is displayed in table below.

Table 18

Correlations Spearman's rho for Professional Development Activities

	A	B	C	D	E	F	G	H
Participation in PD activities (A)	1.00	.02	-.01	.33 (**)	.21 (*)	.37 (**)	.18 (*)	.18
Activities focused on ELA (B)		1.00	.50 (**)	.10	.12	.07	.13	.07
Activities focused on Math (C)			1.00	.11	.14	.08	.11	.01
Support received (D)				1.00	.31 (**)	.32 (**)	.35 (**)	.38 (**)
Rewards gained (E)					1.00	.03	.36 (**)	.27 (**)
Collaboration activities (F)						1.00	.22 (*)	.24 (**)
Class average in Math test (G)							1.00	.71 (**)
Class average in ELA test (I)								1.00

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Inferential Statistics

In order to test the present study hypotheses, three main statistical tools were selected: multivariate analysis of variance (MANOVA), the standard and the hierarchical multiple regression analysis. Each statistical procedure was identified according to the nature of the

involved variables (categorical, ordinal or continuous) and the specific purpose in each case (exploring differences between groups or exploring potential relationships). The hierarchical multiple regression analysis was performed to assess the ability of the core independent variables: educational background, certification & training status and professional development programs to predict the class performance average in Math and ELA tests.

Results for each hypothesis were examined in three phases. First, a preliminary analysis was conducted to ensure no violation of the assumptions of normality, linearity and multicollinearity. Second, the most representative values of each statistical procedure were assessed in order to accept or reject individually each null hypothesis. Third, based on the most important predictor variables, identified in the previous phase, a regression model was performed to predict the class performance average in Math and ELA tests.

Main Findings

Three main teachers' characteristics were analyzed as independent variables: educational background, certification & training status and professional development activities. The variable educational background was divided into three sub-variables: highest degree earned, major field of study and the pre-teaching tests. The variable certification & training status was divided into six sub-variables: current certification status, certification area, certification grades, teaching practice, preparation for teaching activities and teacher induction activities. The variable professional development activities was divided into six sub-variables: participation in PD activities, activities focused on Math subject, activities focused on ELA subject, types of support received, rewards gained and participation in collaboration activities.

Statistical analysis outputs for each assessed variables are described in the following paragraphs.

The Impact of Teachers' Highest Degree Earned on the Student Achievement

Multiple regression analysis was used to assess the relationship between highest degree earned (independent variable) and class performance average in Math and ELA tests. In this case, the teachers' highest degree earned significantly and positively predicted the student achievement in both ELA test: beta= .38, t=4.4, p< .05 and Math test: beta= .28, t=3.17, p< .05 (see tables 19 and 20, respectively)

Table 19.

Regression Analysis: Highest Degree Earned and Class Performance Average in ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	631.24	8.21		76.86	.00
Highest degree earned	12.53	2.85	.38	4.40	.00

a Dependent Variable: Class performance average in ELA test

Table 20.

Regression Analysis: Highest Degree Earned and Class Performance Average in Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	659.85	7.82		84.30	.00
Highest degree earned	8.62	2.71	.28	3.17	.00

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Major Field of Study on Student Achievement

A multivariate analysis of variance was performed to examine major field of study differences (independent variable) related to the student achievement, expressed as the class

performance average in Math and ELA test (dependent variable). Preliminary assumption testing revealed no serious violations.

The analysis of variance showed that the effect of teachers' major field of study was significantly related to the student achievement in ELA and Math tests: Wilks=.83, $F(8,222)=2.66$, $p<.05$. Statistical outputs are displayed in table 21 below.

Table 21.

Multivariate Analysis of Variance: Major Field of Study

Effect		Value	F	H df	E df	Sig.
Intercept	Pillai's Trace	.10	59289.15(a)	2.00	111.00	.00
	Wilks' Lambda	.00	59289.15(a)	2.00	111.00	.00
FieldQ5 *	Pillai's Trace	.17	2.57	8.00	224.00	.01
	Wilks' Lambda	.83	2.66(a)	8.00	222.00	.01

a Exact statistic
* Teachers' Major field of study

Since the results of the MANOVA were significant, an additional analysis of the test of between-subjects effects was used to determine whether the teachers' major field of study remained significant for each standardized test. It confirms that there was a significant effect, $F(4,112)=3.39$, $p<.05$ for Math test, and $F(4,112)=5.32$, $p<.01$ for ELA test. Class performance average in both tests for each major field of study is displayed in table below.

Table 22.

Descriptive Statistics for Teachers' Major Field of Study

	Major field of study	Mean	SD	N
Class performance average in Math test	Elementary education	682.52	10.92	59
	English language arts	683.00	11.31	2
	Mathematics/Arithmetic	691.50	3.94	6
	Has combined majors	689.32	13.31	34
	Other field of study	678.75	12.31	16
	Total	684.45	12.14	117
Class performance average in ELA test	Elementary education	664.59	10.88	59
	English language arts	671.50	4.95	2
	Mathematics/Arithmetic	675.17	8.75	6
	Has combined majors	673.35	14.49	34
	Other field of study	658.81	13.60	16
	Total	667.00	13.20	117

The Impact of Teachers' Pre-teaching Tests on Student Achievement

A multiple regression analysis was performed to assess the ability of the pre-teaching test taken/passed status to predict the class performance average in Math and ELA tests. According to a preliminary analysis, there were not serious violations to the model's assumptions.

Based on the statistical outputs, the independent variable taken and passed the pre teaching test was found significantly related to the student achievement in ELA test (beta=.38, $t=4.44$, $p<.05$) and Math test (beta=.28, $t=3.13$, $p<.05$). Final results are displayed in tables 23 and 24 below.

Table 23.

Multiple Regression Analysis: Pre-teaching Tests and Class Performance Average in ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	657.38	2.44		268.87	.00
Taken and passed pre-teaching tests	3.94	.89	.38	4.44	.00

a Dependent Variable: Class performance average in ELA test

Table 24.

Multiple Regression Analysis, Pre-teaching Tests and Class Performance Average in Math Test

	UC		SE	t	Sig.
	B	SE	Beta		
(Constant)	677.97	2.34		290.23	.00
Taken and passed pre-teaching tests	2.65	.85	.28	3.13	.00

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Certification Status on Student Achievement

A multiple regression analysis was applied to examine the relationship between teachers' certification status and class performance average in Math and ELA tests. Preliminary analysis demonstrated that there was not any violation to the model's assumption.

According to the statistical analysis results, the variable current certification status was not able to predict the student achievement in either ELA ($p>.05$) or Math test ($p>.05$). Tables 25 and 26 below display the statistical outputs.

Table 25.

Multiple Regression Analysis, Certification Status and Class Performance Average in ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	651.96	10.00		65.19	.00
Current certification status	7.76	5.12	.14	1.52	.13

a Dependent Variable: Class performance average in ELA test

Table 26.

Multiple Regression Analysis, Certification Status and Class Performance Average in Math Test

	UC		SC	t	Sig.
	B	SE	Beta		
(Constant)	670.25	9.19		72.92	.00
Current certification status	7.32	4.70	.14	1.56	.12

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Certification Area on Student Achievement

A multivariate analysis of variance was performed to examine teachers' certification area differences in student achievement, expressed as the class performance average in Math and ELA tests. A preliminary assumption testing revealed no serious violations.

The analysis of variance test showed that the effect of teachers' certification area was significantly related to the student in Math and ELA tests, Wilks= .88, $F(6,224)= 2.40$, $p<.05$. The table below shows the MANOVA results.

Table 27.

Multivariate Analysis of Variance, Certification Area and Student Achievement

Effect		Value	F	H df	E df	Sig.
Intercept	Pillai's Trace	.10	75738.36(a)	2.00	112.00	.00
	Wilks' Lambda	.00	75738.36(a)	2.00	112.00	.00
AreaQ10*	Pillai's Trace	.12	2.38	6.00	226.00	.03
	Wilks' Lambda	.88	2.40(a)	6.00	224.00	.03

a Exact statistic
* Teachers' certification area

As the results of the MANOVA were found statistically significant, the test of between-subjects effects was analyzed to establish whether the teachers' certification area remained significant for each standardized test. The univariate results indicate that there is no significant effect, $F(3,113)=.79$, $p>.05$ for Math test, and $F(3,113)=2.54$, $p>.05$ for ELA test. Class performance score in Math and ELA test for each certification area is shown in table below.

Table 28.

Descriptive Statistics for Teachers' Certification Area

	Certification content area	Mean	SD	N
Class performance average in Math test	English language arts	681.12	12.31	8
	Mathematics/Arithmetic	685.17	9.03	12
	Both Math and English	685.12	12.52	89
	Other content area	679.25	11.92	8
	Total	684.45	12.14	117
Class performance average in ELA test	English language arts	669.00	8.05	8
	Mathematics/Arithmetic	662.33	9.97	12
	Both Math and English	668.35	13.43	89
	Other content area	657.12	14.95	8
	Total	667.00	13.20	117

The Impact of Teachers' Certification Grades on Student Achievement

In this case, a multivariate analysis of variance was performed to analyze the teachers' certification grades differences in the class performance average in Math and ELA tests. Previous assumption testing demonstrated that there were not serious violations.

The analysis of variance showed that the effect of teachers' certification grades was not significantly related to the student achievement in any case (p>.05). The MANOVA output is displayed in the table below.

Table 29.

Multivariate Analysis of Variance, Certification Grades and Student Achievement

Effect		Value	F	H df	E df	Sig.
Intercept	Pillai's Trace	.10	28791.89(a)	2.00	113.00	.00
	Wilks' Lambda	.00	28791.89(a)	2.00	113.00	.00
GradeQ11*	Pillai's Trace	.04	1.11	4.00	228.00	.35
	Wilks' Lambda	.96	1.11(a)	4.00	226.00	.35

a Exact statistic
* Teachers' certification grades

The Impact of Teachers' Teaching Practice on Student Achievement

A multiple regression analysis was applied to examine the ability of the teachers' time spent in teaching practice to predict the class performance average in both Math and ELA tests. Preliminary analysis revealed no violations of the model's assumptions.

According to the multiple regression outputs, teachers' teaching practice does not significantly predicted the class performance average in either ELA test (p>.05) and Math test (p>.05). Statistical outputs are displayed in tables 30 and 31 below.

Table 30.

Regression Analysis: Teaching Practice and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	659.86	4.05		162.76	.00
Teaching practice	2.01	1.09	.17	1.85	.07

a Dependent Variable: Class performance average in ELA test

Table 31.

Regression Analysis: Teaching Practice and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	683.76	3.78		180.78	.00
Teaching practice	.19	1.01	.02	.19	.85

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Preparation for Teaching Activities on Student Achievement

This variable was tested by applying a multiple regression analysis to assess potential relationship between the teachers' preparation for teaching activities and the class performance average in both Math and ELA tests.

According to the statistical outputs, the variable preparation for teaching activities does not significantly predicted the student achievement in ELA test ($p>.05$); however, it was able to predict the student performance in Math test (beta=.18, t=1.95, p=.05). Final results of the statistical test are displayed in tables 32 and 33 below.

Table 32.

Multiple Regression Analysis: Preparation for Teaching Activities and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	666.45	3.10		214.82	.00
Preparation for teaching activities	.20	1.04	.02	.20	.84

a Dependent Variable: Class performance average in ELA test

Table 33.

Multiple Regression Analysis: Preparation for Teaching Activities and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	679.41	2.81		242.03	.00
Preparation for teaching activities	1.83	.93	.18	1.95	.05

a Dependent Variable: Class performance average in Math test

The Impact of Teacher Induction Activities on Student Achievement

A multiple regression analysis was performed to assess the ability of teacher induction activities to predict the student performance in ELA and Math tests. Preliminary assumption testing revealed no serious violations.

The multiple regression analysis demonstrated that the variable teacher induction activities are not significantly related to the student achievement in either ELA test ($p>.05$) or Math test ($p>.05$). Statistical outputs are displayed in tables 34 and 35 below.

Table 34.

Multiple Regression Analysis: Teacher Induction Program and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	665.80	3.36		197.96	.00
Induction program in the first year	.54	1.41	.04	.38	.70

a Dependent Variable: Class performance average in ELA test

Table 35.

Multiple Regression Analysis: Teacher Induction Program and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	684.56	3.09		221.19	.00
Induction program in the first year	-.05	1.31	-.00	-.04	.97

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' professional development activities on Student Achievement

A multiple regression analysis was used to assess how teachers' participation in professional development activities are related to the class performance average in both Math and ELA tests. Preliminary analysis revealed no violations of the model's assumptions.

The multiple regression analysis demonstrated that the teachers' participation in professional development activities are statistically related to the student achievement in both ELA test (beta=.20, t=2.24, p<.05) and Math test (beta=.21, t=2.27, p<.05). Statistical results are displayed in tables below.

Table 36.

Multiple Regression Analysis: Participation in PD Activities and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	660.44	3.16		208.91	.00
Participation in PD activities	3.60	1.61	.20	2.24	.03

a Dependent Variable: Class performance average in ELA test

Table 37.

Multiple Regression Analysis: Participation in PD Activities and Math Test

	UC		SC	t	Sig.
	B	SE	Beta		
(Constant)	678.35	2.91		233.45	.00
Participation in PD activities	3.35	1.48	.21	2.27	.02

a Dependent Variable: Class performance average

The Impact of Teachers' Activities Focused on ELA Subject on Student Achievement

A multivariate analysis of the variance was performed to examine activities focused on ELA subject differences on student achievement in ELA and Math test. Preliminary assumption testing was conducted with no serious violations noted.

The analysis of variance revealed that the effect of teachers' activities focused on ELA subject were not significantly related to the student achievement ($p>.05$). Final statistical test output is displayed in table 38 below.

Table 38.

Multivariate Analysis of Variance: Teachers' Activities Focused on ELA Subject

Effect		Value	F	H df	E df	Sig.
Intercept	Pillai's Trace	.100	48820.01(a)	2.00	114.00	.00
	Wilks' Lambda	.00	48820.01(a)	2.00	114.00	.00
ELAQ22*	Pillai's Trace	.02	1.25(a)	2.00	114.00	.29
	Wilks' Lambda	.98	1.25 (a)	2.00	114.00	.29

a Exact statistic
* Teachers' activities focused on ELA Subject

The Impact of Teachers' Activities Focused on Math Subject on Student Achievement

This variable was tested by applying a multivariate analysis of variance which was used to assess group differences between activities focused on Math subject and the student achievement. A preliminary assumptions test revealed that there were not serious violations.

According to the statistical test output, the effect of teachers' activities focused on Math subject were not significantly related to the student achievement in ELA and Math tests ($p>.05$). The final results of the statistical test are displayed in the table below.

Table 39.

Multivariate Analysis of Variance: Teachers' Activities Focused on Math Subject

Effect		Value	F	H df	E df	Sig.
Intercept	Pillai's Trace	.10	42837.37(a)	2.00	114.00	.00
	Wilks' Lambda	.00	42837.37(a)	2.00	114.00	.00
MathQ23*	Pillai's Trace	.02	1.01(a)	2.00	114.00	.37
	Wilks' Lambda	.98	1.01(a)	2.00	114.00	.37

a Exact statistic
* Teachers'' activities focused on Math subject

The Impact of Teachers' Support Received on Student Achievement

A multiple regression analysis was applied to test this variable. The main purpose was to assess potential relationship between teachers' support received for participating in professional development activities and the student achievement.

In this case, the variable support received was found significantly related to the student achievement in both ELA test (beta=.43, t=5.18, p<.05) and Math test (beta=.36, t=4.09, p<.05). Results of the statistical test are displayed in the following tables 40 and 41.

Table 40.

Multiple Regression Analysis: Types of Support Received and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	660.21	1.71		384.92	.00
Support received in PD activities	7.43	1.44	.43	5.18	.00

a Dependent Variable: Class performance average in ELA test

Table 41.

Multiple Regression Analysis: Types of Support Received and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	679.33	1.64		415.12	.00
Support received in PD activities	5.60	1.37	.36	4.09	.00

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Rewards Gained on Student Achievement

A multiple regression analysis was performed to test this variable. It was selected to assess potential relationships between the teachers' rewards gained for participating in professional development activities and the class performance average in Math and ELA tests. Preliminary analysis was conducted to ensure no violation of the model's assumptions.

Statistical analysis' results demonstrated that the variable rewards gained was able to predict the student achievement in both ELA test (beta=.31, t=3.50, p<.05) and Math test (beta=.31, t=3.55, p<.05). Statistical outputs are displayed in the following two tables.

Table 42.

Multiple Regression Analysis: Rewards Gained and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	662.77	1.68		394.28	.00
Rewards gained for completing PD activities	5.06	1.45	.31	3.50	.00

a Dependent Variable: Class performance average in ELA test

Table 43.

Multiple Regression Analysis: Rewards Gained and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	680.51	1.54		440.82	.00
Rewards gained for completing PD activities	4.71	1.33	.31	3.55	.00

a Dependent Variable: Class performance average in Math test

The Impact of Teachers' Participation in Collaboration Activities on Student Achievement

This hypothesis was tested by performing a multiple regression analysis. In this case, this statistical tool was used to examine the ability of the variable participation in collaboration activities to predict the student achievement in both Math and ELA test. Preliminary assumption testing was conducted with no serious violations noted.

According to the statistical test results, the variable participation in collaboration activities was found statistically able to predict both ELA test (beta=.25, t=2.75, p<.05) and Math test (beta=.21, t=2.29, p<.05). Results are displayed in the following two tables below.

Table 44.

Regression Analysis: Participation in Collaboration Activities and ELA Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	658.18	3.42		192.38	.00
Participation in collaboration activities	3.40	1.23	.25	2.75	.01

a Dependent Variable: Class performance average in ELA test

Table 45.

Regression Analysis: Participation in Collaboration Activities and Math Test

	UC		SC	t	Sig.
	B	SE	beta		
(Constant)	677.62	3.18		213.34	.00
Participation in collaboration activities	2.63	1.15	.21	2.29	.02

a Dependent Variable: Class performance average in Math test

Finding's Summary

In order to assess the core study's hypothesis: "There is a statistically significant relationship between teaching quality characteristics and the student achievement expressed as the class performance average in Math and ELA tests", fifteen specific observable teachers' characteristics were identified: highest degree earned, major field of study, pre-teaching tests, current certification status, certification area, certification grades, teaching practice, preparation for teaching activities, teacher induction activities, participation in professional development activities, professional development activities focused on Math subject, professional development activities focused on English language arts, support received, rewards gained for participating in professional development activities and participation in other professional development activities.

Each teacher characteristic was individually tested by performing either the multivariate analysis of variance (MANOVA) test or the multiple regression analysis. The appropriate statistical test was selected for each hypothesis according to the data type (ordinal, categorical, continuous) and the analysis' purposes (compare differences between groups or explore potential relationships).

According to the multiple regression analysis, six independent variables significantly predicted the student achievement in Math and ELA tests: highest degree earned, taken/passed the pre-teaching tests, participation in professional development activities, support received, rewards gained and participation in collaboration activities. The multivariate analysis of variance test demonstrated that two independent variables revealed statistically significant differences associated to the student achievement in Math and ELA test. They were the teachers' major field of study and the teachers' certification area.

Other analyzed variables such as current certification status, certification grades, teaching practice, preparation for teaching activities, teacher induction activities, activities focused on ELA and Math subject were found not significantly related to the student performance in Math and ELA tests. The table 46 below displays the main statistical test results for each teacher's characteristics tested

Table 46.

Main Statistical Results for each Teacher's Characteristics Tested

Description	Statistical Test	Findings
Educational Background		
Highest degree earned	Regression	ELA test: beta=.38, t=4.40, p<.05 Math test: beta=.28, t=3.17, p<.05
Major field of study	MANOVA	Wilks=.83, F(8,222)=2.66, p<.05
Taken/passed pre-teaching tests	Regression	ELA test: beta=.38, t=4.44, p<.05 Math test: beta=.28, t=3.13, p<.05
Certification & Training Status		
Current certification status	Regression	ELA test: beta=.14, t=1.52, p>.05 Math test: beta=.14, t=1.56, p>.05
Certification area	MANOVA	Wilks=.88, F(6,224)=2.40, p<.05
Certification grades	MANOVA	Wilks=.96, F(4,226)=1.11, p>.05
Teaching practice	Regression	ELA test: beta=.17, t=1.85, p>.05 Math test: beta=.02, t=.19, p>.05
Preparation for teaching activities	Regression	ELA test: beta=.20, t=.20, p>.05 Math test: beta=.18, t=1.95, p=.05
Teacher induction program	Regression	ELA test: beta=.04, t=.38, p>.05 Math test: beta=-.00, t=-.04, p>.05
Professional Development Programs		
Participation in PD activities	Regression	ELA test: beta=.20, t=2.24, p<.05 Math test: beta=.21, t=2.27, p<.05
Activities focused on ELA subject	MANOVA	Wilks=.98, F(2,114)=1.25, p>.05
Activities focused on Math subject	MANOVA	Wilks=.98, F(2,114)=1.01, p>.05

Types of support received	Regression	ELA test: beta=.43, t=5.18, p<.05 Math test: beta=.36, t=4.09, p<.05
Rewards gained	Regression	ELA test: beta=.31, t=3.50, p<.05 Math test: beta=.31, t=3.55, p<.05
Collaboration activities	Regression	ELA test: beta=.25, t= 2.75, p<.05 Math test: beta=.21, t=2.29, p<.05

Predicting the Student Achievement

Based on the most significant predictors previously identified, a hierarchical multiple regression analysis was performed to assess the ability of the three main areas of teacher quality: educational background, certification & training status and the professional development programs to predict the class performance average in Math and ELA tests.

In both cases, the highest degree earned, major field of study and the taken/passed the pre-teaching tests were entered at step 1. The variables certification area, teaching practice and preparation for teaching activities were added at step 2. Finally, at step 3, the following variables were entered: participation in professional development activities, support received, rewards gained and participation in other professional development activities.

Predicting Class Performance Average in ELA test

According to the hierarchical multiple regression analysis output, at step 1, the model was able to explain 24 % of the variance in the class performance average in ELA test. Two predictors were found statistically significant: highest degree earned (beta=.31, t=3.70, p<.05) and taken/passed pre-teaching tests (beta=.31, t=3.72, p<.05).

At step 2, the statistical model was able to explain 26 % of the variance. The same predictors remained statistically significant: highest degree earned (beta=.31, t=3.56, p<.05) and the variable taken/passed the pre-teaching tests (beta=.31, t=3.63, p<.05).

At step 3, the regression model was able to explain 35 % of the variance in the class performance average in ELA test. At this point, three predictors revealed a statistically positive relationship. They were: highest degree earned (beta=.25, t=2.83, p<.05), taken/passed the pre-teaching tests (beta=.21, t=2.43, p<.05) and the variable support received (beta=.25, t=2.68, p<.05). The statistical test results are displayed in table below.

Table 47.

Final Regression Model Predicting ELA Test Results

Mod		UC		SC	t	Sig.
		B	SE	beta		
1	(Constant)	629.08	7.89		79.70	.00
	Teacher highest degree earned	10.26	2.77	.31	3.70	.00
	Major field of study	.30	.66	.04	.45	.65
	Taken/passed pre-teaching tests	3.22	.87	.31	3.72	.00
2	(Constant)	623.22	10.21		61.04	.00
	Teacher highest degree earned	10.11	2.84	.31	3.56	.00
	Major field of study	.32	.70	.04	.46	.65
	Taken/passed pre-teaching tests	3.24	.89	.31	3.63	.00
	Certification content area	.24	1.70	.01	.14	.89
	Teaching practice	.99	1.04	.08	.95	.34
	Preparation for teaching activities	.72	.99	.06	.73	.46
3	(Constant)	630.37	10.10		62.39	.00
	Teacher highest degree earned	8.13	2.87	.25	2.83	.00
	Major field of study	-.00	.68	.00	-.00	.10
	Taken/passed pre-teaching tests	2.18	.90	.21	2.43	.02
	Certification content area	-.35	1.68	-.02	-.21	.83
	Teaching practice	.65	1.04	.05	.62	.53
	Preparation for teaching activities	-.02	.96	-.00	-.02	.99
	Participation in PD activities	-.17	1.55	-.01	-.11	.91

Support received in PD activities	4.27	1.60	.25	2.68	.01
Rewards gained for PD activities	2.67	1.40	.16	1.90	.06
Collaboration activities	.38	1.32	.03	.29	.77

a Dependent Variable: Class performance average in ELA test
* M1 R2 = 24; ** M2 R2 = 26 ; *** M3 R2 = 35

Predicting Class Performance Average in Math test

The hierarchical multiple regression analysis output revealed the following results: at step 1, the model was able to explain 13 % of the variance in the class performance average in Math test. Two variables were found significantly related to the student achievement in Math test: the variable highest degree earned (beta=.23, t=2.59, p<.05) and the variable taken/passed the pre-teaching tests (beta=.22, t=2.51, p<.05)

The second model, at step 2, was able to explain 20 % of the variance in the Math test results. At this point, three predictor variables remained statistically significant: highest degree earned (beta=.27, t=3.09, p<.05), taken/passed the pre-teaching tests (beta=.27, t=3.04, p<.05) and the variable preparation for teaching activities (beta=.26, t=2.89, p<.05)

The third model, at step 3, was able to explain 28 % of the variance in the class performance average in Math test. At this level, four predictor variables were found statistically significant: highest degree earned (beta=.21, t=2.34, p<.05), taken/passed the pre-teaching tests (beta=.18, t=1.97, p=.05), preparation for teaching activities (beta=.21, t=2.28, p<.05) and the variable rewards gained (beta=.19, t=2.12, p<.05). The statistical test results are displayed in table below.

Table 48.

Final Regression Model Predicting Math Test Results

Mod		UC		SC	t	Sig.
		B	SE	beta		
1*	(Constant)	658.07	7.753		84.88	.00
	Teacher highest degree earned	7.06	2.72	.23	2.59	.01
	Major field of study	.39	.65	.05	.60	.55
	Taken/passed pre-teaching tests	2.13	.85	.22	2.51	.01
2**	(Constant)	649.16	9.73		66.70	.00
	Teacher highest degree earned	8.36	2.71	.27	3.09	.00
	Major field of study	-.11	.67	-.01	-.16	.87
	Taken/passed pre-teaching tests	2.59	.85	.27	3.04	.00
	Certification content area	.75	1.63	.04	.46	.65
	Teaching practice	-1.18	.99	-.10	-1.19	.24
	Preparation for teaching activities	2.71	.94	.26	2.89	.00
3***	(Constant)	654.88	9.80		66.80	.00
	Teacher highest degree earned	6.53	2.78	.21	2.34	.02
	Major field of study	-.44	.66	-.06	-.67	.51
	Taken/passed pre-teaching tests	1.71	.87	.18	1.97	.05
	Certification content area	.05	1.63	.00	.03	.98
	Teaching practice	-1.49	1.01	-.14	-1.47	.14
	Preparation for teaching activities	2.13	.93	.21	2.28	.02
	Participation in PD activities	.30	1.51	.02	.20	.84
	Support received in PD activities	2.56	1.55	.16	1.65	.10
	Rewards gained for PD activities	2.88	1.36	.19	2.12	.04
	Collaboration activities	.71	1.28	.06	.552	.58

a Dependent Variable: Class performance average in Math test
* M1 R2 = 13; ** M2 R2 = 20 ; ***M3 R2 = 28

CHAPTER 6: DISCUSSION, CONCLUSIONS AND IMPLICATION OF THE RESEARCH

General Overview

Since the No Child Left Behind act of 2001was signed into law by the President George Busch, the federal, state and local government's efforts are underway to raise the level of student achievement (USDOE, 2003). Accordingly, as the federal government is more deeply concerned regarding the final student outcomes, states are forced to think in terms of "quality inputs to quality outputs" to improve the student achievement. In this context, one of the most critical inputs in the education system is the classroom teacher. In addition, the most of research findings are unequivocally agree about the connection between teacher quality and student learning outcomes (Archibald, 2007).

By recognizing the connection between quality teaching and student achievement, this study addressed the broad question: "what is the relationship between teacher quality and student achievement?" This question was divided into three specific research questions: 1) how is teachers' educational background related to student achievement? 2) how is the teachers' certification & training status related to student achievement? 3) how is the teachers' professional development programs related to student achievement?

Four main statistical procedures, the bivariate correlation analysis, the multiple regression analysis, the hierarchical multiple regression analysis and the multivariate analysis of variance (MANOVA) were applied to assess the variables under investigation. Based on statistical analysis, this study identified statistically significant relationships between eight observable teacher characteristics (highest degree earned, major field of study, the pre-teaching tests, certification area, participation in professional development activities, support received, rewards

gained and participation in other professional development activities) and the student achievement, expressed as the class performance average in Math and ELA tests.

Discussion of Findings

This section discusses the main findings of this study which are considered in the context of the literature that was reviewed for this study. The main findings related to the correlations, multiple regression analysis and the multivariate analysis of variance are summarized in this section.

Correlations

The bivariate correlations between teacher quality characteristics such as educational background, certification & training status and professional development and the student achievement measured as the class performance average in Math and ELA tests) were high. In effect, variables correlation matrix for educational background, certification & training status and professional development revealed a consistent relationship between and among the student performance in Math and ELA tests.

Particularly this study found a significant relationship between the student achievement and the following variables: highest degree earned, the pre-teaching tests, certification area, participation in professional development activities, support received rewards gained and participation in collaboration activities (see tables 16, 17 and 18). In a general way these findings are consistent with the final conclusions of this study.

Inferential Statistics

Fifteen observable teacher's characteristics were individually tested to assess their potential relationship with the student achievement in Math an ELA test. Either the multiple

regression analysis or the multivariate analysis of variance was applied according to the type of variable. Conclusions for each sub-variable are described in the following paragraphs.

Findings Related to the Teachers' Educational Background

In order to properly answer the question: How is teachers' educational background related to the student achievement three variables were statistically tested: highest degree earned, major field of study and the pre-teaching tests. Specific findings for each potential predictor variable are described in the following paragraphs.

The Impact of Teachers Degree on Student Achievement

Multiple regression analysis was used to assess the relationship between highest degree earned and the student achievement in Math and ELA tests. The independent variable highest degree earned revealed a positive and significant relationship with the class performance average in both Math test (beta=.28, $t=3.17$, $p < .05$) and ELA test (beta=.38, $t=4.40$, $p < .05$).

According to the statistical outputs, students taught by teachers who held a higher degree had scores significantly higher in Math and ELA tests than those students taught by teachers who held a lower academic degree. Based on these results, it is reasonable to conclude that teachers' degree is positively related to the student achievement (see tables 19 and 20).

The Impact of Teachers' Major Field of Study on Student Achievement

A multivariate analysis of variance was performed to examine differences between the major field of study differences and the student achievement, expressed as the class performance average in Math and ELA test.

The analysis of variance showed that the effect of teachers' major field of study was significantly related to the student achievement in Math and ELA tests: Wilks=.83, $F(8,222)=2.66$, $p<.05$. Furthermore, the univariate analysis with the test of between-subjects

effect confirms a significant effect, $F(4,112)=3.39$, $p<.05$ for Math test, and $F(4,112)=5.32$, $p<.05$ for ELA test.

Based on the statistical analysis results, this study demonstrated that teachers who had a major field of study in areas such as Mathematics, English language arts or a combined major (Math and ELA) showed a class performance average in Math and ELA tests significantly different from those teachers who held certification in other content areas (see table 21 and 22)

The Impact of Pre-teaching Test on Student Achievement

A multiple regression analysis was used to assess the ability of the variable pre-teaching test to predict the class performance average in Math and ELA tests. The statistical analysis revealed that the variable taken/passed the pre-teaching test was significantly related to the student achievement in Math (beta=.28, $t=3.13$, $p<.05$) and ELA tests (beta=.38, $t=4.44$, $p<.05$).

Based on these results, this study found that students taught by teachers who did not take/ approve any of the pre-teaching tests had significantly lower scores in the Math and ELA tests compared with those students taught by teachers who took/approved at least one pre-teaching test (see tables 23 and 24). Accordingly, it is rational to conclude that the pre-teaching tests are significantly related to the student achievement.

Findings Related to the Teachers' Certification & Training Status

The second research question attempted to respond whether teachers' certification & training status is related to the student achievement. In this case six variables were statistically tested. They were: current certification status, certification area, certification grades, teaching practice, preparation for teaching activities and teacher induction activities. Specific findings for each tested variables are described in the following paragraphs.

The Impact of Teachers' Certification Status on Student Achievement

A multiple regression analysis was used to assess the ability of teachers' certification status to predict the student achievement. According to the statistical test outputs, the variable current certification status was not able to predict neither the Math test (beta=.14, t=1.56, p>.05) nor the ELA test (beta=.14, t=1.52, p>.05).

Based on the regression results, this study found that students taught by teachers who held a full state standard certification had similar test scores in ELA and Math tests compared to students taught by teachers who did not (see tables 25 and 26).

The Impact of Teachers' Certification Area on Student Achievement

A multivariate analysis of variance was performed to examine teachers' certification area differences in student achievement, expressed as the class performance average in Math and ELA tests.

The univariate results with the test of between-subject effects revealed that there is no significant effect, F(3,113)=.79, p>.05, and F(3,113)=2.54, p>.05 for ELA test. However, the multivariate effect of teachers' certification area was significantly related to the student achievement in Math and ELA test, Wilks=.88, F(6,224)=2.40, p<.05. This means that while the individual effects for each teachers' certification area is not statistically significant, the interaction effects are significant for the Math and ELA test.

Consequently, this study found that teachers who held certification in English language arts and/or Math content area had class performance averages in Math and ELA tests significantly different from those teachers who held certification in other content areas (see table 27 and 28). These results indicate that teachers' certification area is statistically related to the class performance average in Math and ELA tests

The Impact of Certification Grades on Student Achievement

A multivariate analysis of variance was performed to analyze the teachers' certification grades differences in the student achievement. The analysis of variance revealed that the effect of teachers' certification grades was not significantly related to the class performance average in Math and ELA test: beta=.96, $F(4,226)=1.11$, $p>.05$.

Based on the statistical analysis, this study found, for example, that teachers who held certification in elementary grades had similar class performance average in Math and ELA tests in compared to those teachers who held certification in middle and/or secondary grades (see table 29).

The Impact of Teachers' Teaching Practice on Student Achievement

A multiple regression analysis was applied to examine the ability of the teachers' teaching practice to predict the student achievement. The regression outputs revealed that the variable teaching practice was not significantly related to the student achievement in Math (beta=.02, t=.19, $p>.05$) and ELA tests (beta=.17, t=1.85, $p>.05$)

Based on statistical analysis, this study discovered that teachers who reported time spent in teaching preparation activities had not significant differences in their class performance average in Math and ELA tests compared to those teachers who did not (see tables 30 and 31).

The Impact of Teachers' Preparation for Teaching Activities on Student Achievement

A multiple regression analysis was applied to assess potential relationships between teachers' preparation for teaching activities and student achievement. The regression results demonstrated that the teachers' preparation for teaching activities does not significantly predicted the student achievement in ELA test results (beta=.02, t=.20, $p>.05$); however, this variable was able to predict the Math test results (beta=.18, t=1.95, $p=.05$)

Based on these results, this study found that students taught by teachers who were involved in teaching preparation activities performed higher in the Math test compared with those students taught by teachers who did not (see tables 32 and 33)

The Impact of Teacher Induction Activities on Student Achievement

A multiple regression analysis was used to evaluate potential relationship between the teacher induction activities and student achievement. The statistical analysis demonstrated that the predictor "teacher induction activities" was not significantly related to the student achievement in Math (beta=-.00, t=-.04, p>.05) and ELA tests (beta=.04, t=.38, p>.05).

This study found that teachers who were involved in teacher induction activities had similar class performance average in Math and ELA tests (see tables 34 and 35).

Findings Related to the Teachers' Professional Development Activities

The third research question attempted to analyze how teachers' professional development activities can impact the student achievement. Six variables were individually tested to assess this research question. They were: participation in professional development activities, activities focused on Math, activities focused on ELA, support received, rewards gained and participation in other professional development activities. Specific findings for each variable are described below.

The Impact of Teachers' Participation in PD Activities on Student Achievement

A multiple regression analysis was used to assess how teachers' participation in professional development activities is related to the student achievement. Regression outputs revealed that teachers' participation in professional development activities are significantly related to the student achievement in Math test (beta=.21, t=2.27, p<.05) and ELA test (beta=.20, t=2.24, p<.05).

Based on statistical data analysis, this study found that students taught by teachers who were involved in professional development activities had significantly higher scores in Math and ELA tests than students taught by teachers who did not (see tables 36 and 37).

The Impact of Teachers' Activities Focused on Math on Student Achievement

A multivariate analysis of variance was performed to examine differences between activities focused on Math and the student achievement. Based on the MANOVA test outputs, this study found that was not a statistically significant difference between teachers who participated in activities focused on Math and those teachers who did not on the combined dependent variables: Wilks=.98, $F(2,114)=1.01$, $p>.05$.

The Impact of Teachers' Activities Focused on ELA on Student Achievement

A multivariate analysis of variance was applied to assess differences between activities focused on English language arts (ELA) and the student achievement. MANOVA test outputs demonstrated that there was not a statistically difference between teachers who participated in professional development activities focused on ELA and those teachers who did not on the combined dependent variables: Wilks=.98, $F(2,114)=1.25$, $p>.05$.

The Impact of Teachers' Support Received on Student Achievement

A multiple regression analysis was used to assess the potential relationship between the teachers' support received for participating in professional development activities and the student achievement. The regression analysis demonstrated that the predictor variable support received was significantly related to the student achievement in Math test (beta=.36, $t=4.09$, $p<.05$) and ELA test (beta=.43, $t=5.18$, $p<.05$).

Based on these results, this study found that student taught by teachers who received support for participating in professional development activities had significantly higher scores in the ELA and Math test than those students taught by teachers who did not (see tables 40 and 41).

The Impact of Teachers' Rewards Gained on Student Achievement

A multiple regression analysis was used to test the ability of the variable teachers' rewards gained to predict the student achievement. Regression analysis revealed that teachers' reward gained was significantly related to the student achievement in Math test (beta=.31,t=3.55, $p<.05$) and ELA test (beta=.31, t=3.50, $p<.05$)

Based on the statistical analysis outputs, this study found that students taught by teachers who did not gain rewards for completing professional development activities had test scores in Math and ELA tests significantly lower than those students taught by teachers who did it (see tables 42 and 43)

The Impact of Teachers' Participation in Collaboration Activities on Student Achievement

A multiple regression analysis was performed to examine the relationship between the teachers' participation in collaboration activities and the student achievement. Regression analysis test demonstrated that the teachers' involvement in other professional development activities was significantly related to the student achievement in Math test (beta=.21, t=2.29, $p<.05$) and ELA test (beta=.25, t=2.75, $p<.05$)

Based on these results, this study found that students taught by teachers who were involved in collaboration activities had significantly higher scores in the Math and ELA test compared to those students taught by teachers who did not (see tables 44 and 45).

Findings in Predicting the Student Achievement

A hierarchical multiple regression analysis was applied to assess the relative importance of the most significant predictors previously identified.

Predicting the Class Performance Average in ELA test

In the first case, predicting class performance average in ELA test, at step 3, the model was able to explain 35 % of the variance. Three predictor variables revealed a statistically relationship. They were highest degree earned (beta=.25, t=2.43, p<.05), taken/passed the pre-teaching tests (beta=.21, t=2.43, p<.05) and support received (beta=.25, t=2.68, p<.05). These data results suggest a relatively fragile statistical model because it explains only 35 % of the variance. In other words, around 65 % of the variance cannot be explained for the model's predictors.

Predicting the Class Performance Average in Math test

This statistical model, designed to predict the class performance average in Math test, was able to explain 28 % of the variance in the Math test results. This model is less powerful than the previous predicting variance in ELA test. Once again, this model is not strong enough since around 72 % of the variance cannot be explain for the independent variables introduced in the model.

In the final model, at step 3, four variables were found significantly related to the class performance average in Math and ELA tests. They were: the highest degree earned (beta=.21, t=2.34, p<.05), taken/passed the pre-teaching test (beta=.18, t=1.97, p=.05), preparation for teaching activities (beta=.21, t=2.28, p<.05) and rewards gained (beta=.19, t=2.12, p<.05)

Conclusions

Conclusions Related to Teachers' Educational Background

According to the data results, three teachers' educational background characteristics were significantly related to the student achievement in both Math and ELA tests. They were highest degree earned, major field of study and the variable taken/passed the pre-teaching tests.

At this point, the results of this study confirms the findings of other studies such as Goldhaber and Brewer (1997) and Kellman (1997) who found that teachers' educational background such as educational degree are strongly related to student achievement. However, these findings contradict with other researchers such as Wenglinsky (2002) Rowan et al (2002), Hasan C. (2006) and Archibald (2007) who found that teachers' educational degree do not have a significant impact on student achievement.

On the other hand, this study's results contradicts other research findings like Bryant's (2007) who found that there was not linear relationship between the high qualified mathematics teachers, which included pre-teaching tests, and the student achievement. In the same way, Mubenga (2006) found that teacher qualifications and specialty, which included major field of study, are not significantly related to the student achievement.

Conclusions Related to the Teachers' Certification & Training Status

The statistical analysis demonstrated that the certification area was significantly related to the student achievement in Math and ELA test. The variable preparation for teaching activities was found partially related to the student achievement. In effect, teachers' preparation for teaching activities was found statistically related to the Math test but it was not significantly related to the ELA test results.

In a general way, these findings corroborate other research conclusions such as the Kellman's (1997), Fetler's (1999), Darling-Hammond's (2000), Laczko-Kerr's (2002) and Alexander's (2004) who found that the teachers' certification status are strongly related to student achievement. However, these results disagree with Stephens' findings (2003) who found that teachers' certification status is not significantly related to student achievement.

Conclusions Related to the Teachers' Professional Development Activities

Statistical test results revealed that teachers' professional development activities are related to the student achievement in Math and ELA tests. In effect, variables such as participation in professional development activities, support received, rewards gained and participation in collaboration activities are significantly related to the student achievement.

These results confirm other authors' findings such as Hanushek et al (1996), Gibson (2004) and Heitman (2006) who found that professional development activities can affect positively on student achievement. Other authors like Milanosksy (2004) and Milanosky and Kimball (2005) also agree that some professional development activities such as teachers' training and teacher evaluation scores are significantly related to the student's level of achievement.

Critical Analysis of Findings and Conclusions

This study attempted to examine potential relationships between some observable teacher quality characteristics and the student achievement. Three core hypotheses were statistically tested:1) there is no significant difference in the student achievement based on the teachers' educational background; 2) there is no significant difference in the student achievement based on the teachers' certification & training status; and 3) there is no significant difference in the student achievement based on the teachers' professional development activities.

In regards to the variable teachers' educational background, this study demonstrated that teachers' characteristics such as highest degree earned, major field of study and the pre-teaching test are strongly related to the class performance average in Math and ELA test; accordingly, the first null hypothesis "there is no significant difference in the student achievement based on the teachers' educational background" was rejected.

In regards to the second variable teachers' certification & training status, this study found that teachers' certification area is significantly related to the student achievement in Math and ELA tests. However, other teachers' certification characteristics such as current certification status and certification grades are not.

In the same way, training activities such as teaching practice, preparation for teaching activities and teacher induction programs are not statistically related to the student achievement. Based on these results, the null hypothesis "there is no significant difference in the student achievement based on the teachers' certification & training status" was partially rejected.

In relation to the third variable teachers' professional development activities, this study found that teachers' participation in professional development activities, support received, rewards gained and involvement in collaboration activities are significantly related to the student achievement in Math and ELA tests. Other activities such as activities focused on Math and ELA subjects were found not significantly related to the student achievement. As a result, the third null hypothesis "there is no significant difference in the student achievement based on the teachers' professional development activities" was rejected.

In conclusion, since the results of the present study are statistically consistent, the above-mentioned results can be generalized for elementary schools but it must be restricted to elementary schools in New York City's community district schools.

Implications for Practice

As the report of the commission on No Child Left Behind (Commission on NCLB, 2007) was made clear, school leaders and policymakers need a better way to identify, to enhance and to allocate high quality teachers across districts and schools. In this way, according to this study's findings, teachers characteristics such as highest degree earned, major field of study, the pre-teaching tests, certification area, participation in professional development activities, support received, rewards gained and participation in collaboration activities, might be considered as critical characteristics to assess teacher quality issues in elementary schools.

First, the findings of this study indicate that teachers' degree, major field of study and the taken/passed pre-teaching tests status are consistent, positive, statistically significant predictors of student achievement. Accordingly, teachers who passed the pre-teaching tests, hold a higher degree and has a major in the subject taught seem to be those who are able to enhance their students' achievement.

The point here for school leaders and policymakers is that teachers' educational background matters not only to identify good teachers but also to decide how to allocate good teachers across districts and schools. Furthermore, it should be considered for teacher evaluation and compensation purposes.

Second, other primary findings from this study show the significant and positive impact that teachers' certification area can have on the student achievement. Although other observed certification & training status such as current certification status, certification grades, teaching practice, preparation for teaching activities and teacher induction program were not significant as teachers' certification area, it is still relevant as it is one of the most important standard for teaching licensure.

Based on these results, it seems clear that teachers who hold a certification in areas directly related to the subject taught such elementary education, mathematics and/or English language arts may reflect a higher students' scores that those teachers who do not. This finding would be particularly helpful to guide policies to recruit and/ or to allocate teachers across schools and districts.

Third, this research found that teachers' professional development activities have many implications for practice. Since this study demonstrated that teachers' participation in professional development activities, support received, rewards gained and involvement in collaboration activities are positively and significantly related to the student achievement in Math and ELA tests, it would be essential to guide policies to assess teachers' performance.

Based on these findings, teachers' involvement in continuing education and teachers' involvement in collaboration activities can be considered as best practices. In the same way, recognition support and rewards all seem to be powerful tools to motivate good teachers and consequently enhance the student achievement in elementary schools.

Because the State of New York requires annual evaluations to measure teachers' effectiveness at classroom, the findings of this research can help school leaders and policymakers to guide some policies in the areas of teacher accountability, support, compensation and rewards. On the other hand, it would be helpful to plan policies to provide adequate support to new teachers, to improve and to promote their effectiveness at classroom.

Implications Regarding Theoretical Background

This study relied on total quality management (TQM) theory. The concept of TQM implies that schools must be perceived as service organizations created to accomplish educative needs of their community. Based on this notion, schools must develop effective processes to

respond efficiently to the present and future social-educative needs (Geoff, 1997). In other words, schools under TQM not only must be able to develop the capacity and competences to maintain minimum levels efficiency but also generate continuous improvement to reach high levels of performance (Fitzgerald, 2004).

In order to accomplish their social aims, schools must be not only a quality organization at the macro level, by developing competitiveness standards according to other educational organizations performance, but also they need to develop an internal quality management processes to delivery a high quality service to their students. In this context, classroom teacher becomes a critical input in the education system; however, in fact, it is difficult to define and identify teacher quality characteristics in a reliable way.

Most research widely agrees that teacher characteristics such as teacher credentials, individual characteristics or instructional practices are important factors to enhance student achievement (Owings A. et al, 2006). Whit this in mind, this study was focused on the teacher quality concept as an essential input of the educative process in order to test the TQM's theoretical proposition relating quality inputs to quality outputs.

The main findings of this study suggest that some desirable teacher quality characteristics (quality inputs) can impact student achievement (quality outputs). In effect, data results demonstrated that specific teacher characteristics such as highest degree earned, certification area, professional development activities, support received and rewards gained are strongly related to the student achievement in Math and ELA tests. In other words, these teachers' characteristics can be considered as significant factors to enhance the student outcomes in elementary schools.

Although this study does not support exhaustive conclusions regarding TQM in education field, it may provide insight into future research to more fully examine quality issues such as improving students' learning, empowering teachers, supporting team-works or even developing school leadership (Sallis, 2003).

Implications for Future Research

This study demonstrates that there is a link between teacher quality characteristics (highest degree earned, certification area, professional development activities, support received and rewards gained) and the student achievement (class performance average in Math and ELA tests). These results, however, suggest some issues that must be analyzed more in-depth. Based on these findings, a variety of other research studies that could explore further into other aspects are addressed in this section.

On the one hand, based on this study's results, further investigations might re-analyze the variables included in this research to confirm or contradict the presented conclusions. Another possibility might be to analyze independently each significant predictor identified in this study. This means, the teachers' highest degree earned, major field of study, certification area, participation in professional development activities, support received and reward gained and participation in collaboration activities, might be analyzed individually in connection to the student outcomes.

Also, it would be particularly interesting examine similar variables but applied to other educational contexts such as middle and/or secondary schools, even in more specialized context such as the special education. Once again, it would be interesting to know if the same results can be obtained in different context.

On the other hand, it would be interesting include in future research some teachers characteristics such as content knowledge, experience and/or teaching practices. Furthermore, other school related factors such as student motivation, class size, school leadership or even family support could be consistent variables to explain most of the variance that was miss-specified in the present study.

Since the literature reviewed for this study found some theoretical discrepancies, the above-mentioned concerns might be essential components of future studies in order to resolve these issues.

Limitations

Although the main findings of the present study were consistently built up, there are some study's limitations that must be taking into account.

First, sample and data collection process included a relatively small number of schools in comparison to the number of variables involved in the statistical analysis. On the one hand, this study surveyed 117 teachers from 13 elementary schools of a community school district. On the other hand, it involved the statistical analysis of 12 main potential predictors. Although this study accomplished the statistical power's requirements, it would be desirable include more teachers and schools in a way that it would allows the researcher to reach more significant conclusions.

Secondly, generalization of the present study's findings can be restricted because this research is based on one year of data only. As a cross sectional research, this study used a teacher survey distribution at one point in time to gather information regarding teacher characteristics; accordingly, some important multilevel and longitudinal information could not be fully captured by the present study's analysis.

Thirdly, standardized Math and ELA test, as learning outcome, might be considered not enough to properly reflect the teacher performance and/ or the student achievement level. In other words, since schools are immersed in a complex reality, standardized test results cannot reproduce totally neither the teaching work in school nor the student's learning outcomes.

Fourthly, there are some miss specified variables that must be identified in order to analyze them in further investigations. Some variables such as the teachers' content knowledge, teaching practices or even teachers' experience could be important in predicting student achievement in elementary schools (USDOE, 2003).

Fifthly, while the statistical tools used in this study (correlation analysis, multiple regression analysis and MANOVA) can ascertain and predict relationship, these models cannot determine an absolute cause-effect relationship between variables. Consequently, in the absence of a controlled experimental design with a control group, the ability of this research study to determine causation is limited.

Sixthly, as the students' achievement in elementary public schools is not always homogeneous (it usually varies from low-to-high learning outcomes in one classroom) the class performance average, as it was used in the present study, might not adequately reflect the student achievement.

Finally, variables such as class size, school leadership or pedagogical resources that can influence the relationship between teachers' performance and student achievement could be taken into account as potential confounder variables that might affect the present study's conclusions. In the same way, the time gap between the students test were taken (Winter 2007) and teachers' survey (Fall 2007) might affect the quality of the gathered data and accordingly the study's conclusions.

Significance of the Study

In a general way, this study attempted to add new knowledge to the body of literature on quality education by exploring the relationship between teacher quality characteristics and student achievement. Since this study found that teachers' highest degree earned, certification area, participation in professional development activities, support received and rewards gained for participating in professional development activities are significantly related to the student achievement (class performance average in Math and ELA tests), it would be particularly helpful to understand topics such school quality and/or teacher quality in elementary schools.

In addition, this information could be especially valuable in guiding some policies regarding whom to hire, whom to reward, to retain the best teachers and how best to distribute available teachers across schools and classrooms. Furthermore, by knowing which a specific teacher attributes really can enhance student achievement, it could guide some strategic decisions; particularly those referred to propose some policy options to improve teacher quality as well as other education policies focused on to retain and to reward high-quality teacher in elementary schools.

Concluding Remarks

This study attempted to explain how specific observable teacher characteristics are related to the student achievement. It was successful in demonstrating a clear relationship between some teacher characteristics and the student achievement.

In an extensive way, final data results demonstrated that the some observable teacher quality characteristics such as the teachers' educational background, certification & training status and professional development activities are significantly related to student achievement in elementary schools.

In a particular way, this study demonstrated that specific factors such as the teachers' highest degree earned, major field of study, certification area, participation in professional development activities, support received, rewards gained and participation in collaboration activities are statistically related to the class performance average in Math and ELA tests in elementary schools.

Since this study's results provide consistent information that can be used in further investigations in similar topics, its conclusions can be incorporated into the existing knowledge-base of education quality and/or teaching quality to both complement existing theory and advance the existing understanding to analyze scientifically related issues.

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APPENDIX A. TEACHER QUESTIONNAIRE

Instructions

a) This survey should be complete only for regular full time teachers from third, fourth and fifth grade.
b) The data you enter on this form will be processed confidentially. You do not need to enter personal private data. Please print all information clearly in ordinary characters, using a black ball point pen.
c) Please do not write any comments near the answers boxes
d) If you are not sure about how to answer a question, please give the best answer you can rather than leave it blank.
e) If you have questions, call to Roberto Alvarez at 718-843-3064. Someone will be available to take your call Monday through Friday, between 2:30 and 6:00 pm. You can send your questions by e-mail at ralvarez@tourou.edu anytime.
f) If you consent to fill out this questionnaire, please use the envelope attached and deposit it in the sealed box located in your school's main office. You do not need to write your personal data on the envelope

I. GENERAL INFORMATION

1. School general information
   School name:

   School Number Grade Class

2. You are an elementary school teacher who is teaching regularly either mathematic and/or English subjects?
   ( ) Yes ( ) No

3. In which grades are the student you currently teach at this school? *(Mark all that apply)*
   ( ) Third grade ( ) Fourth grade ( ) Fifth grade

II. EDUCATIONAL BACKGROUND

4. What is your highest degree?
( ) Associate ( ) Bachelor ( ) Master ( ) Ph. D.

5. What was your major field of study?
   ( ) Elementary education ( ) Secondary education
   ( ) Special education ( ) Arts & music
   ( ) English and Language arts ( ) English as a second language
   ( ) Foreign languages ( ) Health education
   ( ) Arithmetic / Mathematic ( ) Computer science

( ) Natural sciences ( ) Social sciences
( ) Vocational/ technical education ( ) Other, Please specify

6. Did you have a second major field of study?
( ) Yes ( ) No

If yes, what was your second major field of study?

7. Have you earned any of the degrees listed below? ( ) Yes ( ) No

( ) Vocational Certificate ( ) Associate's degree
( ) Second Bachelor degree ( ) Second Master's degree
( ) Education Specialist ( ) Professional Diploma
( ) Advance Graduated Studies ( ) Doctorate or first Professional Degree

If yes, what was your second major field of study?

8. Have you taken any of the following tests?
The praxis I Pre-Professional Test (PPST) in reading
The Praxis was formerly called the National Teacher Exam (NTE)l
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

The Praxis I Pre-Professional Skills Test (PPST) in Mathematics
The Praxis was formerly called the National Teacher Exam (NTE)
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

The Praxis I Pre-Professional Skills Test in Writing
The Praxis was formerly called the National Teacher Exam (NTE)
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

The Praxis II Subject Assessment in English Language Arts (ELA)
The Praxis was formerly called the National Teacher Exam (NTE)
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

The Praxis II Subject Assessment in Mathematics
The Praxis was formerly called the National Teacher Exam (NTE)
( ) Taken and passed ( ) taken and have not yet passed ( ) Not taken

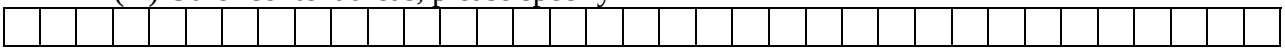
An exam for National Board for Professional Teaching Standards Certification
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

Another test of basic skills or subject knowledge, other than those listed above, required by New York State or your district
( ) Taken and passed ( ) Taken and have not yet passed ( ) Not taken

III. CERTIFICATION AND TRAINING STATUS

9. Which of the following describes the teaching certificate you currently hold in this state?
   ( ) Regular or standard state certificate or advanced professional certificate
   ( ) Probationary certificate (issued after satisfying all requirements except the completion of a probationary period)
   ( ) Provisional or other type of certificate given to persons who are still participating in what the state calls an "alternative certification program"
   ( ) Temporary certificate (requires some additional college coursework, student teaching, and/or passage of a test before regular certification can be obtained)
   ( ) Waiver or emergency certificate (issued to persons with insufficient teacher preparation who must complete a regular certification program in order to continue teaching
   ( ) I do not have any of the above certification in this state

10. In what content areas does the teaching certificate marked above allow you to teach in this state?
   ( ) English Language Arts ( ) Arithmetic /Mathematics
   ( ) Other content areas, please specify



11. Which of the following grade ranges does this certificate apply to?
   ( ) Elementary grades ( ) Middle and secondary grades ( ) Undergraduate

12. How long did you practice teaching last? (In hours)
   ( ) No practice at all ( ) 1 – 20 hrs. ( ) 21 – 40 hrs.
   ( ) 41 – 60 hrs. ( ) 61- 80 hrs. ( ) More than 80 hours

13. Did your preparation for teaching include
   Coursework in how to select and adapt instructional material
   ( ) Yes ( ) No
   Coursework in learning theory or psychology appropriate to the age of student you teach
   ( ) Yes ( ) No
   Your observation of other classroom teaching
   ( ) Yes ( ) No
   Formal feedback on your teaching
   ( ) Yes ( ) No

14. In your first year of teaching did you participate in a teacher induction program?
   ( ) Yes ( ) No

15. In your first year of teaching, did you work closely with a master or mentor teacher
   ( ) Yes ( ) No

16. In your first year of teaching, did you participate in any teaching training and or continuing education program
    ( ) Yes ( ) No

17. If yes, please specify the main topic:
    (If you participated in more than one program, mention only the most important for you)

18. How long was your teaching training or continuing education program? (In hours)
    ( ) less than 10 hours ( ) 11 – 20 hours
    ( ) 20 – 30 hours ( ) More than 30 hours

19. Did your teaching training or continuing education program help you
    ( ) Not at all ( ) To some extent ( ) To a moderate extent ( ) To a great extent

IV. PROFESSIONAL DEVELOPMENT

20. In the past 12 month, did you participate in any of the following professional development activities
    University course (s) related to teaching
    ( ) Yes ( ) No
    Observational visit to other schools
    ( ) Yes ( ) No
    Workshops conferences or training session in which you were a presenter
    ( ) Yes ( ) No

21. In the past 12 months, have you participated in any professional development activities
    ( ) Yes ( ) No
    If yes, how many hours you spend on these activities? (In hours)
    ( ) 8 hrs. or less ( ) 9 – 16 hrs. ( ) 17 – 32 hrs. ( ) More than 32 hrs.
    Overall, how useful were these activities to your
    ( ) Not useful ( ) Somewhat useful ( ) Useful ( ) Very useful

22. In the past 12 months, have you participated in any professional development activities that focused on English Language Arts instruction
    ( ) Yes ( ) No
    If yes, how many hours you spend on these activities? (In hours)
    ( ) 8 hrs. or less ( ) 9 – 16 hrs. ( ) 17 – 32 hrs. ( ) More than 32 hrs.
    Overall, how useful were these activities to your
    ( ) Not useful ( ) Somewhat useful ( ) Useful ( ) Very useful

23. In the past 12 months, have you participated in any professional development activities that focused on Mathematics instruction
    ( ) Yes ( ) No
    If yes, how many hours you spend on these activities? (In hours)

( ) 8 hrs. or less ( ) 9 – 16 hrs. ( ) 17 – 32 hrs. ( ) More than 32 hrs.
Overall, how useful were these activities to your
( ) Not useful ( ) Somewhat useful ( ) Useful ( ) Very useful

24. For the professional development in which you participated in the past 12 months, did you receive the following types of support
Release time from teaching (i.e., your regular teaching responsibilities were temporarily assigned to someone else)
( ) Yes ( ) No
Stipends for professional development activities that took place outside regular work hours
( ) Yes ( ) No
Full or partial reimbursement of college tuition
( ) Yes ( ) No
Reimbursement for travel and/or daily expenses
( ) Yes ( ) No

25. As a result of completing these professional development activities, did you receive the following
Credits towards re-certification or advanced certification in your main teaching assignment or other teaching fields
( ) Yes ( ) No
Increase in salary or other pay increases as a result of participating in professional development activities
( ) Yes ( ) No
Recognition or higher rating on an annual teacher evaluation
( ) Yes ( ) No

26. In the past 12 months, did you do any of the following
Engage in individual or collaborative research on a topic of interest to you professionally
( ) Yes ( ) No
Participate in regularly scheduled collaboration with other teachers on issues of instruction (*Exclude administrative meetings)*
( ) Yes ( ) No
Observe, or be observed by, other teachers or staff in your classroom (for at least ten minutes)
( ) Yes ( ) No
Act as a coach or mentor to other teachers or staff in your school, or receive coaching or mentoring
( ) Yes ( ) No

27. Which grade did you teach the last 2006-2007 school year?
Third grade ( ) Fourth grade ( ) Fifth grade ( ) Other ( )

Class Number					

28. What was your class' performance average in the last citywide /statewide tests? (optional)

Subject	**Class average**			
	1	**2**	**3**	**4**
English Language Art				
Mathematics				

Thank you very much for your participation in this survey. Please place the questionnaire in the enclosed envelop and leave it in the sealed box located in the school's main office.

APPENDIX B. FREQUENCIES OF THE SURVEY ITEMS: EDUCATIONAL BACKGROUND

Characteristics/Data Type	n=117	%	Survey Question
Teaching Grade *(Ordinal Data)*			3
1=Third grade	42	35.9	
2=Fourth grade	40	34.2	
3=Fifth grade	35	29.9	
Highest Degree Earned *(Ordinal Data)*			4
0=None	0	0.0	
1=Associate	0	0.0	
2=Bachelor's	19	16.2	
3=Master's	96	82.1	
4=Ph.D.'s	2	1.7	
Major Field of Study *(Ordinal Data)*			5
1=Elementary education field	59	50.4	
2=English language art field	2	1.7	
3=Mathematics/Arithmetic field	6	5.1	
4=Has combined majors (at least two previous fields)	34	29.1	
5=Other field of study	16	13.7	
Second Major Field of Study *(Categorical Data)*			6
0=No	91	77.8	
1=Yes	26	22.2	
Second Degree Earned *(Ordinal Data)*			7
0=No	93	79.5	
1=Yes	24	20.5	
Taken/Passed the Pre-teaching Tests *(Ordinal Data)*			8
0=Not at all	3	2.6	
1=Has taken/passed one pre-teaching test	31	26.5	
2=Has taken/passed two pre-teaching tests	35	29.9	

3=Has taken/passed three pre-teaching test	7	6.0
4=Has taken/passed more than three pre-teaching tests	41	35.0

APPENDIX C. FREQUENCIES OF THE SURVEY:
CERTIFICATION AND TRAINING STATUS

Characteristics	n=117	%	Survey Question
Current Certification Status *(Ordinal Data)*			9
0=No process certification completed	0	0.0	
1=Hold a provisional/temporary certification	7	6.0	
2=Hold a full state certification	110	94.0	
Certification Area *(Categorical Data)*			10
1= English language arts content area	8	6.8	
2=Mathematics/arithmetic content area	12	10.3	
3= Includes both Math and ELA content areas	89	76.1	
4=Other content area	8	6.8	
Certification Grades *(Categorical Data)*			11
1=Elementary level grades	108	92.3	
2=Middle and/or secondary level grades	6	5.1	
3= Undergraduate level grades	3	2.6	
Teaching Practice *(Ordinal Data)*			12
0=No practice at all	0	0.0	
1=Between 1 and 20 hours	2	1.7	
2=Between 21 and 40 hours	19	16.2	
3=Between 41 and 60 hours	43	36.8	
4=Between 61 and 80 hours	19	17.1	
5=More than 80 hours	34	29.1	
Preparation for Teaching Activities *(Ordinal Data)*			13
0=Not at all	6	5.1	
1=Has participated in one PTA	12	10.3	
2=Has participated in two PTAs	28	23.9	
3=Has participated in three PTAs	30	25.6	
4=Has participated in four PTAs	41	35	

Teacher Induction Program *(Ordinal Data)*			14-16
0=Lacks TIP activities	7	6.0	
1=Has participated in one TIP activity	13	11.1	
2=Has participated in two TIP activities	45	38.5	
3=Has participated in three TIP activities	52	44.4	
Time Spent in PT activities *(Ordinal Data)*			18
0=Less than 10 hours	0	0.0	
1=Between 11 and 20 hours	69	59.0	
2=Between 21 and 30	47	40.2	
3=More than 30 hours	1	0.9	
Satisfaction Level in PT activities *(Ordinal Data)*			19
0=Unsatisfied	31	26.5	
1=Some satisfied	48	41.0	
2=Satisfied	35	29.9	
3=Very satisfied	3	2.6	

APPENDIX D. FREQUENCIES OF THE SURVEY: PROFESSIONAL DEVELOPMENT

Characteristics/Data Type	n=117	%	Survey Question
Participation in PD Activities *(Ordinal Data)*			20
0=Lacks PD activities	0	0.0	
1=Has participated in one PDA	45	38.5	
2= Has participated in two PDAs	48	41.0	
3=Has participated in three PDAs	24	20.5	
Time Spent in PD activities *(Ordinal Data)*			21
0=Less than 8 hours	3	2.6	
1=Between 9 and 16 hours	38	32.5	
2=Between 17 and 32 hours	74	63.2	
3=More than 32 hours	2	1.7	
Satisfaction in PD activities *(Ordinal Data)*			22
0=Unsatisfied	33	28.1	
1=Some satisfied	49	41.9	
2=Satisfied	34	29.1	
3=Very satisfied	1	0.9	
PD Activities Focused on ELA *(Categorical Data)*			22
0= Lacks PD activities focused on ELA	8	6.8	
1=Has participated in PD activities focused on ELA	109	93.2	
Time Spent in ELA activities *(Ordinal Data)*			22
0=Less than 8 hours	8	6.8	
1=Between 9 and 16 hours	69	59	
2=Between 17 and 32 hours	40	34.2	
3=More than 32 hours	0	0.00	
Satisfaction in ELA activities *(Ordinal Data)*			22
0=Unsatisfied	22	18.8	
1=Some satisfied	43	36.8	
2=Satisfied	39	33.3	
3=Very satisfied	13	11.1	

PD Activities focused on Math *(Categorical Data)*			23
0= Lacks PD activities focused on Math	7	6.0	
1=Has participated in PD activities focused on Math	110	94	
Time Spent in Math activities *(Ordinal Data)*			23
0=Less than 8 hours	8	6.8	
1=Between 9 and 16 hours	40	34.2	
2=Between 17 and 32 hours	69	59.0	
3=More than 32 hours	0	0.0	
Satisfaction in Math activities *(Ordinal Data)*			23
0=Unsatisfied	22	18.8	
1=Some satisfied	30	25.6	
2=Satisfied	45	38.5	
3=Very satisfied	20	17.1	
Support Received *(Ordinal Data)*			24
0=Not at all	38	32.5	
1=Received one type of support	53	45.3	
2=Received two types of support	24	20.5	
3=Received three types of support	2	1.7	
4=Received four types of support	0	0.0	
Rewards Gained *(Ordinal Data)*			25
0=Not at all	46	39.3	
1=Has one type of reward gained	47	40.2	
2=Has two types of rewards gained	21	17.9	
3=Has three types of rewards gained	3	2.6	
Collaboration Activities *(Ordinal Data)*			26
0=Not at all	1	0.9	
1=Has participated in one collaboration activity	15	12.8	
2=Has participated in two collaboration activities	36	30.8	
3=Has participated in three collaboration activities	43	36.8	
4=Has participated in four collaboration activities	22	18.8	

APPENDIX E. VARIABLE MEASUREMENT:
STUDENT ACHIEVEMENT*

Sub-Variable	Data Type	Score Range/Indicators*	Source	Mean	SD
Class Performance Average in Math Test	Continuous	470 - 770	NYCDOE	684.45	12.14
Class Performance Average in ELA Test	Continuous	475 -780	NYCDOE	667.01	13.20

* In this case, the dependent variable (student achievement) by definition is a continuous variable, because it is expressed as the class performance average. In this sense, the measurement criterion is the "student passing ratio in the citywide and statewide test". For example, the NYCDOE data not only specifies the mean scale score for each grade but also how many student do not meet the standards (level 1); how many students show a partial achievement (level 2), how many student meet the standards (level 3), and how many students exceed the standards (level 4). Considering that student achievement standards were established by the New York State Department of Education (NSDOE) to evaluate *what the students are expected to know and be able to do,* these levels of achievement are important to understand the student achievement in Math and ELA tests.

APPENDIX F. DEFINITION OF TERMS

Teacher quality: Essential attributes such as educational background, certification and training, attitudes and professional development that allow the teachers to meet a high degree of excellence in their work.

Student achievement: Learning outcomes, determined based on quality education standards, expressed as passing scores obtained by students in citywide and statewide tests in mathematics and English language arts (ELA)

Educational background: Academic degrees and major field of study awarded by teachers.

Certification: Official recognition from the New York State Department of Education, issued based on the teacher's academic degree, course work assessment and professional experience.

Training: A series of connected practices and instruction activities to achieve proficient in teaching work

Teacher attitudes: Feeling, beliefs and expectation of teachers with regard to their work-place environment and school organizational climate.

Professional development: Specific activities to improve knowledge, skills and attitudes in order to improve the teachers' performance

Citywide and Statewide Tests: Standardized-Timed test which were designed to assess the student's performance and progress based on high-quality learning standards that describe what students should know and be able to do.

APPENDIX G: LETTER MODEL TO RESPONDENT TEACHER

Dear teacher,

This letter is being sent to you because of your status as a full-time teacher from (District Number) District's elementary schools. Accordingly, I would like to invite you to participate as a survey-respondent to the research "The Relationship of Teacher Quality on Student Achievement in Elementary School in a District of the New York City Department of Education". The study will be part of my doctoral dissertation in Educational Leadership at Touro University International.

The main purpose of this study is to analyze how a set of specific observable teacher-quality Characteristics such as educational background, certification & training status and professional development programs are related to student achievement expressed as class performance average in mathematics and ELA citywide and statewide tests. In this way, this research will attempt to contribute to the current effort to better understand school quality phenomena by providing new information that may be relevant to guide hiring practices and the development of quality teacher retention programs.

If you volunteer to participate in this study, the information you provide will be kept confidential and protected from unauthorized disclosure. All your responses will be combined with the information provided by others in statistical reports. In order to assure anonymity, you will not provide any individual data that link your name, address or telephone number.

If you have any further questions, please feel free to contact me via email at ralvarez@tourou.edu or by phone in the evenings at (PHONE NUMBER).

Thank you for your time and consideration of my request.

Sincerely,

Roberto Alvarez
Researcher

Enclosure: Consent Form
Teacher survey
cc. UFT Chapter Chair

APPENDIX H: CONSENT FORM MODEL TO PARTICIPATE IN RESEARCH

CONSENT TO PARTICIPATE IN RESEARCH

"The Relationship of Teacher Quality on Student Achievement in Elementary Schools in a District of the New York City Department of Education"

You are asked to participate in a research study conducted by Roberto Alvarez, doctoral candidate, from the College of Education at Touro University International. You were selected as a possible participant in this study because you are a full-time teacher from third, fourth or fifth grade in the (District Number) District of the New York City Department of Education.

The main purpose of this study is to analyze the relationship between teacher quality and student achievement in elementary schools. Accordingly, this research will attempt to contribute to the current effort to better understand school quality phenomena by providing new information that may be relevant to guide hiring practices and the development of quality teacher retention programs.

If you volunteer to participate in this study you will ask to fill out a questionnaire, which is divided into three components: educational background, certification status and professional development. You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may also refuse to answer any questions you don't want to answer and still remain in the study.

Since this research was designed for academic purposes only, there is not any payment or other monetary incentives for participation.

In order to guarantee confidentiality, all responses that relate to or describe identifiable characteristics of individuals will be used only for statistical purposes and may not be disclosed or used, in identifiable form for any other purposes. Furthermore, no individual data that links your name, address or telephone number will be included in the statistical reports.

If you have any questions or concerns about the research, please feel free to contact to
Roberto Alvarez
(Personal address)
(Phone Number)
E-Mail: ralvarez@tourou.edu

The Dissertation Committee Chair, Dr. Leslie Henrickson, can be reached at Touro University International, 5665 Plaza Drive, Third Floor, Cypress, California 90630; Telephone (714) 226-9840 extension 2012 or email to LHenrickson@tourou.edu

You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact the

Institutional Review Board for the Protection of Human Subjects at Touro University International, 5665 Plaza Drive, Third Floor, Cypress, California 90630; Telephone: (714) 226-9840 extension 2004 or email to aafrookhteh@tourou.edu

I understand the procedures and conditions of my participation described above. My questions have been answered to my satisfaction, and I agree to participate in this study. I have been given a copy of this form.

Name of Subject Sign Date

If you consent to participate in this study, please sign the form, use the envelope attached and deposit it in the sealed box located in your school's front desk. You do not need to write your personal data on the envelope.

APPENDIX I: PARTICIPANT TEACHERS FROM SELECTED SCHOOLS

School	Grades			Total
	Third	Fourth	Fifth	
A	3	2	2	7
B	4	3	3	10
C	2	1	3	6
D	4	4	3	11
E	3	3	3	9
F	3	3	2	8
G	4	4	4	12
H	4	4	3	11
I	3	3	2	8
J	3	3	3	9
K	2	2	1	5
L	4	3	3	10
M	4	4	3	11
Total	43	39	35	117