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Western Michigan University

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TEACHER QUALITY AND TEACHER PREPAREDNESS IN PUBLIC SECONDARY SCHOOLS: EVIDENCE FROM SASS 1999-2000

by

Xuejin Lu

A Dissertation
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Dr. Sue Boppink, Adviser

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In this study, I inquired into the quality of public secondary school teachers by examining what percentages of teachers were highly qualified in the fields of their main teaching assignment and in each specific field they taught. The focus was placed on the core academic fields (English, social studies, math, and science) and the subfields of science (chemistry, physics, earth science, and physical science). I also investigated whether there were possible variations in the distribution of highly qualified teachers by school locations and by the percentages of minority student enrollment in schools. Furthermore, I examined the relationship between the quality of new secondary school teachers and their perceptions on their preparation for teaching.

In this study, a highly qualified teacher had the following characteristics: holding at least a bachelor’s degree, a full state certification, and an undergraduate or graduate major in the subject taught. I analyzed data extracted from the 1999–2000 Schools and Staffing Survey (SASS) for public school teachers. Descriptive statistics was used to identify the percentages of highly qualified teachers in the subjects taught. Chi-Square tests were employed to examine the distribution of highly qualified teachers. Multivariate analysis of variance was used to determine the relationship between the quality of new teachers and their perceptions on their preparedness.
Results revealed that the percentages of highly qualified teachers in the core academic fields, especially in the subfields of science, were far from satisfactory. Overall more than one-fourth of the teachers were not highly qualified in their main assignment fields. Teachers who were not highly qualified in the subfields of science were found with a range from 52 percent to 84 percent. Urban schools and schools with a higher percentage of minority students were much less likely to have highly qualified teachers. New teachers who were highly qualified in the subject taught felt better prepared than those who were not highly qualified. The findings suggest that the situation of teacher quality in secondary schools is posing a serious challenge for implementing the NCLB’s mandate of highly qualified teachers by 2006. Furthermore, the findings seem to raise an equity issue in staffing schools.
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Acknowledgments—Continued

I dedicate this dissertation to my talented and lovely daughter, Yajing Xie, who is determined to achieve a higher goal.

Xuejin Lu
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Since the publication of *A Nation at Risk* (National Commission on Excellence in Education, 1983), American schools have been urged to continue to improve student achievement. Because of the natural connection between learning and teaching, the teacher quality problem has been at the center of public concern. The concern about teacher quality is neither unique nor surprising. Recent research has demonstrated that teacher quality; especially teachers' preparation and qualifications play important roles in student achievement (Darling-Hammond, 2000b; Ferguson, 1991; Goldhaber & Brewer, 2000; Laczkó-Kerr & Berliner, 2002; Mont, 1994; Sanders & Rivers, 1996; Wenglinsky, 2000). Yet, more and more studies reveal that a large proportion of students, especially those in secondary schools and disadvantaged schools, were taught by teachers who lack professional training and knowledge in the subjects they teach (Ingersoll, 1996; Seastrom, Gruber, Henke, McGrath, & Cohen, 2002). Ingersoll reported over one quarter of all public school students enrolled in mathematics classes in grades 7-12 were taught by teachers without at least a minor in mathematics or in mathematics education. According to Ingersoll, there were distinct inequities in the distribution of teacher quality across schools and classrooms. High-poverty schools had more teachers who did not even have a minor in the subject they taught than low-poverty schools.

In recognition of the problem of teacher quality and its impact on student achievement, the No Child Left Behind Act (NCLB) includes provisions mandating that
all teachers must be _highly qualified_ in the subject they teach by the end of 2005-06 school year.

The NCLB’s definition of a highly qualified teacher relies mainly on teachers’ preparation and qualifications, requiring teachers to obtain at least a bachelor degree, a full state certification as a teacher and to demonstrate competence in each academic subject in which the teacher teaches. It is expected that highly qualified teachers would lead to high quality teaching and the improvement of academic achievement for all students.

In response to these concerns and expectations, a study that inquires into teacher quality status based on the definition of a highly qualified teacher provided by NCLB and explores the relationship between teacher quality and teacher preparedness would help better understand the teacher quality problem and its impact on teacher effectiveness and student learning.

**Background of the Study**

_The Importance of Teacher Quality_

For students, good teaching lasts a lifetime and bad teaching limits dreams and opportunities (U.S. Department of Education, 2002). The National Commission on Teaching and America’s Future (1996) asserts that what teachers know and can do is the most important influence on what students learn. Few people would disagree that the quality of teachers is the critical element in effective schooling and student learning. In contrast with earlier research, which suggested that school inputs had little effect on student achievement independent of family and societal background (Coleman et al.,
1966), current research shows that "schools can make a difference, and a substantial portion of that difference is attributable to teachers" (Darling-Hammond, 2000b, p. 2). Darling-Hammond, analyzing data from a 50-state survey, found that teacher quality variables, namely, holding full certification and a major in the field, appeared more influential than student demographic characteristics in predicting student achievement and it was a stronger correlate of student achievement than class size, overall spending, or teacher salaries. Goldhaber and Anthony (2003), after extensively reviewing the research on the relationship between teacher quality and student achievement, concluded that teacher quality had the largest impact on student achievement among all education factors and school resources (e.g., investments in technology, educational materials, class size). Other studies have also illustrated that teachers are the key to the successful learning of students and high quality teacher can raise student achievement (Collias, Pajak, & Rigden, 2000; Ferguson, 1998; Goldhaber, 2002; Rivkin, Hanushek, & Kain, 2005; Kaplan & Owings, 2001; Wright, Horn, & Sanders, 1997).

While teacher effects on student achievement is critical, there are substantial differences among teachers in the ability to produce student achievement gains (Nye, Konstantopoulos, & Hedges, 2004). Studies focusing on investigating total teacher effects by looking at differences in growth rates of student achievement across teachers revealed that, in the course of a single school year, students who were assigned to an effective teacher could gain a full grade level more than those students who have an ineffective teacher (Hanushek, 1992; Ferguson, 1991). This approach to the examination of teacher quality concentrates on pure outcome-based measures of teacher effectiveness. It does not require the choice of specific teacher characteristics. An effective teacher
would be one who consistently obtained high learning growth from students, while an ineffective teacher would be one who consistently produced low learning growth (Hanushek & Rivkin, 2004). However, in the book of *Qualities of Effective Teachers*, Stronge (2002) defined that qualities of effective teachers include “characteristics of the teacher as an individual, teacher preparation, classroom management, and the way a teacher plans, teaches, and monitors student progress” (p. viii).

To study teacher effects at the classroom level using the Tennessee Value-Added Assessment System, Sanders and Rivers (1996) found that students who were taught by several ineffective teachers in a row have significantly both lower achievement and lower gains in achievement. For example, students with highly effective teachers for three years in a row scored 50 percentage points higher on a test for math skills than those whose teachers were ineffective. The above studies demonstrate that teacher differ in their effectiveness and differential teacher effectiveness is a strong indicator of differences in student achievement, suggesting that interventions to identify high quality teachers and to improve teacher effectiveness might be productive strategies for improving student achievement (Jordan, Mendro, & Weerasinghe, 1997; Nye et al., 2004; Olson, 2003; Wright et al., 1997).

*Teacher Quality and Disadvantaged Students*

One of the key challenges of No Child Left Behind (NCLB) legislation is to hold schools and districts accountable for raising the scores test of all students, including disadvantaged students. “Disadvantaged students” commonly refers to those who are traditionally underachieving and apparently predisposed to struggle in typical school
programs, including minority, limited-English-proficient (LEP) students, and students of low socioeconomic status (Johnson, 1994; Henderson-Sparks, Paredes & Gonzales, 2002; Shen, Mansberger, & Yang, 2004; Slavin, 1989).

Research has shown that disadvantaged students’ achievement is especially sensitive to the quality of their teachers (Sanders & Rivers, 1996). For example, Nye et al. (2004) found that teacher effects are much larger in low-SES (Social Economic Status) schools, suggesting that teacher quality matters more in low-SES schools than it does in high-SES schools. Olson (2003) also found that having a quality teacher for four or five years in a row could fundamentally close the gap in student achievement between students from low-income and high-income families. In Sanders’ and Rivers’ study, they had similar findings that the effects of teacher quality were more substantial for low achieving students; those in classroom with most effective teachers gained over 50 percentile points in their test scores while those with the least effective teachers gained 14 percentile points. These studies suggested that improving teacher quality for disadvantaged students should have the potential to help close student achievement gap.

Unfortunately, students in high-poverty, high-minority, and low-performing schools are less likely than other students to be taught by teachers who are highly qualified in their subjects (Ansell & McCabe, 2003). Ansell and McCabe suggested that if one wants to understand the root of the achievement gap, he or she should first understand the teacher gap that exists between the skill levels of teachers. Therefore, to end achievement gap between minority and non-minority students and those from rich and poor families, Education Week urged that states must first end the teacher gap: the
lack of well-qualified teachers for those who need them most ("To Close the Gap," January 9, 2005).

The Challenge of Highly Qualified Teachers

Despite a general consensus among educational researchers, policy makers and the public that teacher quality is important to student learning, there is little agreement among these groups regarding its composition and measurement. The focus of the recent debate on teacher quality is which of the attribute of a teacher is more important to student achievement: a teacher’s pedagogical knowledge or subject content knowledge. Studies that focus on either pedagogical dimensions or subject knowledge dimensions are subject of considerable debate and reflect the complexity of the research on teacher quality. As a result, the task of defining teacher quality has been difficult.

What constitutes a highly qualified teacher has also been at the center of a long-running and heated debate. While the debate continues, the definition of a highly qualified teacher provided by the NCLB seems to suggest teachers’ subject knowledge and their pedagogical knowledge should both be important to student achievement. Research focusing on examining the relationship between teacher quality and student achievement supports this policy action to improve teacher quality. Considerable research demonstrates that teachers who are highly qualified in their subject they taught can make a difference in student achievement (Darling-Hammond, 2000b; Ferguson, 1991; Goldhaber & Brewer, 2000; Laczko-Kerr & Berliner, 2002; Mont, 1994; Sanders & Rivers, 1996; Wenglinsky, 2000). In Darling-Hammond’s study, she found that the most consistent highly significant predictor of student achievement was the proportion of
highly qualified teachers (holding a full certification and a major in the field being taught).

While teacher quality is critical to student achievement, a substantial percentage of students were taught by teachers who were under-qualified in the subject they teach (Kaplan & Owings, 2002). An under-qualified teacher usually refers to those teachers who lack professional training and knowledge in the subject they teach, including those teachers who lack regular teaching certification (teaching under emergency, temporal or provisional teaching certificates) or have not obtained academic majors or minor in the subjects taught (out-of-field teachers) (Ingersoll, 2002; Laczko-Kerr & Berliner, 2002; Shen et al., 2004).

Ingersoll (2001) observed that one of the most important problems in contemporary American education was the failure to ensure that the nation’s classrooms are all staffed with qualified teachers. A recent Education Trust analysis found that nearly one-fourth of core academic classes at the secondary level nationwide are taught by teachers lacking even a minor in the subject taught (Jerald & Ingersoll, 2002). In disadvantaged schools, there are more under-qualified teachers (Bishop, 2002; Ingersoll, 1996, 2002). For example, in schools with higher poverty levels, there are more teachers who are not fully prepared, namely, not having full certification, more teachers teaching under emergency, temporary, and other certificates (Shen et al., 2004), and more out-of-field teachers (Ingersoll, 1996). Analyzing the Schools and Staffing Survey, Seastrom et al. (2002) reported that the nation made no progress in reducing out-of-field teaching between 1993-1994 and 1999-2000; that is, the number of out-of-field teachers in the nation remains unacceptably high in secondary schools.
Statement of the Problem

In recent years, questions concerning teacher quality and its impact on student achievement have been increased among educational policymakers and researchers. Researchers tend to approach this problem in the following two ways. A large set of studies focus on exploring how well our teachers are trained and prepared to teach in public schools by presenting findings that describe the characteristics of teacher preparation and teacher qualifications, including degree level, teachers certification status, teaching assignment (in-field and out-of-field teaching), allocation patterns of qualified teachers, and so on (Darling-Hammond, Chung, & Frelow, 2002; Ingersoll, 1994; Lewis et al., 1999; Seastrom et al., 2002; Shen et al., 2004; Shen & Poppink, 2003). Another set of studies focus on investigating how specific characteristics (attributes) of teacher quality (degree, certification, subject knowledge, etc) are related to teacher effectiveness and student achievement (Ball, 1988; Darling-Hammond, 2000b; Ferguson & Womack, 1993; Goldhaber & Brewer, 2000; Laczko-Kerr & Berliner, 2002; Rowan, Chiang, & Miller, 1997).

While some of studies have investigated the characteristics of teacher quality and distribution of teacher quality across schools and classroom, these previous studies tended to look at these teacher characteristic variables (i.e., degree, certification or in-field teaching) separately. For instance, how many teachers have bachelor degrees, how many teachers are fully certified and how many teachers have a major or a minor in the subject area taught respectively? Few studies attempted to combine these teacher characteristics to estimate teacher quality. In this study, I added to the traditional
approach by combining indicators of teacher quality (e.g., certification and academic major) in the investigation of teacher quality.

In the past two decades, while numerous studies exist on the influence of specific teacher quality attributes on student learning outcomes, relatively few studies have focused on exploring how teacher quality influences teachers’ perceptions on their professional preparation for teaching. In this study, I explored the relationship between teacher quality and teacher preparedness in an attempt to provide research evidence in this area. Given the importance of teacher quality on student achievement and the demand for a highly qualified teacher in every classroom, the examination of teacher quality, its distribution and its impact on teacher preparedness grows increasingly important.

Purpose of the Study

This study attempts to contribute to the knowledge base by examining teacher quality based on the definition of a highly qualified teacher under NCLB. Indicators of a highly qualified teacher in this study include a bachelor degree, a full state certification and a major in the subject taught. In this study, I first inquire into secondary teachers’ quality by studying the percentage of highly qualified teachers in their main teaching assignment field, the field in which they teach the most classes, by (a) all main assignment fields, (b) core academic subjects (i.e., English, social studies, math, and science), and (c) the subfields of science (i.e., chemistry, physics, earth, life, and physical science). Second, I examine teacher quality by studying the percentage of highly qualified teachers in each subject taught, individual subjects that teachers are assigned to
teach during the school day, also by (a) core academic subjects and (b) the subfields of science. Third, I inquire into whether there are significant differences in the percentage of highly qualified teachers in teachers’ main teaching assignment field by school locations (urban, suburban, and rural) and percentage of minority student at school (5% or less, 5% to 19%, 20% to 49%, and 50% or more).

Finally, I inquire into the influence of teacher quality on teacher preparedness by comparing highly qualified new teachers’ perceptions on preparedness with the perceptions of those new teachers who are not highly qualified in their fields. Teachers’ perceptions on teacher preparedness are measured from the following seven areas (classroom management, instructional methods, subject knowledge, technology, planning lessons, assessing student assessment and selecting teaching materials).

To be more specific, in this study I address the following issues: (a) quality of secondary school teachers, (b) the allocation of quality teachers, and (c) influence of teacher quality on new teachers’ perceptions on preparedness. The study was guided by the following research questions.

Research Questions

Question 1

According to teachers’ main teaching assignment field, what is the percentage of highly qualified secondary teachers in

a. all main teaching assignment fields (a combined variable including all the fields that are assigned as main teaching assignments),
b. core academic fields (English/language arts, social studies, math and science), and  
c. sub-fields of science (chemistry, physics, earth, life and physical science)?

Question 2

According to the each subject field a teacher teaches, what is the percentage of highly qualified secondary teachers in

a. core academic fields (English/language arts, social studies, math and science), and  
b. subfields of science (chemistry, physics, earth, life and physical science)?

Question 3

According to teachers’ main teaching assignment field, is the proportion of highly qualified secondary teachers the same

a. for different school locations (urban, suburban and rural), and  
b. for the schools with different percentages of minority students (less than 5%, 5-9%, 20-40% and 50%-over)?

Question 4

Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, are there any significant differences in their perceptions on their preparation for teaching related to the following seven teaching areas: (1) classroom management, (2)
instructional methods, (3) subject knowledge, (4) technology, (5) planning lessons, (6) assessing students, and (7) selecting teaching materials?

Significance of the Study

This study of teacher quality by examining the characteristics of highly qualified teachers is unique for several reasons. First, this study is timely in light of recent concern about teacher quality and its influence on student achievement. Many of these concerns draw attention to such issues as the professional training teachers receive and the qualifications of teachers who teach a specific subject, since teacher certification status and subject knowledge have been identified as important elements of teacher effectiveness and student achievement (National Commission on Teaching and America’s Future, 1997). By analyzing the national data set, this study can provide a national picture of the current status of teacher preparation and qualifications in their main teaching assignment field as well as in the each subject field they teach. The results of the study can also help keep track of trends in teacher preparation. For example, researchers can compare the findings of this study with previous studies regarding teacher preparation and qualification and policymakers can use the information of this study to monitor or regulate future teacher preparation programs.

Second, the study departs from the more traditional teacher quality research that focused on describing each indictor of teacher quality separately. By combining indicators of teachers’ full certification and their major in the subject taught, this study is not only able to contribute to the existing knowledge of teacher quality, but it also provides a new angle to the understanding of the teacher quality problem and, more
important, to the understanding of the challenge of highly qualified teachers that many policymakers and educators are confronted. To date few studies have empirically inquired into teacher quality focusing on the NCLB’s definition of a highly qualified teacher.

Third, the focus of this study is on the measure of highly qualified teachers in their fields (a match between teacher assignment and teacher preparation and education). This differs from some of the other measures frequently used in the publications on this subject. The measures of these previous studies usually focused on out-of-field teaching (a mismatch between teacher assignments and teacher preparation and education) (Ingersoll, 1994; 1996; Seastrom et al., 2002). Furthermore, the previous approaches to studying out-of-field teaching usually focused on examining the proportion of students being taught by out-of-field teachers. In contrast, the measure in this study focuses on investigating the proportion of teachers who are highly qualified in their fields. That is, the focus of this study is played on teachers rather than on students.

Fourth, by investigating teacher quality in their main teaching assignment field as well as in each subject taught focusing on the core academic subjects as well as on the sub-fields of science, this study can help to reveal in which specific academic fields teachers lack preparation and qualifications and can help policymakers evaluate strategies to improve the policy of highly qualified teachers in specific subject areas.

Fifth, the study, by using a national data set, is able to yield an estimate of highly qualified teachers and the allocation pattern of highly qualified teachers in a national scene. This knowledge can serve as input to the national debate on the issues of teacher quality and educational equity.
Finally, a fundamental concern confronting policymakers and educational researchers is the effect of highly qualified teachers on teacher effectiveness and student achievement. Since feeling 'very well prepared' is one of the possible indicators of teacher effectiveness (Lewis et al., 1999), valuable information can be obtained by examining the extent to which teachers feel prepared for teaching, and exploring how teacher quality influences teachers’ feeling on their preparedness. From a practical point of view, knowledge of new teachers’ perceptions on their preparedness can help colleges of education improve the curriculum design for teacher education; help schools and school districts develop new teacher induction programs or mentor programs to better address the needs of new teachers and help school administrators’ hiring decisions. The findings and conclusions of this study have the potential to provide knowledge and information to policymakers and school educators. Therefore, this study is basically policy-oriented.

Operational Definitions

For the purpose of this study, the following definitions are used:

*Highly qualified teachers*: indicators of a highly qualified teacher used in this study include: (a) a bachelor degree, (b) a full state certification and (c) a major in the subject a teacher teaches.

a. **A bachelor degree**: Teachers who receive a “regular” or “standard” certificate to teach a specific subject and grade level are required by all states to have at least a bachelor’s degree that includes subject matter as well as pedagogical studies (Seastrom et al., 2002).
b. **A full state certification:** A full state certification in this study refers to those teachers who have obtained (a) standard/regular, advanced professional certificate or (b) probationary certificate. In the survey questionnaire, these are five types of teacher certificates: (1) Regular / standard state certificate or advanced professional certificate, (2) probationary certificate, (3) provisional or alternative certificate, (4) temporary certificate, and (5) emergency certificate or waiver. In many states, a “probationary” certificate is provided to new teachers who have completed all requirements of the standard certificate except for the completion of the probationary period. These new teachers will earn the standard certificate in due time through full-time teaching in the school (usually 2 or 3 years of beginning teaching) (Seastrom et al., 2002).

c. **A major in the subject taught:** In this study, a teacher must have a major in the subject taught to be considered as highly qualified. It is argued that a secondary highly qualified teacher should demonstrate strong subject area knowledge and a major in the subject taught is necessary to ensure that a teacher has that knowledge.

Therefore, operationally, if teachers who meet these two criteria: a full certification (teachers with standard/regular, advanced or probationary certificate) and a major in the subject taught, they will be identified as highly qualified teachers. Those teachers who do not meet these two criteria will be identified as under-qualified teachers.

*Teachers’ main teaching assignment field*—the field/subject in which they teach the most courses. According to Lewis, et al. (1999), teachers’ main teaching assignment...
refers to these three situations: (1) In self-contained classroom, the teacher teachers all or most academic subjects to the same group of students all or most of the day; (2) The teacher teaches mathematics or science in a departmentalized setting, teaching the subject to several classes of different students all or most of the day and (3) The teacher teaches English/language arts, social studies/social science, or foreign language in a departmentalized setting, teaching the subject to several classes of different students all or most of the day. The following is the actual question in the 1999-2000 SASS for public school teachers: This school year, what is your MAIN teaching assignment field at this school, that is the field in which you teach the most classes (survey question # 12)?

*Each subject taught:* individual subjects that teachers are assigned to teach, that is any one of the classes that teachers are assigned to teach during the school day. In the area of teacher assignments, the Schools and Staffing Survey (SASS) for teachers collected data on main and secondary subject fields of assignment, and for secondary school teachers, on the subject fields they taught for each period of the school day (U.S. Department of Education, 1994). The following is the actual question in the 1999-2000 SASS for public school teachers: This school year, are you assigned to teach classes in OTHER fields at this school, in addition to your MAIN teaching assignment field (survey question # 15a.)? In what OTHER teaching assignment field do you teach the most classes (survey question # 15b)?

*Core academic subjects:* referring to English/language arts, social studies, math and science in this study.

*Sub-fields of science:* referring to chemistry, physics, earth, life and physical science in this study.
Teachers’ Preparedness: the state of being ready for teaching. In this study, teachers’ preparedness is measured by teachers’ perceptions on how well they are prepared to perform in the following seven teaching areas: (1) classroom management, (2) instructional methods, (3) subject knowledge, (4) technology, (5) planning lessons, (6) assessing students, and (7) selecting teaching materials.


School location (urban, suburban and rural): In the SASS data file, urban schools refer to the schools in large or mid-size central city. Suburban schools refer to the schools in urban fringe of large or mid-size city and rural schools refer to the schools in small town or rural areas.

Percentage of minority students at the school: It refers to the percentage of students enrolled in the school whose race or ethnicity is classified as one of the following: American Indian or Alaskan Native, Asian or Pacific Islander, black, or Hispanic based on data in the 1995-96 Common Core of Data (CCD). In the 1999-2000 SASS data file, percentage of minority students at schools is classified into four groups: less than 5% students, 5% to 19% students, 20% to 49% students and 50% or more students.
Conceptual Framework

In this study, indicators of a highly qualified teacher basically include a full state certification and a major in the subject taught. On the basis of literature review, teachers who are highly qualified in their subjects taught can make a difference in student achievement. This assumption of highly qualified teachers provides a general framework for selecting variables to examine teacher quality status and its influence on teachers’ preparedness in this study. Figure 1 provides a visual model of the conceptual framework for this study. Basically four research questions about teacher quality are answered. The first question concerns teacher quality in secondary public schools in their main teaching assignment fields by examining the percentage of highly qualified teachers in (a) all main teaching assignment fields, (b) core academic fields, and (c) sub-fields of science. After examining teacher quality in their main assignment field, the second question shifts the focus of the study on teacher quality in each subject taught by investigating the percentage of highly qualified teachers in core academic fields and sub-fields of science. The third question deals with teacher quality by inquiring into the allocation pattern of highly qualified teachers by school locations (urban, suburban and rural) and by percentage of minority students in schools (less than 5%, 5-9%, 20-40% and 50%-over). The fourth question emphasizes the relationship between teacher quality and teacher preparedness. Perceptions of preparedness of new teachers who are highly qualified are compared with the perceptions of those who are not highly qualified. Seven items related to teaching are used to determine teachers’ preparedness.
Teacher Quality Status in Secondary Schools

1. In main teaching assignment field, what percentage of teachers are highly qualified in

   All main teaching assignment fields
   - Core subjects:
     - English,
     - Social Studies,
     - Math, and
     - Science,
   - Subfields of science
     - Chemistry,
     - Physics,
     - Earth Science,
     - Life Science, and
     - Physical Science

2. In each subject taught, what percentage of teachers is highly qualified in

Allocation of Teacher Quality in Secondary Schools

3. Are there any differences in the percentage of highly qualified teachers in their main teaching assignments?

   by school locations (urban, suburban, rural)
   by percentage of minority students (less than 5%, 5-19%, 20-49%, 50%-over)

Influence of Teacher Quality on Teachers' Preparedness

4. Between these two groups of new teachers, are there any differences in their perceptions on preparation for teaching in the following seven areas?
   - Classroom management,
   - instructional methods,
   - subject knowledge,
   - using technology
   - planning lessons,
   - assessing students, and
   - selecting materials

New secondary teachers who are highly qualified in their main teaching Assignment field

New secondary teachers who are not highly qualified in their main teaching assignment field

Teacher Quality and Teacher Preparedness

Figure 1. Conceptual Framework of Teacher Quality and Teacher Preparedness.
Strengths and Limitations of the Study

An important strength of this study is the use of national data. These data can be used to produce national estimates regarding highly qualified teachers and the allocation of highly qualified teachers, since SASS data were based on national representative samples of American teachers.

Second, in this study I created the highly-qualified-teacher variable by combining teachers' degrees, certification status and subject knowledge. This composite variable was created based on the definition provided by the NCLB. This allows me to examine the status of highly qualified teachers in secondary public schools in a fairly direct and complete way. Therefore, the study has the advantage to provide a timely and clear picture related to the policy of highly qualified teachers.

Third, recent concern over student achievement gap has focused attention to the teacher gap-unequal distribution of teacher quality across various types of schools. The investigation of the distribution of highly qualified teachers across schools will provide updated information for policymakers in this aspect.

Finally, relatively few studies inquire into the relationship between new teachers' qualification status and their self-assessment of their preparedness. The comparison between highly qualified teachers' and under-qualified teachers' perceptions on preparedness provides new information to help address the issue of whether highly qualified teachers matter to teacher effectiveness and student learning. According to Darling-Hammond (2000a), teachers with the most preparation are the most confident and successful.
There are several potential limitations in this study. First, the study is purely quantitative, focusing on certain aspects of teachers’ qualifications in the investigation of teacher quality, which makes it difficult to have a complete understanding of the complexity and richness of teacher quality issues. Second, the variables used to measure highly qualified teachers in this study are limited to the available existing dataset. Other possible indicators of a highly qualified teacher are not able to be included. For example, according to the NCLB, teachers can demonstrate competence in subject knowledge in several ways such as passing a rigorous subject exam, possessing an academic major or equivalent coursework, graduate degree, or advanced certification or credentialing in the subject taught. While, in this study, only the teachers who possess an academic major in their subject taught are identified as highly qualified teachers regarding teachers’ competence in the subject knowledge. As a result, some of the teachers who are highly qualified may not be included in this study. Third, the study uses an existing dataset. Data was collected before the study was conceptualized and research questions were formulated, which may also place some limits on this study. Finally, since the latest available Schools and Staffing Public School Teachers Survey was conducted during 1999-2000 school year, the data from this study about teacher quality are not as recent as preferred.

Organization of the Study

This study is organized into five chapters. Chapter I is the introduction to the study which provides the background of the study, the purpose of the study, the research problem, research questions, the significance of the study, operational definitions,
conceptual framework, strengths and limitations of the study. Chapter II is the review of the related literature focusing on the definition of teacher quality, research on teacher quality, indicators of teacher quality and student achievement, the status of teacher quality in public secondary schools, quality of new teachers, teacher quality and teacher preparedness. Chapter III describes the methodology for the study in detail, which includes the research design, sample characteristics, weighting, instrumentation, data collection methods, quality of the data and data analysis procedures. Results of the study are presented in Chapter IV, and the conclusions and implications are summarized in Chapter V.
CHAPTER II

LITERATURE REVIEW

The purpose of the study is to investigate teacher quality in secondary schools based on the definition of a highly qualified teacher under NCLB. Indicators of a highly qualified teacher in this study include a bachelor degree, a full certificate and a major in the subject taught. In this study, I examine teacher quality in their main teaching assignment field as well as in each subject taught with focus on the core academic subjects and the sub-fields of science. I also explore the distribution of teacher quality by school locations and by minority student enrolment in schools. In addition, I investigate the relationship between teacher quality and teacher preparedness among new teachers.

In the following section, I review the existing literature related to the following areas: (a) how teacher quality has been defined; (b) how teacher quality has been studied; (c) how teacher quality is related to student achievement; (d) the status of teacher quality in public secondary schools and how teacher quality is distributed; and (e) the quality status of new teachers and how teacher quality is related to teachers’ preparedness. Table 1 displays a basic structure of the review of the related studies.

Defining Teacher Quality

Teacher quality is an often used term, but, what accounts for teacher quality? There is little consensus on what it is and how to measure it. One of the traditional
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<td>• Teacher preparation and qualification</td>
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<td>What has been found</td>
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approaches to characterizing teacher quality is the “expert teacher study” (Leinhardt, 1989; Westerman, 1991), which focused on teachers who have been identified as successful by their administrators or peers. Researchers found that expert teachers connect what they know with how they teach. For instance, they use knowledge about the children in their classrooms to create lessons that connect new subject matter to students’ experience. In addition, expert teachers also know how to recognize children experiencing difficulties, diagnose sources of problems in their learning, and identify strengths on which to build. Clearly, expert teachers not only have the knowledge, but also know how to convey that knowledge to different students effectively.

Today, teacher quality tends to include standards developed by educational organizations such as the Interstate New Teacher Assessment and Support Consortium (INTASC), the National Board for Professional Teaching Standards (NBPTS) and the National Council for the Accreditation of Teacher Education (NCATE). Though these organizations may differ in some respects, they share many common themes regarding standards for teachers. Standards established by INTASC (1995) state that teachers should be able to understand their subject matter and relate it to students, adopt teaching strategies that are responsive to different learners, employ diverse instructional strategies, establish proper assessment tools to measure student development, and engage in continual curriculum evaluation and professional development.

In brief, teacher quality usually refers to these two broad areas: teacher preparation and qualifications, and teaching practices (Lewis et al., 1999). Teacher preparation and qualifications concerns the inputs that teachers bring to the school, including postsecondary education, certification, prior professional work experiences,
professional development, demographics and aptitude. Teaching practices involve in the actual quality of teaching that teachers exhibit in their classroom (U.S. Department of Education, 1996a). In the literature, some researchers classified teaching practice as teaching quality and teacher preparation and qualification as teacher quality (Kaplan & Owings, 2001). Teaching practices or teaching quality refer to what teachers do to promote student learning, including creating a positive learning climate, selecting appropriate instructional goals and assessments, using the curriculum effectively and know how to use various instructional methods to teach to high standards. “Conceptually, measuring teaching quality ought to be a high priority of any examination of teaching and learning, since, literally defined, it represents the direct effect on students by teachers as they create their classroom magic” (U.S. Department of Education, 1999, p. 1). While teacher preparedness and qualifications may not directly address the actual quality of teaching and student learning, they are necessary prerequisites of effective teaching (Stronge, 2002). Some well-established indicators of teacher preparation and qualifications, such as teachers’ education credentials, their subject knowledge and their certification type, do inform researchers and policymakers in terms of how well-prepared teachers are to take on the assignments they are handed (Lewis et al., 1999; Mandel, 1996). According to Stronge (2002), a growing body of research concerning teacher quality has reinforced the notion that both teacher preparation and qualification and teaching practice matter in teaching, in terms of student achievement. In order for a clearer discussion, this study focuses exclusively on teacher preparation and qualification, more specifically, on teacher qualifications as a single aspect of teacher quality.
Defining Highly Qualified Teachers

The definition of a highly qualified teacher under NCLB relies on teacher preparation and qualifications (e.g., bachelor degree, full state certification and competence in subject knowledge). Such a definition is warranted. Recent research has confirmed that teacher preparation and qualifications are important factors that have influence on student achievement (Darling-Hammond, 2000b; Ferguson, 1991; Goldhaber & Brewer, 2000; Laczko-Kerr & Berliner, 2002; Mont, 1994; Wenglinsky, 2000). Using data from a 50-state survey of policies, state case study analysis, the 1993-94 Schools and Staffing Surveys (SASS), and the National Assessment of Educational Progress (NAEP), Darling-Hammond’s (2000b) found that the following aspects of teacher qualifications are related to student achievement: (a) general academic and verbal ability; (b) subject matter knowledge; (c) knowledge about teaching and learning as reflected in teacher education courses or preparation experiences; (d) teaching experience; and (e) the combined set of qualification measured by teacher certification.

Although many agree that teacher preparation and qualification are important for effective teaching, in terms of what specific indicators of teacher preparation and teacher qualifications matter most to student achievement, there is a heated debate in the educational community. The focus is on which knowledge is more important for a teacher to gain; pedagogical or subject matter knowledge. Regarding teachers’ subject knowledge, policymakers and researchers are increasingly recognizing the critical role it plays in student achievement. Many argue that all teachers ought to possess strong knowledge of the subject they teach because it is an essential element that positively...

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affects teaching performance and student achievement (Goldhaber & Bredwer, 2000). Strong subject knowledge is particularly fundamental for a high school teacher. Ingersoll (1996) reported that college training in the subject in which he or she teaches is one of the most important characteristics of a qualified high school teacher, since the level of mastery needed to teach different subjects is higher at the secondary school level.

However, how much content knowledge does a teacher need to be considered adequate? Some argue that a secondary school teacher at least should have a college minor in the subject taught to be considered qualified (Ingersoll, 1996). Others suggest that secondary school teachers should pursue an academic degree or advanced degree in the subject taught (Goldhaber & Bredwer, 2000). Given the significant influence of teachers’ subject matter knowledge on student achievement, The NCLB Act requires highly qualified teachers to demonstrate competence in each subject taught. The NCLB Act also defines how this competence may be demonstrated, which differs for teachers of different grade levels and for veteran versus new teachers. Briefly, new secondary teachers must demonstrate subject matter competence by either passing a rigorous subject exam or possessing an academic major or equivalent coursework, graduate degree, or advanced certification or credentialing in the subject taught. Obviously there are various ways for teachers to demonstrate competence in subject knowledge. However, limited by the available data, in the aspect of teachers’ subject knowledge, this study can only include those teachers who have obtained a major in their subject taught to be considered as highly qualified teachers.

There are many disagreements among policymakers, researchers and educators regarding the value of pedagogical preparation for teachers. Shen and Poppink (2003)
observed that on one side there are people who hold that teaching ability is a function of innate talents and that teachers need minimal preparation to teach, therefore, suggesting no formal or little teacher preparation for teachers. On the other hand, there are people who believe teaching requires multiple forms of knowledge and skill that can be taught and learned, thus suggesting highly developed forms of preparation and ongoing professional development to heighten the need for careful preparation. Regarding teacher certification, NCLB requires all teachers obtain a full state certificate and licensure to be considered highly qualified. However, according to NCLB, the state has freedom to define certification as it sees fit. For example, the state can use this opportunity to streamline its certification requirements to the essential elements. It can also create alternative routes to certification. In this study, teachers who have obtained a full state certificate status refer to those teachers who have obtained regular/standard state certificate or advanced professional certificate or probationary certificate. Only teachers who have obtained a full state certificate are considered to be highly qualified. Teachers who are holding other types of certifications (e.g., alternative certification, temporary certificate, emergency certificate or waiver) are not considered to have a full state certificate and are not considered highly qualified, either.

Based on the NCLB’s definition of a highly qualified teacher, pedagogical and subject matter knowledge are both important for a teacher to gain. Research also demonstrates the advantage for a teacher to have both strong pedagogical and subject matter knowledge. For example, Darling-Hammond (2000b) found the most strongly and consistently significant predictor of student achievement was the proportion of well-qualified teachers—teachers who hold both full certification and a major in the field
being taught. While, the strongest, consistently negative predictors of student achievement, are the proportions of new teachers who are uncertified and the proportions of teachers who hold less than a minor in the field they teach. Darling-Hammond (2000b) explained that the strength of having a highly qualified teacher in classroom is in fact "a proxy for both strong disciplinary knowledge (a major in the field taught) and substantial knowledge of education (full certification)" (Darling-Hammond, 2000b, p. 18).

It is noticed that the idea of highly qualified teachers with an emphasis on a teacher’s subject knowledge and pedagogical knowledge is quite consistent with the concept of pedagogical content knowledge, a concept that is based primarily on qualitative research by Shulman (1986, 1987) and his colleagues (e.g., Grossman, 1990; Grossman, Wilson, & Shulman, 1989). While teachers draw upon both general pedagogical knowledge and knowledge of their subject matters in teaching, teachers also draw upon knowledge that is specific to teaching particular subject matters. Shulman (1986) termed this body of knowledge pedagogical content knowledge. When discussing teaching secondary English, Grossman (1990) conceptualized pedagogical content knowledge as the following four components: (1) conceptions of purposes for teaching the subject matter; (2) knowledge of students’ understanding; (3) curriculum knowledge, and (4) knowledge of instructional strategies. The argument for highly qualified teachers seems to support the development of a teacher’s pedagogical content knowledge to improve teaching and learning.

In particular, Grossman (1990) suggested that when preparing teachers to work in secondary schools, it is important to consider both the subject matter knowledge they
bring with them and the pedagogical content knowledge they will need for effective teaching. Subject knowledge alone, while crucial for teaching, does not provide teachers with the pedagogical understanding necessary for teaching a wide range of students (Grossman, 1990). A number of studies on teacher effectiveness revealed that both subject content courses and content-specific pedagogy courses in a teacher’s preparation were positively related to student achievement (Ferguson & Womack, 1993; Monk & King, 1994), emphasizing the importance in preparing teachers with subject knowledge and pedagogical content knowledge.

The debate on a more proper definition for teacher quality or for highly qualified teachers is continuing, however, the message sent to the public seems to be clear with the passage of No Child Left Behind Act which defines what a “highly qualified teacher” means. A highly qualified teacher should have a certain level of general education (at least a bachelor degree), substantial pedagogical knowledge (a full state certification) and strong subject knowledge (e.g., at least a major in the subject taught to show competence in the subject a teacher teaches).

Research on Teacher Quality

Research on teacher quality is difficult because there is surprisingly little consensus on how to define it or how to measure it. In spite of the complexity and difficulty, researchers have been attempted to use variety of ways to study teacher quality. According to Lewis and his colleagues (1999), approaches to measuring teacher quality usually takes the following four forms: (1) classroom observations of teacher practices; (2) written examinations of teachers measuring their basic literacy, subject
matter knowledge, and pedagogical skills; (3) student performance and achievement; and (4) large-scale survey of teacher qualifications, attitudes, behaviors, and practices.

**Classroom Observation**

Classroom observation, often combined with interviews and collections of artifacts (e.g., teacher logs, homework), has been employed to document teacher practices or to assess teaching quality. Observational studies typically include investigations of teachers’ pedagogical content knowledge and reasoning (Ball & Wilson, 1996; Grossman, 1990) and the connections between education policy and teacher practices (Ball, 1990; Cohen, 1988; Grossman & Thompson, 2004; Peterson, 1990), professional development and teaching (Ball, 1996), and subject matter and curricular activity (Stodolsky & Grossman, 1995). Observation is typically used to provide a detail picture of classroom instruction and observational data provide rich detail and in depth information. However, collecting such data is costly and it is difficult to be conducted in a large number of classrooms.

**Teacher Testing**

Variety of tests such as tests of verbal ability, teacher licensure or college entrance exams have been used to measure teachers’ basic knowledge or overall academic proficiency. The measure of teacher scores on these achievement tests has received considerable attention, because it has been frequently linked to student test scores. For example, Ferguson (1990) found that teachers’ scores on a test of basic literacy skills were significantly correlated with their students’ test scores. Goldhaber and
Anthony (2003), summarizing studies by Ferguson (1991), Ferguson and Ladd (1996), Strauss and Sawyer (1986), Strauss and Vogt (2001) and others, observed that there was a positive relationship between teachers’ test scores on achievement tests and student achievement. They concluded that the measure of teacher tests on their academic proficiency represented one of the best predictors of teacher quality.

While many experts agree that teacher academic preparation is an important prerequisite to effective teaching, critics argue that teacher tests only focus on measuring teachers’ basic academic knowledge and not their pedagogical knowledge or their teaching practice, thus, this approach does not provide a complete picture of teacher quality.

Large-Scale Surveys

In the last 15 years, large-scale national surveys of teachers, such as the Schools and Staffing Survey (SASS), have been used to provide quantifiable indicators of teacher quality. Typically, teachers have been asked to provide information on attributes such as their educational background, major and minor fields of study, certification, and professional development experiences. Such indicators have been used to study characteristics of teacher certification (Shen, 1999; Shen & Poppink, 2003); teacher retention and attrition (Shen, 1997); out-of-field teaching (Ingersoll, 1994, 1996; Lewis et al., 1999; Seastrom et al., 2002). Indicators of teacher quality have also been linked to school characteristics to address the issues of educational equity (Shen et al., 2004; Ingersoll, 2004). Furthermore, indicators of teacher quality such as teachers’ certification and subject knowledge have been connected to student achievement (Darling-Hammond,

**Student Achievement**

Many argue that the bottom line of whether teachers are effective is whether their students are successful. Student achievement test scores gains have been used to assess teacher quality. A general approach is to estimate the relationship between teacher quality and student achievement. Teacher characteristics such as degree level, subject matter knowledge, certification type, teaching experience, teacher tests scores on achievement tests are often used as proxies for teacher quality. In the last two decades, interest in the impact of teacher quality on student achievement has been growing among educational policymakers and researchers. While early studies focus more on the actual behaviors in the classroom, now more focus on teacher preparations and qualifications before they go into the classrooms. Many studies indicated that teacher preparation and qualification are important indicators of student achievement (Darling-Hammond, 2000b; Ferguson 1991; Goldhaber & Brewer 2000; Laczko-Kerr & Berliner, 2002; Mont, 1994; Sanders &
Rivers, 1996). However, research on this topic does not always produce consistent results. Based on Goldhaber and Anthony (2003), some of the meta-analyses on the same teacher (but different school) attributes have reached very different conclusions. For example, Hanushek (1986) found that there was no strong evidence that teacher student ratios, teacher education, or teachers' experience have an expected positive effect on student achievement. In contrast, Greenwald, Hedges and Laine (1996) found that teacher variables like academic ability, teacher education, and teacher experience show very strong relations with student achievement. In addition, the use of student achievement test score gains to assess teacher quality has received substantial criticism (U.S. Department of Education, 1996a). Critics argue that it is very difficult to separate out the portion of student achievement gains that can be reliably attributed to an individual teacher, since many factors affect student achievement over the course of a school year in addition to his or her teacher. Regarding what is known about specific teacher attributes and student achievement, I have provided a more comprehensive discussion in the later section of the review.

In brief, educational researchers have employed many different ways to investigate teacher quality. Some researchers define teacher quality in terms of student achievement. Some focus on high performance ratings from supervisors. Some rely on comments from students and administrators. Still some use large-scale national surveys of teachers to provide quantifiable indicators of teacher quality. Since teaching a complex task and a teacher's influence is far reaching, it is challenging to define what outcomes might show high teacher quality and how those outcomes should be measured. In
addition, many variables outside the teacher's control affect each of the potential measures of teacher quality.

Despite the complexities, many researchers agree that high quality teachers do make an extraordinary and lasting impact on the lives of students. In recent years, in an attempt to develop an understanding of what qualities of a teacher cause higher student achievement, researchers have begun to focus on the investigation on the relationships between specific characteristics of teachers and student achievement. Looking across studies, although they do not always yield consistent results in defining characteristics of high quality teachers, carefully exploration of the research, nevertheless, helps confirm what characteristics of teachers are most important in determining student outcomes. The following section of the review focuses on what has been found in terms of the relationships between specific characteristics (e.g., degree, certification and subject knowledge) of teachers and student achievement.

Indicators of Teacher Quality and Student Achievement

What specific characteristics of teacher quality are related to student achievement? Research on this topic has focused on the following characteristics of teacher quality: (a) the impact of teacher degree level on student learning; (b) the relationship of teachers' subject matter knowledge and student learning; and (c) the importance of teacher certification on student achievement. While the results of these studies are mixed, some trends have emerged.
Does a teacher's degree level (education level) affect student performance? According to Hanushek's meta-analysis (1986) on the effect of teacher's degree level on students, the results are mixed. Some studies showed that the measure of teachers' degree level is statistically significant. Others showed that additional teacher education actually has statistically significant negative relationship with student achievement. Greenwald et al. (1996) reviewed the literature in this area and had similar findings. They found that teacher with master's degrees had a statistically significant positive effect on student outcomes in 15 percent of the cases reviewed and a statistically significant negative effect in 13 percent of the cases. However, these studies generally only cover the level of the degree and not the subject of the degree (Goldhaber & Anthony, 2003). Using data from the National Educational Longitudinal Study of 1988 (NELS: 88), Goldhaber and Brewer (1996) estimated the impact of teachers' degrees on students' performance in the areas of mathematics, science, English, and history. Their study covered not only the level of the degree but also the subject of the degree that teachers obtained. They found that teachers certified in mathematics and those with bachelors' or masters' degree in mathematics and science were associated with higher student performance scores. Teachers with mathematics and science degrees were not found to influence student outcomes in English and history, suggesting that it is the subject-specific training rather than teacher ability that results in improved performance.

It is assumed that teachers' advanced degrees may enhance a teacher's productivity. However, Goldhaber and Brewer's (1997) analysis revealed that a teachers' advanced degree was not generally associated with increased student learning from the
eighth to the tenth grade, but having an advanced degree in math and science for math and science teachers did appear to influence students’ achievement in those subjects.

In a more recent study of 8th- and 10th-graders’ math and science achievement, Goldhaber and Brewer (1998) did not find any evidence that a teacher with an advanced degree in a subject other than the one he or she teaches was any more effective than a teacher without an advanced degree. This suggests that the use of subject-specific information about teachers is critical in interpreting the effects of teacher characteristics on student achievement.

Under NCLB, one of the criteria of a highly qualified teacher is to obtain at least a bachelor degree. Based on the research, this criterion would not be a problem for teachers to meet since nearly all the public school teachers have at least a bachelor degree and about half of all teachers have a master’s degree (Goldhaber & Brewer, 1996). However, Goldhaber and Brewer (1996) pointed out that far fewer teachers had degrees specific to the subject they teach. Having a bachelor or even an advanced degree alone does not have any advantage in influencing the students’ learning if a teacher is assigned out-of-field teaching, emphasizing that it is the subject-specific training rather than teacher ability that results in improved performance. This body of literature shows that there is little impact from teachers having degrees in subjects different from the subjects they teach, implying that in order for teachers to strengthen their subject matter knowledge, teachers, especially secondary teachers, should pursue subject-specific degree or advanced degree in the subject taught.
Teachers' subject matter knowledge is another important measure that is related to student achievement. Peters (1977) noted that as specific preparation for teaching, priority must be given to a thorough grounding in the subject to be taught. Teachers with strong subject matter knowledge are better able to go beyond the basic textbook content and involve students in meaningful discussion and student-directed activities. In recent years, interest in the impact of teachers’ subject knowledge on student achievement has been growing among educational researchers and policy makers. Studies on this topic tend to look at: (a) whether a teacher has a major or minor in a subject area; (b) whether a passing score on a certification exam provides evidence that certain subject matter has been mastered; (c) whether a teacher has an advanced degree (e.g., master degree); or (d) whether a teacher has a bachelor or master degree in the subject he or she teaches (Goldhaber & Brewer, 1996, 2000, Monk & King, 1994, Rowan et al., 1997).

Requiring all teachers to possess strong content knowledge in the subjects they teach is an important step that is grounded in research demonstrating the importance of teacher content knowledge for student achievement, particularly at the secondary school level (Rotherham & Mead, 2003). For example, Goldhaber and Brewer (1998, 2000), analyzing data from the first two waves of the National Educational Longitudinal Study of 1988 (NELS), found subject-specific training of teachers in math and science had significant positive impact on 10th grade student achievement. Using the same data set (NELS: 88), Chaney, (1995) and Rowan et al. (1997) had similar findings that students’ mathematics achievement was higher for those students who had a teacher with a major in mathematics at the undergraduate and/or graduate level. Wenglinsky (2000), using
data from the National Assessment of Educational Progress (NAEP), observed that in
math and science students whose teachers majored or minored in the subject they teach
outperformed their peer by 40% of a grade level. Other studies also reported that
teachers’ subject knowledge had positive relation with student learning (Betts & Frost
2000; Ferguson & Womack, 1993; Hawk, Coble, & Swanson, 1985, Monk & King,
1994). After reviewing the studies on the effect of teachers’ subject knowledge on student
achievement, Wilson and Floden (2003) concluded that, in mathematics, there seems to
be a trend that the students whose teachers have mathematics or mathematics education
degrees demonstrate higher levels of achievement.

In conclusion, this body of literature shows that subject matter knowledge
positively affects teaching performance and student learning and teachers with strong
content knowledge are associated with higher student achievement, especially in the areas
of secondary science and mathematics. Given the critical role of teachers’ subject
knowledge plays on student achievement, NCLB requires that all teachers must
demonstrate “rigorous” subject-matter preparation either through adequate performance
on a test or through successful completion of a major, graduate degree, advanced
credentialing or other demanding requirements (U.S. Department of Education, 2002).

Teacher Certification and Student Achievement

The purpose of teacher certification is to ensure that every public school teacher
has had rigorous screening and training and has been judged qualified to teach (Laczko-
Kerr & Berliner, 2002). Having certification to teach is a necessary prerequisite, although
it does not guarantee quality teachers or quality teaching (Ingersoll, 1996). In most
states, teacher certification status is related to educational background and to scores on some tests of pedagogical or content knowledge, or both. A teacher with a standard certificate generally refers to a teacher who has been prepared in a state-approved teacher education program at the undergraduate or graduate level and has completed either a major or a minor in the field(s) to be taught, plus anywhere from 18 to 40 education credits, including between 8 and 18 weeks of student teaching (Darling-Hammond, 2000a). The measure of teacher certification usually combines aspects of knowledge about subject matter and about teaching and learning. Research on the importance of certification usually focuses on the following areas: (a) the effect of teachers’ content knowledge on student achievement; (b) the effect of teachers’ pedagogical knowledge on student achievement; (c) the effects of regularly certified teachers teaching in-field or out-of-field. Out-of-field teaching here can be viewed as teaching without the appropriate certification to do, and (d) the effect of fully certified teachers in comparison to under-certified teachers (emergency, temporary and provisionally certified teachers).

Studies focusing on the influence of teachers’ educational coursework on student achievement have found a positive relationship between teachers’ educational coursework and student achievement. Studies show that fully prepared teachers with background knowledge of pedagogy are better able to recognize individual student needs and customize instruction to increase overall student achievement. Darling-Hammond’s recent review (2001) of literature on this topic provides compelling evidence. For example, Monk and King (1994) found that teachers’ education courses in subject matter methods had a positive effect on student learning. Similarly, Denton and Lacina (1984) found positive relationships between the extent of teachers’ professional education
coursework and their students' achievement. Evertson, Hawley, and Zlotnik (1985) also found a consistent positive effect of teachers' formal educational training on supervisory ratings and student achievement, with 11 of 13 studies showing greater effectiveness for fully prepared and certified vs. uncertified or provisionally certified teachers.

To investigate the difference between certified and non-certified mathematics teachers at secondary schools, Hawk et al. (1985) found that student achievement in mathematics was greater when the students were taught by certified teachers in mathematics. Goldhaber and Brewer (2000), analyzing data primary from NELS: 88 confirmed that in math teachers certified in their subjects performed better than those who were not certified in their subject areas. When comparing academic achievement of students taught by regularly certified teachers to the academic achievement with students taught by under-certified teachers (emergency, temporary and provisionally certified teachers), Laczko-Kerr and Berliner (2002) found that students taught by regularly certified teachers out-performed students taught by under-certified teachers. Students taught by regularly certified teachers made about 20% more academic growth per year than did students taught by under-certified teachers. In comparison of student achievement between schools with low and high percentages of certified teachers, Fuller (1999) found that students in districts with greater proportions of licensed teachers were significantly more likely to pass the Texas state achievement tests, after controlling for student socioeconomic status, school wealth, and teacher experience. Other studies on this subject also reported that teacher certification status did make a difference in student learning (Darling-Hammond, Berry & Thoreson, 2001; Ferguson, 1991; Fuller, 1999; Grossman, 1990; Hawk et al., 1985; Strauss & Sawyer, 1986; Wilson & Floden, 2003).
Overall, this body of literature suggests that teacher certification is an important factor that has an effect on teacher effectiveness and student achievement. Fully prepared and fully certified teachers have a greater impact on gains in student achievement than do uncertified or under-certified teachers and more importantly, teachers certified within their field have significantly higher achievement rates among their students than teachers who are not certified in their field.

Despite the positive effect of teacher certification on student learning, in recent years, teacher certification has been under attacked for not being able to ensure teacher preparation quality, especially teachers’ subject-area preparation. According to Thomas and Raechelle (2002), teacher certification in many states did not require subject-area expertise: less than a third of all state require an academic major in the subject taught; and only two-thirds require teacher candidates to pass a subject-matter exam for initial licensure, therefore, a certified teacher may not necessary be a qualified teacher.

Highly Qualified Teachers and Student Achievement

The NCLB’s definition of a highly qualified teacher emphasizes that teachers need to obtain both strong subject knowledge and pedagogical knowledge. To be deemed highly-qualified, a teacher must obtain a full state certification and demonstrate competence in subject knowledge. This definition is well supported by empirical evidence and by many researchers. Kaplan and Owings (2002) remarked what made the difference in student achievement was not just what a teacher knew but also how well a teacher could convey what he or she knew to students, indicating that to be an effective teacher, a teacher needs subject knowledge as well as pedagogical knowledge. Other
researchers also share the similar ideas. While subject matter knowledge is an important prerequisite for effective teaching, subject matter knowledge alone does not result in increasing the quality of teaching performance (Ferguson & Womack, 1993). For example, in their research review, Evertson et al. (1985) could find little empirical evidence to show that increasing teachers' knowledge of their subjects beyond what typically required for certification significantly increased teacher effectiveness. Druva and Anderson (1983) found consistently positive relationships between student achievement in science and their teachers' backgrounds in both education courses and science courses. Monk's (1994) study of relationships between teacher preparation and student achievement indicated that both subject content courses and content-specific pedagogy courses in a teacher's preparation were positively related to student achievement. In a more recent study, using data from 1993-94 Schools and Staff Surveys (SASS), and the National Assessment of Educational Progress (NAEP), Darling-Hammond (2000b) found that the most consistent highly significant predictor of student achievement in the subjects of reading and mathematics, in all years and at all grade levels, was the variable of well-qualified teachers (teachers with full certification and a major in the subject they teach). The finding of this study illustrated that the combination of strong subject content knowledge (a major in the subject taught and strong pedagogical content knowledge (full certification in the subject taught) by far be the most important determinant of student achievement. This study has highlighted the significant influence of a highly qualified teacher on student achievement.

In summary, this body of literature suggests that both rigorous subject training and pedagogical training of a teacher are strong indicators to student achievement.
(Rotherham & Mead, 2003). Kaplan and Owings (2001), after carefully reviewing the literature on the relationship between teacher quality and student achievement, recommend that principals should “hire teachers with majors in their fields and full professional certification” (p. 5).

Teacher Quality and its Distribution

While some researchers have been interested in the impact of teacher quality on student achievement, others have focused their attention on examining the status of teacher quality and the distribution of teacher quality in public schools (Ingersoll, 1994, 1996, 1999; Kaplan & Owings, 2002; Shen & Poppink, 2003; Seastrom et al., 2002). This is out of a growing concern that a substantial percentage of students are taught by teachers who are under-qualified in their subjects taught (Kaplan & Owings, 2002). Concern about teacher quality has been directed toward teachers’ postsecondary degrees—that is, teachers, particularly secondary teachers, should have academic major rather than a general education degree (Ravitch, 1998). In addition, certification policies have drawn criticism—that is a growing number of the nation’s teachers are entering classrooms with emergency or temporary certification (Riley, 1998; Shen & Poppink, 2003). Finally, attention is increasingly directed toward teaching assignments—that is, teachers being assigned to teach subjects that they do not match their training or education (U.S. Department of Education, 1996b). Such mismatches are commonly referred to as out-of-field teaching. For instance, teachers with a degree in English are teaching classes in math or, conversely, teachers with educational backgrounds in math are assigned to teach classes in reading.
Teacher Degree and its Distribution

Regarding teachers' degree, results of the 1998 Fast Response Survey System (FRSS) survey indicated that virtually all teachers had a bachelor's degree and nearly half (45 percent) had a master's degree (Lewis et al., 1999). However, only 66 percent of high school teachers had an undergraduate or graduate major in an academic field. In a more recent study of 8th- and 10th-grades' math and science achievement, Goldhaber and Brewer (1998) had similar findings. Only 68% to 76% of teachers (depending on the subject) have at least a bachelor's degree in their subject area and even a lower proportion of math and science teachers than of English and history teachers have bachelor's degrees in their subject areas. Although about half of all teachers have at least a master's degree, less than a quarter have advanced degree in their subject area.

When examining the allocation of teachers who hold a master's degree by school poverty level (as measured by the percentage of students eligible for free or reduced price lunch), NCES (1999) found that there is variability in the distribution of teacher degree level between low- and high-poverty schools. In low-poverty schools (less than 15% poverty), 57% of the teachers had master’s degree, while only 37% of the teachers held master’s degrees in high-poverty schools (i.e., those with 60% or more poverty). Investigating the allocation of teachers in masters' degree in California, Betts, Reuben and Danenberg (2000) also revealed that on average, teachers in high-poverty and high-minority enrollment schools had lower percentages of teachers who held master's degrees.
Teacher Certification and its Distribution

In terms of teachers' certification, (Lewis et al., 1999) reported that most of the teachers (92 percent and 93 percent, for departmentalized and general elementary, respectively) were fully certified in the field of their main teaching assignments. However, when exploring the certification characteristics of the public school teaching force nationwide, Shen and Poppink (2003) found that over a twelve-year period (1987-88 to 1999-2000), the percentage of teachers uncertified in their primary teaching assignments increased from 2.7 to 5.7. Regarding the distribution, Shen and Poppink (2003) reported, in comparison to suburban and rural schools, urban schools had higher percentage of uncertified teachers and a higher percentage of teachers with less certification (temporary certificates, emergency certificates and waivers) in their primary teaching assignments. Similarly, Lavigne (1992) observed that in New York City Public Schools, high-poverty schools and those with high percentages of minority students had significantly fewer certified teachers than low-poverty and low-minority enrollment schools. The findings of Betts, Reuben and Danneberg (2000)'s study paralleled those of Lavigne's regarding the allocation of certified teachers in California schools. That is, there is a disproportionately higher percentage of uncertified teachers in high-poverty and high-minority enrollment schools.

Out-of-Field Teaching and its Distribution

In order to find out the extent to which public secondary students are taught core academics by out-of-field teachers (teachers without at least a college minor in the field they teach), Ingersoll (1996) analyzed the national data—Schools and Staffing Survey
Ingersoll found that many students were taught by out-of-field teachers: 20 percent in English classes, 25 percent in mathematics, 39 percent in life science or biology, 56 percent in physical sciences classes, and over 50 percent in history or world civilization. In addition, Ingersoll examined out-of-field teaching nationwide by the attributes of school size (1997), school poverty (1998), percentage of minority students (1998), and course level (1999). He found that: (a) low-income schools had higher levels of out-of-field teaching than did more affluent schools; (b) in several fields, students in both low-track and low-achievement-level classes were more often taught by out-of-field teachers than were students in high-track and high-achievement-level classes; and (c) a greater incidence of out-of-field teaching across small and mid-sized schools.

A more recent study by Seastrom et al. (2002) confirmed that even at the high school level a large number of teachers taught subjects in which they do not have major, minor, or certificate. They reported when the definition of out-of-field was expanded to include teachers who did not have certification and a major in the subject taught, the amount of out-of-field teaching increased.

This body of literature illustrates that a large number of teachers are under-qualified in their subject taught. Some teachers are teaching a subject in which they do not have a certification and some teachers are teaching a subject in which they do not even have a minor, indicating that there is a deficit of quality teachers in American public schools. Regarding distribution patterns of qualified teachers, several studies with various measures documented consistent findings that schools with substantial poor and minority students were the least likely to have high quality teachers (Ingersoll, 1996, 2002; Seastrom et al., 2002; Shen et al., 2004).
Distribution of Teacher Quality by Subjects and School Characteristics

Equity studies in education have included a number of classroom and school characteristics in the examination of resource distribution. In this study, I include those variables such as subjects, school location and percentage of minority students in the investigation of the distribution of teacher quality. In the following section I discuss the rationales for the inclusion of these variables in this study.

Core Academic Subjects. In the last decade, national and statewide school reform efforts have focused primarily on student achievement. In response, nearly all states have implemented rigorous standards for student achievement in the core academic subjects (English, history/social studies, math, and science). Consequently, educational researchers and policy makers have begun to turn their attention to the quality of teachers in those critical subject areas, particularly in math and science. Several studies in this topic revealed that students in math and science classes, particularly in the sub-fields of science are more likely to be taught by out-of-field teachers (Ingersoll, 1996; Betts et al., 2000; Seastrom et al., 2002). Using data from the School and Staff Survey, Seastrom et al. (2002) inquired into the issue of out-of-field teaching and provided subject-specific estimates. They reported that at the high school level in 1999-2000, a minimum of 6 out of every 10 students enrolled in physical science (including the sub-fields of chemistry, geology/earth/space science) had teachers who did not have certification and a major in the subject taught. Approximately 30 percent of those enrolled in mathematics, English, and social science classes had out-of-field teachers.
According to Blank and Langesen (2001), a shortage of qualified teachers in mathematics classrooms is obvious. Though the number of high school mathematics teachers in U.S. public schools increased by 22,000 between 1990 and 2000 to a total of 134,000, the percentage of teachers who are assigned to teach high school mathematics classes who are certified to teach mathematics has decreased from 90% in 1990 to 86% in 2000 (Blank & Langesen, 2001). Council of Great City Schools (2000) also reported that 95% of urban school districts nationwide report an immediate need for high school mathematics teachers. In addition, the shortages for high-minority and low-income schools are particularly distressing. In schools with over 50% minority enrollment in grades 7-12, 24% of mathematics teachers teach out-of-field. For high-poverty schools where 60% or more of the students qualify for free or reduced-price lunch programs, 31% of mathematics teachers have neither an undergraduate or graduate major or minor in mathematics (Clewell & Forcier, 2001). These studies showed that the need to find qualified mathematics teachers for the nation's schools was critical.

Percentage of Minority Students at Schools. One of the concerns of NCLB is to provide highly qualified teachers to the high-need schools. High-need schools have been identified as high-poverty, high-minority, or low-performing schools (Ansell & McCabe, 2003). Many studies of the distribution of qualified teachers have included the variable of percentage of minority student enrollment in schools in their examination (Ingersoll, 2002; Lavigne, 1992; NCES, 1997; Shen & Poppink, 2003). The findings from these studies reveal that high-minority enrollment schools are associated with more under-qualified teachers: more out-of-field teachers, more teachers without certifications or lack of appropriate certifications and fewer teachers with advanced degree.
Using data from the U.S. Department of Education’s 1999-00 Schools and Staffing Survey to examine the patterns and trends of out-of-field teaching in secondary schools, Jerald (2002) found that in public secondary schools there were unacceptably high rates of out-of-field teaching in core academic subjects, with classes in high poverty and high minority schools the most likely to be assigned out-of-field teachers. For example, nationally, one out of four secondary (grades 7-12) classless in core academic subjects (24%) are assigned to a teacher lacking even a college minor in the subject being taught. In the nation’s high-poverty schools, the rate is over one-third of classes (34%), compared with about one out of every five classes (19%) in low-poverty schools. Similarly, in high-minority schools 29% of classes are taught by out-of-field teachers, compared with 21% in low-minority schools. The results of Jerald’s study also indicated that the nation made no progress in reducing this problem between 1993-94 and 1999-00.

School location. Some studies of the distribution of qualified teachers have also included school location in their examination (Stoddart & Floden, 1995; Shen & Poppink, 2003; Harris & Ray, 2003) These studies have shown that urban schools tend to have teachers who are less qualified in their subjects taught, particularly in subject areas such as math and science (Stoddart & Floden, 1995). In comparison to suburban and rural schools, urban schools had not only a higher percentage of uncertified teachers but also a higher percentage of teachers with less certification in their main teaching assignments (Shen & Poppink, 2003). Using data from the National Center for Education Statistics, Harris and Ray (2003) examined the distribution of teacher quality in Michigan’s Public Schools by analyzing teacher certification status. They found that teachers in urban schools are less likely to meet the NCLB certification requirements for highly qualified...
teachers in their main teaching assignment than their counterparts in suburban and rural areas. About three times as many urban school teachers do not meet the NCLB certification requirements for their main assignment when compared to suburban or rural teachers. Based on Dallas Morning (August 15, 2003) and Detroit Free Press (August 17, 2003), Shen et al. (2004) reported that many urban school districts have been forced to employ under-qualified teachers due to teacher shortage and class-size reduction movement. In New York City, for example, more than 9,000 teachers were teaching on temporary or emergency license, compared with 1,185 in the rest of the state in the year of 1997-1998 (Darling-Hammond, 2002).

Taken together, studies on the distribution of teacher quality show that high-minority enrollment schools and urban schools are more likely to employ under-qualified teachers, particularly in the subjects of math and science. Given the compelling research evidence demonstrating that teacher quality is the single most important school variable affecting student achievement, the existing disparities in student access to highly-qualified teachers will further broaden the student achievement gap. In order for all the students to meet the high educational standards that have been established, students in those high-need schools need to be provided with equal access to high quality teachers (Prince, 2002; Haycock, 2003). However, according to Ansell and McCabe (2003), facing the existing student achievement gap and teacher quality gap, there was also a policy gap nationwide: few states track and inform the public about the distribution of qualified teachers across different types of schools and few states or districts try to match highly qualified teachers with high-need schools. Therefore, by including the above school characteristics in the investigation of the distribution pattern of highly qualified
teachers, this study has the potential to provide new information for policymakers and educators to design specific policy strategies to address the issue of teacher quality.

Quality of New Teachers and Their Preparedness

One of the focuses of this study of teacher quality is about the relationship between teacher quality and teachers' perceptions of their preparedness among new teachers. In the following section, I summarize the literature related to quality of new teachers, teacher preparedness and the relationship between teacher quality and teacher preparedness.

Quality of New Teachers

Given research findings that show that teacher attrition rate is high among new teachers, that teacher attrition is associated with lower levels or lack of certification, preparations and qualifications of new teachers raise a public concern (Shen & Poppink, 2003). Shen and Poppink (2003) analyzed three waves of SASS teacher data (1987-88, 1993-94 and 1999-2000) and found the following:

The percentage of those who held no certificates or low-level certificates was much higher among new teachers than among all teachers. Furthermore, among the new teachers, the percentage of those who held no certificates in their primary teaching assignments increased from 5.5 in 1987-88, to 1993-94, and to 14% in 1999-2000 (p.136).

Lewis et al. (1999) reported the similar finding that emergency and temporary certification was higher among new teachers compared to teachers with more experience.
Analyzing the data from the Baccalaureate and Beyond Longitudinal Study 1993-97 (B&B: 93/97), Shen et al. (2004) inquired into whether students living in poverty have received an equitable share of qualified new teachers. Shen et al. found that schools with high levels of students in poverty tended to have less-qualified new teachers. For example, in schools where 50 percent or more of the students were poor, 16.9 percent of the new teachers were uncertified, while the percentages for schools with lower levels of poor students ranged from 8.5 to 14.6.

In summary, studies focusing on the examination of qualities of new teachers indicate that the percentage of those who held no certificates or low-level certificates was much higher among new teachers than among all teachers. In high-poverty schools, there are more new teachers who are less qualified.

*Teacher Preparedness*

Whether teachers are adequately prepared to teach our children requires extensive and in-depth studies of teachers including their practices and student achievement. However, one approach to address these concerns is to examine the extent to which teachers themselves feel prepared for teaching. Teacher preparedness refers to the state of being ready for teaching. It is usually assessed by teachers’ self assessment, feeling or perceptions of their preparation for performing the various important dimensions of teaching activities, such as classroom management, instructional methods, subject knowledge, use of technology, planning lessons, assessing students, selecting teaching materials, etc. Teachers’ self-assessments provide one indication of the extent to which preservice or on-the-job learning prepare teachers to meet the new demands of education.
Since feeling “very well prepared” can be one of the possible indicators of a high-quality teacher, it is useful to compare teachers’ self-assessments across various teaching activities to identify which activity that teachers felt most prepared or least prepared (Lewis et al., 1999).

Lewis et al. (1999), analyzing 1998 NCES’ Fast Response Survey System (FRSS), examined to what extent teachers felt prepared to meet the most compelling classroom demands, including maintaining order and discipline in the classroom; implement new methods of teaching; implementing state or district curriculum and performance standards; using student performance assessment techniques; addressing the needs of students with disabilities; integrating educational technology into the grade or subject taught; and addressing the needs of students with limited English proficiency or from diverse cultural backgrounds. Lewis et al. found that overall less than half of American teachers reported feeling very well prepared to meet many of the above requirements. Particularly, only 20 percent of teachers reported feeling very well prepared to integrate educational technology into classroom instruction; about 20 percent of teachers who taught students with limited English proficiency or from culturally diverse background or students with disabilities felt very well prepared to meet the needs of these students, and only 28 percent of teachers felt very well prepared to use student performance assessment techniques.

When comparing teacher preparedness between new teachers and experienced teachers, Lewis et al. (1999) found that in the context of education reform, experienced teachers may not necessarily feel better prepared than new teachers in certain teaching activities, such as integrating technology into classroom instruction and employ new
teaching strategies. However, in the areas of classroom management and implementing state or district curriculum, new teachers did feel less prepared than more experienced teachers. In this study, Lewis et al. also found that teachers who spent more than 8 hours in professional development in the content area of a specific activity in the previous 12 months were generally more likely than other teachers to feel very well prepared in that area.

Imbimbo and Silvernail (1999) reported the similar findings regarding teachers' perceptions on their professional preparation. Using data from the New York City Teacher Survey, which was designed to examine how teachers' perceptions on their preparedness differed according to type of preparation they received, Imbimbo and Silvernail found that overall teachers felt the need for better preparation before entering the classroom, particularly in the areas of educational technology and working with new English language learners and teachers' overall feelings of preparedness as they entered teaching most strongly related to: subject area knowledge and instructional strategies, proficiency in educational technology, and effective classroom management.

Teacher Quality and Teachers' Perceptions on Preparedness

Research has shown that teacher quality can make a difference in student achievement. Research has also shown that a growing number of new teachers enter teaching without adequate preparation or appropriate certification in their subject taught. In recent years, researchers also ask whether variation in teacher preparation and qualifications influence how teachers feel about their preparation for teaching. Darling-Hammond et al. (2002) did one of the important studies on this topic. In this study,
Darling-Hammond et al. inquired into whether different kinds of program prepare teachers differently by examining beginning teachers’ views of their preparation for teaching, their beliefs and practice, and their plans to remain in teaching. They analyzed data from a 1998 survey of nearly 3,000 beginning teachers in New York City. Their finding indicated that beginning teachers who have experienced different education programs or pathways into teaching felt differently about their preparation. Teachers who were prepared in teacher education programs felt significantly better prepared across most dimensions of teaching than those who entered teaching through alternative programs or without preparation. The finding of this study is quite consistent with other research that has found relationships between teachers’ preparation and their effectiveness with students (Darling-Hammond, 2002; Monk, 1994; Wenglinsky, 2000). These studies found that those who entered teaching with little professional education have greater difficulties in the classroom (Darling-Hammond, 1992; Grossman, 1989; Jelmberg, 1996) and that they tended to leave teaching at higher rates than those with professional preparation (Darling-Hammond, 2000a).

In summary, studies reviewed confirmed that teacher quality is one of the most important factors to have an influence on students’ achievement. Teachers who are highly qualified in the subject taught are strong predictors to students’ achievement, which emphasizes that both teachers’ pedagogical knowledge and subject knowledge are important to student achievement. However, a growing number of studies pointed out that the trend of overall teacher quality is unpromising. The percentage of under-qualified teachers in secondary schools, especially in high-need schools, is unacceptably high. In addition, the percentage of new teachers who do not have a certification or teach under
emergency or temporary certification is going up. Overall, less than half of American teachers report feeling very well prepared to meet many of the teaching requirements and teachers received formal teacher education felt better prepared in most of the teaching activities than those teachers who enter teaching through alternative programs and those who entered teaching without prior experience or training.

Given that highly qualified teachers play a critical role in student achievement, in this study I inquire into: (a) to what extent teachers are highly qualified in the subject taught in secondary schools (according to the NCLB requirements for highly qualified teachers); (b) whether highly qualified teachers are equally distributed across different schools, and (c) whether teachers who are highly qualified in the subject taught feel better prepared to teach than those who are not highly qualified.
CHAPTER III

METHODOLOGY

In this study, I employ a survey research design that involves a quantitative description of teacher quality status and the investigation of the relationship between teacher quality and teacher preparedness. The purpose of survey research is to generalize from a sample to a population so that inferences can be made about some characteristic, attitude, perception or behavior of this population (Babbie, 1990). First, teacher quality in their main teaching assignment field is examined. Second, teacher quality in each subject taught is investigated. Third, the allocation of teacher quality is studied by using the following school characteristics: school locations and percent minority student enrollment in the school. Fourth, new teachers’ perceptions on preparedness are compared between the two groups of new teachers, highly qualified teachers versus those who are not highly qualified.

In this chapter, I discuss the methodological issues that include (a) data source, (b) sample, (c) instrumentation, (d) quality of the SASS data, (e) data analysis and (f) limitations of data and methodology.

Data Source

The data for this study were extracted from the Schools and Staffing Survey (SASS), which was sponsored by the U. S. Department of Education’s National Center for Education Statistics (NCES). SASS is an integrated set of surveys that is collected
from public, private, public charter, and Bureau of Indian Affairs (BIA) schools nationwide. SASS provides information about teachers and administrators and the general condition of America’s elementary and secondary schools. NCES initiated SASS in the mid-1980s in response to the need for information about critical aspects of teacher supply and demand, the qualifications and working conditions of teachers and principals, and the basic conditions in schools as workplaces and learning environments. SASS has been conducted four times: in school years 1987–88, 1990–91, 1993–94, and 1999–2000 by the United States Census Bureau. The fourth administration (1999–2000) of SASS consisted of the following six survey components: (1) the School District Survey, (2) the Principal Survey, (3) the School Survey, (4) the Teacher Survey, (5) the School Library Media Center Survey, and (6) the Teacher Follow-up Survey.

Given the nature of this study, the 1999-2000 SASS data collected from the public school teachers was used. The 1999-2000 SASS Public School Teacher Questionnaire collected data from teachers regarding their education and training, teaching assignment, teaching experience, certification, teaching workload, perceptions and attitudes about teaching, job mobility, and workplace conditions. This data set was selected as the method of data collection for this study because of several reasons. First, SASS is a major source of data regarding teacher qualifications in the United States and it collects the most information on the broadest range of teacher qualification measures including teachers’ educational backgrounds, professional credentials and teaching assignments (Fabiano, 1999). Second, SASS data were based on national representative samples of American teachers, therefore, these data can be used to produce national estimates regarding teacher quality status and the distribution of teacher quality. Third, the SASS
data had the following characteristics: (a) systematic—carefully planned and executed; (b) national and state-by-state representative—reflecting the population; (c) objective—insuring that the data are explicit; (d) quantifiable—yielding data that can be expressed numerically; (e) a comprehensive range of measures of the dimensions of schools and teachers; and (f) large sample size which allows for disaggregating data along a number of key characteristics of schools and teachers and the use of multiple respondents which provides a rich and reliable description of schools and teachers (U.S. Department of Education, 2000).

In this study, I used existing national data to investigate teacher quality. This type of data is called secondary data. To reanalyze the data gathered by a previous investigator, a new investigator may employ different hypotheses, different experimental designs, or different methods of statistical analysis (Best & Kahn, 1993). By employing alternative or secondary analysis, Best and Kahn (1993) argued that the new investigator might bring a fresh point of view to the investigation or bring greater expertise to the area of investigation and greater skill in experimental design and statistical analysis. Furthermore, they argued that reanalysis would involve less expense in both time and money, since the data are already available.

Sample

Characteristics of the Sample

The target population for this study is the secondary public school teachers who taught students in grade 9 through grade 12 in the school year 1999-2000 ($N = 895,327$). The sample of the study consisted of all the secondary public school teachers who
responded to the 1999-2000 SASS Public School Teacher Questionnaire ($N = 21,493$). For the last research question in this study, which explores the relationship between teacher quality and teacher preparedness, only new secondary school teachers are included ($N = 3343$). New teachers are classified as those in their first, second, or third year of teaching.

SASS was designed to support estimates at the national, regional, and state levels for public school districts, schools, principals, teachers, and school library media centers. The public school sampling frame was based on the 1997-98 school year Common Core of Data (CCD), a file of information collected annually by NCES from all state education agencies and believed to be the most complete public school listing available at the time of sample selection (Tourkin et al., 2004). The frame for public schools contains regular public schools and special purpose schools such as special education, vocational, and alternative schools. The sampling frame for the School Teacher Questionnaire consisted of lists of teachers submitted by schools in the SASS sample.

Sample Selection Procedures

The primary sampling unit of SASS is the school. Public schools were sampled to be representative at the national and state levels. Once schools were selected, each selected school was asked to provide a list of their teachers (Teacher Listing Form). The Teacher Listing Form (TLF) included space for schools to indicate the race/ethnicity of each teacher, whether the teacher was new (less than 3 years of experience), whether the teacher taught classes designed for students with limited English proficiency, the teacher’s assignment (subject matter and/or grade level), and whether the teacher was
full- or part-time. The above information for each teacher in a selected SASS school comprised the school teacher frame. About 7 percent of the in-scope public schools did not provide teacher lists for the 1999-2000 SASS public teacher survey.

Within each selected school, teachers were stratified into one of the five teacher types in the following hierarchical order: (1) Asian or Pacific Islander (API); (2) American Indian or Alaska Native (AIAN); (3) Taught classes designed for students with limited English proficiency; (4) New; and (5) Experienced.

Within each school and teacher stratum, teachers were selected systematically with equal probability. Sample teachers were selected from each stratum across schools using the teacher sampling interval and a random start. To reduce the variance of teacher estimates, one goal of the teacher selection was to make the teacher sample self-weighting (i.e., all teachers within a school stratum had the same probability of selection). The goal was generally met within teacher stratum within school stratum. However, since the school sample size of teachers was altered due to the minimum constraint (i.e., at least one teacher/school) or maximum constraint (i.e., no more than either twice the average stratum allocation or 20 teachers/school), the goal of achieving self-weighting for teachers was not achieved in some schools (Tourkin et al., 2004).

Sample Design

The 1999-2000 SASS public school teacher survey is a sample, i.e., the entire population was not surveyed. The SASS sampling used stratification, disproportionate sampling of certain strata, and clustered probability sampling. SASS is not a simple 'random sample (SRS). That is, not all public school teachers had an equal probability of
selection. SASS employs *complex sample design*. In SASS complex sample design, different sample rates across different states and affiliations lead to different probabilities of selection. Different probabilities of selection within states and affiliations also lead to different probabilities of selection (unequal probability of selection). In addition, not all sampled teachers responded, which leads to differential response rates.

Therefore, the initial sample that resulted was not representative of the public school teaching force. In order to make the sample nationally representative of public school teachers, researchers must weight the sample to approximate the population. Through weighting, the findings can accurately reflect the counts and percentages of the population and can therefore be generalized to the national population of public school teachers. If the data come from a survey with a complex sample design, unweighted statistics will be biased because some cases (e.g., over-sampled minorities) will be over-represented in the population. Weights bring cases back to their correct proportions within the population, so weights must be used when estimating population characteristics.

*Sampling Weights*

The general purpose of the weighting is to produce population estimates from the SASS sample data. Weights can adjust for differential selection probabilities. Weights can adjust for differential response rates, and weights can also compensate for not collecting data from the entire population. The weighting process includes adjustment for nonresponse using respondents' data, and adjustment of the sample totals to the frame totals to reduce sampling variability. The final sample teacher weight variable in 1999-
The final weighted sample size is the actual population size. For instance, for each of the teacher survey, more than 40,000 public school teachers took part in the study and the weighted sample was more than 2 million. The actual sample size and the weighted sample size of the study are displayed in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Teacher samples</th>
<th>Total public school Teachers</th>
<th>Secondary teachers</th>
<th>New secondary teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unweighted</td>
<td>42,086</td>
<td>21,493</td>
<td>3,343</td>
</tr>
<tr>
<td>Weighted</td>
<td>2,984,782</td>
<td>895,327</td>
<td>142,039</td>
</tr>
</tbody>
</table>

In this study, relative sample weights were used in the data analysis for research questions 1, 2 and 3. The relative sample weight for public school teachers is produced based on the final weight for public school teachers (relative weight = teacher final weight * sample size/population). Because of the relative weighting, the total sample of secondary school teachers was reduced from 21,493 to 12,624. The use of relative sample weight rather than final sample weight is out of the concern that, when conducting chi-square tests, the large sample size may inflate the Type I error—an erroneous rejection of the null hypothesis, which leads to the conclusion that a difference or relationship does exists among variables when in fact one does not (Charles, 1998). According to Shen (1997), the use of the relative sample weight can not only approximate the population but also adjust the population down to the actual sample size.
of the study and the findings of the study may also be generalized to the national population of secondary public school teachers with relative sample weights.

Instrumentation

The measurement approach adopted in this study is a large-scale survey administered to a representative sample of American teachers—the 1999-2000 SASS Public School Teachers Questionnaire. According to Tourkin et al., (2004), the SASS is a mail survey of teachers, principals, and district administrators. Data collection for 1999-2000 SASS took place during the 1999-2000 school year. The teacher questionnaires were sent to the sampled individuals. Data collection began with a mailout questionnaire. Reminder postcards were mailed within 1 week of the first questionnaire mailout. Within 6 weeks of the initial mailing, a second copy of the questionnaire was mailed. A second reminder postcard was mailed within 1 week of the second questionnaire mailout. Additional nonresponse follow-up was conducted by telephone from centralized telephone centers. Remaining nonrespondents were assigned to field staff, who obtained interviews by phone or personal visit.

The unweighted response rate for 1999-2000 SASS Public School Teacher Questionnaire was 81.2 percent and the weighted response rate was 83.1 percent. The unweighted response rates were calculated by dividing the number of interview cases by the total number of eligible cases. The weighted response rates were derived by dividing the sum of the basic weights for the interview cases by the sum of the basic weights for the eligible cases. The basic weight for each sample case is the inverse of the probability of selection.
SASS is the most comprehensive national survey in the history of American education concerning the school work force (U. S. Department of Education, 1994; 2000). The Teacher Survey collected data from the nation’s teachers about workload, education, experience, perceptions and attitudes toward teaching, compensation, and demographic characteristics. The Teacher Survey is a major source of data regarding teacher quality. It collects data from teachers on numerous aspects of teacher quality. SASS indicators of teacher quality include teacher preparation, induction programs, teaching assignment (e.g., committee work, in and out-of-field teaching), and professional development opportunities. There were 362 questionnaire items organized into nine sections in 1999-2000 Public School Teacher Questionnaire. For the purpose of this study, data from Section 1: General Information and Section II: Certification and Training Information were utilized. These two sections collected information about teachers' teaching status, teaching experience, professional experience, certification, academic degrees, teacher preparation programs and other formal training.

Matching Teacher Assignments and Teacher Credentials

In the area of teacher educational background, SASS collected data on all degree earned (from associate’s to doctorate), the subject field of these earned degrees, whether teachers were certified in their fields of assignment, and the type of certification they held in those fields. In the area of teacher assignments, the survey collected data on main and secondary subject fields of assignment, and, for secondary school teachers, on the subject fields they taught for each period of the school day. In order to match teacher assignments and teacher credentials, SASS offered teachers three lists. The first list
(Major and Minor Field of Study Codes) provided teachers a list of fields of study. The second list (Teaching Assignment Field Codes) provided teachers a list of potential main assignment fields. Teachers were asked to use the same list when reporting fields in which they had earned certification. The third list (Subject Matter Codes) provided teachers a list of subjects in which they could have taught one or more classes. The followings are some examples of the related questions that the teachers were asked to provide information in the survey questionnaire, see Table 3.

Table 3
Examples of the Related Questions in the SASS 1999-2000 Survey Questionnaire for Public School Teachers

<table>
<thead>
<tr>
<th>Survey Question #</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>#8a</td>
<td>Do you have a bachelor’s degree?</td>
</tr>
<tr>
<td>#8c</td>
<td>What was your major field of study?</td>
</tr>
<tr>
<td>#12</td>
<td>This school year, what is your main teaching assignment field at this school, that is, the field in which you teach the most classes?</td>
</tr>
<tr>
<td>#13a</td>
<td>Do you have a teaching certification in this state in your MAIN teaching assignment field?</td>
</tr>
<tr>
<td>#13b</td>
<td>What type of certificate do you hold in this field?</td>
</tr>
<tr>
<td>#15a</td>
<td>This school year, are you assigned to teach classes in OTHER fields at this school, in addition to your main teaching assignment field?</td>
</tr>
<tr>
<td>#15b</td>
<td>In what OTHER teaching assignment field do you teach the most classes?</td>
</tr>
<tr>
<td>#16a</td>
<td>Do you have a teaching certificate in this state in your OTHER teaching assignment field at this school?</td>
</tr>
<tr>
<td>#16b</td>
<td>What type of teaching certificate do you hold in this field?</td>
</tr>
</tbody>
</table>
Measures of In-Field and Out-of-Field Teaching

In-field or out-of-field teaching has been defined by examining two elements of teachers' qualifications: state certification status and postsecondary education (Seastrom, et al., 2002). To aid research on in-field or out-of-field teaching, the SASS teacher data files provided the created (composite) variables for measuring in-field and out-of-field teaching; to what extent a teacher's qualifications including a teacher's postsecondary education and a teacher's certification match the subject a teacher teaches. Created variables are added to the file to aid analysis. One type of created variable is calculated using one or more survey variables. The other type of created variable contains information from another source. Based on the SASS data file, there are approximately 500 variables that were derived mainly for use in analyzing out-of-field teachers and there are four kinds of measures to measure in-field and out-of-field teaching. Two of these measures focus on teachers: teachers in-field or out-of-field by main teaching assignments, teachers in-field or out-of-field by each subject taught. Two other measures focus on students: classes taught by in-field or out-of-field teachers, and students taught by in-field or out-of-field teachers. The purpose of this study is to measure how many of the teachers are highly qualified teachers in their fields; thus, the study focuses on the two measures for teachers.

One of the measures for teachers indicates the extent to which teachers were in-field or out-of-field in their main assignment subjects. Teachers were asked about the subject areas of their main assignment and asked about the subject areas in which they held certifications and postsecondary majors and minors. The "main assignment"
measure captures the extent to which teachers' qualifications match the subject area of their main assignments.

Another measure for teachers was based on the subject matter of courses teachers taught rather than on teachers' main assignments. It indicates the extent to which teachers teach in-field or out-of-field in each subject they teach. The "each subject taught" measure captures the extent to which teachers' qualifications match the subject area of each subject area in which they teach at least one class. In this case, the same teacher may have taught multiple fields, depending on how many different fields the teacher taught. The teacher may have been in-field in one subject area taught and out-of-field in another subject area taught. As a result, the teacher will have different values on this measure in different subject areas. This measure produces estimates of the percentage of all teachers teaching a specific subject who were teaching in-field or out-of-field.

In this study, I applied both measures—a teacher's main assignment field and each subject taught in the examination of teacher quality in secondary schools. Table 4 is an example of the created variables about in-field and out-of-field teachers in main teaching assignments in the SASS teacher data file.

*The Created Highly Qualified Teacher Variable Featured in this Study*

Based on the information provided in the SASS teacher data file about in-field and out-of-field teaching, in this study I used the recode technique in SPSS program to create a series of new variables labeled as 'highly-qualified teachers' in the subject taught (e.g., highly-qualified teachers in math or science). The highly qualified teacher variables in this study were created by combining the following two categories of
### Table 4

An Example of a Created Variable to Measure In-Field and Out-of-Field Teaching in Science, by Main Teaching Assignment

<table>
<thead>
<tr>
<th>Variable Wording</th>
<th>Teacher taught classes in-field in main assignment—science</th>
</tr>
</thead>
<tbody>
<tr>
<td>INF_M_SC</td>
<td>T in-fld mn assign-science</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Category</th>
<th>Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No regular certification or major or minor</td>
</tr>
<tr>
<td>1</td>
<td>No regular certification, no major, yes minor</td>
</tr>
<tr>
<td>2</td>
<td>No regular certification, yes major, no minor</td>
</tr>
<tr>
<td>3</td>
<td>No regular certification,</td>
</tr>
<tr>
<td>4</td>
<td>Regular certification, no major or minor</td>
</tr>
<tr>
<td>5</td>
<td>Regular certification, no major, yes minor</td>
</tr>
<tr>
<td>6</td>
<td>Regular certification and major, no minor</td>
</tr>
<tr>
<td>7</td>
<td>Regular certification and major and minor</td>
</tr>
</tbody>
</table>

Teachers in the SASS teacher data file: (1) teachers with regular certification and major, no minor; and (2) teachers with regular certification and major and minor (see Table 4). The teachers who fall into either of these categories were identified as highly qualified teachers in the subject taught. The first category is straightforward, indicating that the teacher has a regular certification and a major in the subject taught. The second category indicates that the teacher has a regular certification, both a major and a minor in the subject taught (see Table 5). This happens when a teacher teaches those subjects such as social studies or general science. For example, in the subject field of social studies, a teacher may have a major in history and a minor in economic. As a result, the teacher has both a major and a minor in social studies (J. E. Kramer, personal communication, September 15, 2004).
Table 5
An Example of the Created Variables of Highly Qualified Teachers

<table>
<thead>
<tr>
<th>Category</th>
<th>Teacher taught classes in-field in main assignment—science</th>
<th>Highly qualified teachers in main assignment—science (Re-coded)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No regular certification or major or minor</td>
<td>UNDERQUALIFIED TEACHERS</td>
</tr>
<tr>
<td>1</td>
<td>No regular certification, no major, yes minor</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>No regular certification, yes major, no minor</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>No regular certification,</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Regular certification, no major or minor</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Regular certification, no major, yes minor</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Regular certification and major, no minor</td>
<td>HIGHLY QUALIFIED TEACHERS</td>
</tr>
<tr>
<td>7</td>
<td>Regular certification and major and minor</td>
<td></td>
</tr>
</tbody>
</table>

Teachers’ Feelings of Their Preparedness

The 1999-2000 SASS questionnaires for public school teachers also gathered information about teachers’ feelings of their preparedness to teach. Teachers were asked, in their first year of teaching, how well prepared they were to do the following: (a) handle a range of classroom management or discipline situations; (b) use a variety of instructional methods; (c) teach your subject matter; (d) use computers in classroom instruction; (e) plan lessons effectively; (f) assess students; and (g) select and adapt curriculum and instructional materials. All seven items were measured on a 4-point scale (1 = “not at all prepared,” 2 = “somewhat prepared,” 3 = “well prepared,” and 4 = “very well prepared”). Information about teachers’ feelings of their preparedness gathered from these items was used in this study. Table 6 illustrates how the variables, the research questions and the items on the survey instrument are related to each other.
Table 6


<table>
<thead>
<tr>
<th>Variable Name</th>
<th>Research Question</th>
<th>Questions on the Survey</th>
</tr>
</thead>
</table>
| Independent variable       | Inferential statistics # 4: Are there any differences between new highly qualified secondary teachers and those who are not highly qualified in their perceptions on preparedness measured by (a) classroom management, (b) instructional methods, (c) subject knowledge, (d) technology, (e) planning lessons, (f) assessing students, and (g) selecting teaching materials? | Question 21: In your first year of teaching, how well prepared were you to-
(a). Handle a range of classroom management or discipline situations?  
(b). Use a variety of instructional methods?  
(c). Teach your subject matter?  
(d). Use computers in classroom instruction?  
(e). Plan lessons effectively?  
(f). Assess students?  
(g). Select adapt curriculum and instructional materials? |
| Dependent variable: #4: Perceptions on teacher preparedness |                                                                                  |                                                                                        |

Quality of the SASS Data

Validity and reliability are two important measures of a survey instrument’s quality. A reliable survey instrument is consistent and a valid one is accurate (Fink, 2003). For example, an instrument is reliable if each time you use it you get the same information. A survey instrument is valid if it serves the purpose it is intended to serve and provides correct information. If an instrument is valid, one can draw meaningful and useful inferences from scores on the instruments (Creswell, 2003). If an instrument is valid, it is reliable, too (Litwin, 2003).

SASS is conducted by the National Center for Education Statistics (NCES) on behalf of the United States Department of Education in order to collect extensive data on
American public and private elementary and secondary schools. NCES activities are designed to address high priority education data needs and provide consistent, reliable, complete, and accurate indicators of education status and trends. Improving the quality of questionnaires and procedures is an ongoing process for SASS. Before each survey year, field tests and other studies (e.g., cognitive research) are conducted to test new or revised questionnaire items and changes in procedures.

In order to produce reliable and valid survey data, in preparation for the 1999-2000 SASS, the NCES program staff undertook the following four stages of testing:

1. Cognitive interviews to make improvements to the School Teacher Questionnaire;

2. Cognitive interviews and a split panel test to make improvement to the Teacher Listing Form;

3. 1998 Spring Field Test of new modules of questions for all SASS questionnaires; and

4. 1998 Fall Spring Test of re-designed SASS questionnaires.

In stage one, twenty cognitive interviews were conducted with teachers in 1995 in order to evaluate the overall format of the 1993–94 teacher questionnaires and to investigate questions that were identified as problematic during the 1993–94 survey. In cognitive interviews various cognitive techniques was used—including the concurrent think-aloud technique, the use of paraphrasing, and unstructured retrospective interviewing. Respondents were asked to read aloud as they read through the form and to think aloud as they answered the questions. With the respondents’ permission, the
interviews were tape-recorded and either a summary or a transcription of each was written.

In stage two, the Teacher Listing Form (TLF), the form used to construct the sampling frame for teachers and select a sample of teachers, was studied in both 1995 and 1997. In 1997, a formal split panel test was conducted with a total of 500 schools that included 250 (half private and half public) in the panel to compare alternative versions of the TLF. The test showed there was no statistical difference in response rates between the two forms (Zukerberg & Lee, 1997).

In stage three, a field test was conducted in spring 1998 to evaluate new modules of questions. Teacher questionnaires were mailed to approximately 550 public teachers. Telephone follow-up of some nonrespondents was conducted to evaluate administration of the questions by phone. The goal of this field test is to obtain enough data on all questionnaire items to perform a thorough evaluation of them. The questionnaires used for the field test were abbreviated versions that included primarily newly developed items and some core items asked on previous versions. The completed questionnaires were evaluated using the following three methodologies: professional review of questionnaires, behavior coding, and cognitive interviews (Zukerberg, 1999). Behavior coding is the systematic application of codes to the interaction between the respondent and interviewer.

In the fall of 1998, a field test was conducted that used the questionnaires proposed for use in the full scale 1999–2000 SASS. Approximately 500 of teacher questionnaires were mailed to public teachers. As with the spring field test, the intent was to obtain enough questionnaires to evaluate how well they operated.
In addition to the pretest, NCES program staff review the quality of SASS data before the files were released to the public. NCES staff review the data for errors associated with the edit, imputation, and weighting programs. Comparisons were also made to external sources, such as CCD, an annual administrative census of all public school districts and schools in the United States to verify the external validity of SASS data. Furthermore, a reinterview study is conducted for each SASS administration.

Reinterview programs are typically designed to evaluate fieldwork and/or estimate error components, such as simple response variance and response bias, in a survey model (Forsman and Schreiner, 1991). The purpose of the SASS reinterview programs was to estimate simple response variance; that is, to measure the consistency in response between the original survey and the reinterview (reliability of the data) for certain questions considered critical to the survey or suspected to be problematic. High response variance (inconsistency) indicates there is a problem with the design of the question or the nature of the data being collected. Also, it may sometimes suggest the presence of bias in the data. The 1999–2000 SASS reinterview program for teachers consisted of administering a subset of questions to a subset of public and private school teachers.

The Teacher Reinterview Questionnaire (SASS-4(R)) collected information on 57 questions from the Teacher Questionnaire. The reinterview sample for each of the SASS surveys was a random subsample of that survey's full sample. The sample included only those cases originally conducted by mail in order to match the original interview and reinterview modes. The reinterview response rate was 70.5 percent for the teacher sample.
The response error reinterview model assumed the reinterview was an independent replication of the original interview. The index of inconsistency and the gross difference rate were the principal measures of response variance in categorical data. Pearson’s correlation coefficient provided a measure of data reliability for continuous variables. (In some cases where questions in the 1999–2000 SASS were asked in previous administrations of SASS, the 1993–94 reinterview results were given for comparison.). Results indicated that, 44 percent of the 57 questions for public school teachers displayed high response variance, suggesting problems with reliability. There was moderate response variance for 42 percent of the questions analyzed and low response variance for 14 percent (Tourkin et al., 2004).

Data Analysis

Corresponding with the research questions, the data analysis in this study involves using descriptive and inferential statistics. The discussion below presents four analyses of teacher quality using the 1999-2000 SASS Public Teacher Questionnaire. Each analysis differs in the focus it brings to the issue of teacher quality. Relative weights are applied when conducting chi-square tests and the frequency analysis.

Research Question 1

According to teachers’ main teaching assignment field, what is the percentage of highly qualified secondary teachers in: (a) all main teaching assignments; (b) the core academic fields (English/language arts, social studies, math and science); and (c) the sub-fields of science (chemistry, physics, earth, life and physical science)?
The first research question was analyzed using descriptive statistics. The first analysis focused on teacher quality in their main teaching assignment field. The percentages of highly qualified secondary public school teachers in (a) all main teaching assignments, (b) the core subjects, and (c) the subfields of science were identified and described. The analysis enabled me to describe to what extent that secondary school teachers were highly qualified in their main teaching assignment field as measured by all the main teaching assignment fields, the core academic fields and the sub-fields of science.

Research Question 2

According to the each subject field a teacher teaches, what is the percentage of highly qualified secondary teachers in (a) the core academic fields (English/language arts, social studies, math and science); (b) the sub-fields of science (chemistry, physics, earth, life and physical science)?

The second research question was analyzed using descriptive statistics. The second analysis focused on teacher quality in each subject a teacher teaches. The percentages of highly qualified secondary public school teachers in (a) the core subjects, and (c) the subfields of science were identified and described. This analysis enabled me to describe to what extent that secondary school teachers were highly qualified in each subject taught as measured by the core academic fields and the sub-fields of science.

Research Question 3

According to teachers’ main teaching assignment field, is the proportion of highly qualified secondary teachers the same for (a) the different school locations (urban, suburban and rural); and for (b) the schools with
different percentages of minority student enrollment (less than 5%, 5-9%, 20-40% and 50% or more)?

It is hypothesized that variables of school locations and percentage of minority students in schools may have an impact on the distribution of highly qualified teachers.

Null Hypotheses

1. There is no difference in the proportion of highly qualified teachers in their main teaching assignment field among the three school locations (urban, suburban and rural).

2. There is no difference in the proportion of highly qualified teachers in their main teaching assignment field among the five levels of percentage of minority student enrollments in schools (less than 5%, 5-9%, 20-40% and 50% or over).

The third question was analyzed using chi-squared tests for school location, and for schools with different percentages of minority students. These analyses enabled me to determine if significant differences existed in the distribution of highly qualified teachers when these school characteristics were taken into consideration.

Research Question 4

Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, are there any significant differences in their perceptions on their preparation for teaching related to the following seven teaching areas: (a) classroom management, (b) instructional methods, (c) subject knowledge, (d) technology, (e) planning lessons, (f) assessing students, and (g) selecting teaching materials?
It is hypothesized that the teacher quality variables may have an impact on teachers’ perceptions on their preparedness.

Null Hypotheses

Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, there is no difference in their perceptions on their preparation for teaching related to the following seven teaching areas: (a) classroom management, (b) instructional methods, (c) subject knowledge, (d) technology, (e) planning lessons, (f) assessing students, and (g) selecting teaching materials.

Corresponding with this research question, a one-way between-subject multivariate analysis of variance (MANOVA) was performed to investigate group differences in the seven outcome variables that measured teacher preparation for teaching: The independent variables are the two groups of teachers: highly qualified teachers vs. teachers who are not highly qualified. The seven dependent variables are: classroom management, instructional methods, subject knowledge, technology, planning lessons, assessing student assessment and selecting teaching materials. After group difference was found on a combination of the seven outcome variables, variable-based post-hoc procedure univariate $F$ tests, were performed to examine group differences on each outcome variable separately to determine which of the individual outcome variables would contribute to the significant multivariate result. To reduce the risk of a Type I error, a more stringent and higher alpha value was set using Bonferroni adjustment in the post-hoc procedure (Tabachnick & Fidel, 2001). That is univariate $F$ tests were
conducted at $a/p$ (Bonferroni inequality) level of significance. To do this, I divided the normal alpha value (0.05) by the number of dependent variables (7), which equaled 0.0071 after rounding and I used this new value as my cut-off. Multivariate analysis of variance (MANOVA) is a multivariate technique that compares groups with respect to means on one or more linear composites of the outcome variables. The measurement of multiple outcome variables can help the researcher understand the treatment under study by investigating its effects on a set of related outcomes and it can also add to the researchers’ understanding of the sensitivity and specificity of the treatment (Tabachnick & Fidel, 2001). As a result, this analysis not only enabled me to determine if significant difference exists in teachers’ perceptions on preparedness as measured by a combined set of related outcome variables between the two groups of new teachers but also enabled me to determine which outcome variable made a unique contribution to the group differences separately.

**Summary**

This chapter described the methodology of the study including the research design, data source, sampling characteristics, instrumentation, quality of the data and data analysis. The study inquired into teacher quality in public secondary schools. There are four research questions to inquire into the issue of teacher quality: In teachers’ *main* teaching assignment field, what percentages of teachers are highly qualified? In *each* subject taught, what percentages of teachers are highly qualified? In teachers’ main teaching assignment field, are highly qualified teachers equally distributed by different school locations and by different levels of minority student enrollment at schools? Are
there any differences between new highly qualified secondary teachers and those who are not highly qualified in their perceptions on preparedness?

Descriptive statistics were used for research questions 1 and 2. Chi-Square tests were employed for research question 3 and multivariate analysis of variance was applied for research question 4.

For research question 1 and 2, I described teacher quality by showing how many percents of teachers were highly qualified in their subject taught. I first investigated teacher quality in their main teaching assignment field and then in each subject taught with focus on core academic fields and the subfields of science. For research question 3, I inquired into, via chi-square tests, the allocation of teacher quality by school locations and levels of minority student enrollment at schools. For research question 4, I examined, via multivariate analysis of variance, whether there was a relationship between teacher quality and teacher preparedness.
In this study, I inquired into secondary public school teacher quality by looking at whether a teacher had a major in the subject taught and whether a teacher had a full certification in the subject taught. If a teacher has both a major and a full certification in the subject taught, he or she is identified as a highly qualified teacher in the subject taught. First, I examined teacher quality according to their main teaching assignment field. Second, I examined teacher quality according to each subject they teach. Third, I investigated the distribution pattern of teacher quality by school locations and percentage of minority students at schools. Finally, I investigated the relationship between teacher quality and teacher preparedness among the new secondary teachers. In this study, I employed both descriptive and inferential statistics in the data analysis. An alpha of .05 was used with all inferential procedures, since it is a customary set for behavioral science (Hinkle, Wiersma, & Jurs, 1998). In this chapter, I present the results of these analyses. The presentation of the results is organized based on the research questions accordingly.

Research Questions

1. According to teachers’ main teaching assignment field, what is the percentage of highly qualified secondary teachers in: (a) all main teaching assignment fields, (b) core academic fields, and sub-fields of science?
2. According to each subject a teacher teaches, what is the percentage of highly qualified secondary teachers in: (a) core academic fields and (b) sub-fields of science?

3. According to teachers’ main teaching assignment field, is the proportion of highly qualified secondary teachers the same for (a) different school locations and (b) different percentage of minority student enrollment in schools?

4. Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, are there any significant differences in their perceptions on their preparation for teaching related to the following seven teaching areas: (a) classroom management, (b) instructional methods, (c) subject knowledge, (d) technology, (e) planning lessons, (f) assessing students, and (g) selecting teaching materials?

Research Question 1

According to teachers’ main teaching assignment field, what is the percentage of highly qualified secondary teachers in: (a) all main teaching assignment fields, (b) core academic fields, and (c) sub-fields of science?

As mentioned in the earlier section, a teacher’s main teaching assignment field is the field that a teacher teaches most of his or her classes during a school day. The “main teaching assignment” measures capture the extent to which teachers’ preparation and qualifications match the subject area of their main teaching assignments. Among 12,624 secondary school teachers, 11,790 (93.4%) teachers reported to have a main teaching assignment field. Main teaching assignments involved 21 subject fields in the SASS 1999-2000 data set. In SASS 1999-2000 data set, these 21 subject fields were combined into a new created variable called “all main assignments”.

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All Main Teaching Assignments

I first examined the percentage of secondary school teachers who were highly qualified in their main teaching assignment field for the 1999–2000 periods, using the combined variable of all main assignments. The result indicated that overall 72.8% of the secondary school teachers who were assigned main teaching assignment field were highly qualified. This result indicated that even in teachers’ main teaching assignment field more than one-fourth of secondary teachers did not meet the requirements for a highly qualified teacher yet, that is, these teachers did not have a full certification and/or a major in the fields of their main teaching assignment. Highly qualified teachers in all main teaching assignment fields are illustrated in Table 7.

Table 7
Highly Qualified Teachers in All Main Teaching Assignment Fields

<table>
<thead>
<tr>
<th>Secondary Teachers who are assigned main teaching assignments (all subject fields)</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly qualified</td>
<td>8,582</td>
<td>72.8</td>
</tr>
<tr>
<td>Not highly qualified</td>
<td>3,208</td>
<td>27.2</td>
</tr>
<tr>
<td>Total</td>
<td>11,791</td>
<td>100</td>
</tr>
</tbody>
</table>

Core Academic Fields among the Main Teaching Assignments

After observing the overall pattern of highly qualified teachers in their main teaching assignment field, I inquired into the percentage of highly qualified teachers who taught the core academic fields as their main teaching assignments. Table 8 displays the results of highly qualified teachers in the individual core academic fields among teachers’
main teaching assignments. The results showed that the highest percentage of highly qualified teachers was in the field of social studies, 79.1% and the lowest percentage of highly teachers was in the field of math, 73.2%. The results also indicated that the percentage of highly qualified teachers in each of these four core academic fields (English, Math, Science and Social Studies) was higher than the percentage of highly qualified teachers in the overall main teaching assignments (72.8%), which was an average of all the 21 subjects.

Table 8

Highly Qualified Teachers in Each of the Core Academic Fields among the Main Teaching Assignments

<table>
<thead>
<tr>
<th>Core Subjects</th>
<th>N</th>
<th>Highly Qualified</th>
<th>Not Highly Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>1,847</td>
<td>75.7%</td>
<td>24.3%</td>
</tr>
<tr>
<td>Math</td>
<td>1,590</td>
<td>73.2%</td>
<td>26.8%</td>
</tr>
<tr>
<td>Science</td>
<td>1,411</td>
<td>75.4%</td>
<td>24.6%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>1,393</td>
<td>79.1%</td>
<td>20.9%</td>
</tr>
</tbody>
</table>

Subfields of Science among Teachers’ Main Teaching Assignments

In this part of analysis, I investigated the percentage of highly qualified teachers who taught the subfields of science as their main teaching assignment. The subfields of science included in this study were chemistry, earth science, life science, physical science and physics. The results revealed that the percentages of highly qualified teachers in each of the subfields of science were considerably low, ranging from 60.1% for life science to 31% earth science (see Table 9). While, 75.4% of teachers in general science were highly qualified (see Table 8), these results indicated that more than half of the secondary
<table>
<thead>
<tr>
<th>Subfields of Science</th>
<th>N</th>
<th>Highly Qualified</th>
<th>Not Highly Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>302</td>
<td>42.5%</td>
<td>57.5%</td>
</tr>
<tr>
<td>Earth Science</td>
<td>114</td>
<td>31%</td>
<td>69%</td>
</tr>
<tr>
<td>Life Science</td>
<td>612</td>
<td>60.1%</td>
<td>39.3%</td>
</tr>
<tr>
<td>Physical Science</td>
<td>707</td>
<td>41.6%</td>
<td>58.4%</td>
</tr>
<tr>
<td>Physics</td>
<td>127</td>
<td>42.3%</td>
<td>57.7%</td>
</tr>
</tbody>
</table>

teachers who had their main teaching assignments in the subfields of science were not highly qualified yet. For a graphic view of Research Question 1, see Appendix B.

Research Question 2

According to each subject taught, what is the percentage of highly qualified secondary teachers in: (a) core academic fields and (b) subfields of science?

While, the "main teaching assignment" measures capture the extent to which teachers' preparation and qualifications match the subject area of their main teaching assignments, the "each subject taught" measures capture the extent to which teachers' qualifications match the subject area of each subject area in which they teach at least one class. In this case, the same teacher may have taught multiple fields in addition to the field of their main teaching assignment, depending on how many different fields the teacher taught. The teacher may have been highly qualified in one subject area taught and underqualified in another subject area taught. This measure yields estimates of the percentage of all public secondary school teachers who were highly qualified in teaching a specific subject.

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Core Academic Fields

I first examined the percentage of secondary school teachers who were highly qualified to the core subjects. Table 10 presents the results of highly qualified teachers in each of the core subjects. The results showed that the highest percentage of highly qualified teachers was in the field of social studies, 63.2% and the lowest percentage of highly teachers was in the field of math, 59.5%. The results also showed that, of 12,624 secondary teachers, 7,682 (about 61 %) reported to be assigned to teach the core academic fields in addition to the field of their main teaching assignment. Overall, when the measure of “each subject taught” was applied in the analysis, there were lower percentages of highly qualified teachers in each of the core subjects in comparison to the results of each of the core subjects among the main teaching assignments (see Table 8) Again, it is obvious that the percentage of highly qualified math teachers was still the lowest.

Table 10
Highly Qualified Teachers in Each of the Core Academic Fields

<table>
<thead>
<tr>
<th>Core Subjects</th>
<th>N</th>
<th>Highly Qualified</th>
<th>Not Highly Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>2201</td>
<td>61.9%</td>
<td>38.1%</td>
</tr>
<tr>
<td>Math</td>
<td>2005</td>
<td>59.5%</td>
<td>40.5%</td>
</tr>
<tr>
<td>Science</td>
<td>1659</td>
<td>65.2%</td>
<td>34.8%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>1817</td>
<td>63.2%</td>
<td>36.8%</td>
</tr>
</tbody>
</table>
Subfields of Science

In this part of analysis, I investigated the percentage of highly qualified teachers who taught the subfields of science. Although the percentage of teachers who were highly qualified in the general science was higher than other core subjects (see Table 10), the results of the examination on the individual subfields of science showed that the percentage of highly qualified teachers in each subfield of science was not satisfactory (see Table 11). The percentages of highly qualified teachers for each subfield of science ranged from 47.8% for life science and 15.7% for earth science. These results indicated that quite a large number of secondary teachers who taught the subfields of science did not meet the requirements for a highly qualified teacher. In the field such as earth science, the majority of the teachers were not highly qualified. For a graphic view of Research Question 1, see Appendix B.

Table 11
Highly Qualified Teachers in the Subfields of Science

<table>
<thead>
<tr>
<th>Subfields of Science</th>
<th>N</th>
<th>Highly Qualified</th>
<th>Not Highly Qualified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>447</td>
<td>31.1%</td>
<td>68.9%</td>
</tr>
<tr>
<td>Earth Science</td>
<td>250</td>
<td>15.7%</td>
<td>84.3%</td>
</tr>
<tr>
<td>Life Science</td>
<td>805</td>
<td>47.8%</td>
<td>52.2%</td>
</tr>
<tr>
<td>Physical Science</td>
<td>1021</td>
<td>30.3%</td>
<td>69.7%</td>
</tr>
<tr>
<td>Physics</td>
<td>272</td>
<td>23.4%</td>
<td>76.6%</td>
</tr>
</tbody>
</table>

Research Question 3

According to the main teaching assignment field, is the proportion of highly qualified secondary teachers the same for (a) different school locations and (b) different percentage of minority students at schools?
In this part of the study, I investigated how these identified highly qualified teachers were distributed first by school locations and then by the percentage of minority student enrollment in schools. There seems to be many variables available to examine the distribution pattern of teacher quality. However, in this study I focused on the distribution pattern of highly qualified teachers in teachers' main teaching assignments by school locations and by the percentage of minority student enrollment in schools.

**Distribution of Highly Qualified Teachers by School Location**

A $2 \times 3$ chi-square test was applied to examine if the proportion of highly qualified teachers in the main teaching assignment field was the same for the different school locations (urban, suburban and rural). Results revealed a statistically significant difference among different school locations, $\chi^2 = 16.58, \ p < 0.01$, Cramer's $V = 0.04$. The data indicated that urban and rural schools were less likely to be staffed with highly qualified teachers than their suburban counterparts (Table 12). For a graphic view of Research Question 1, see Appendix B.

<table>
<thead>
<tr>
<th>Variable</th>
<th>School Location</th>
<th>$\chi^2$</th>
<th>$df$</th>
<th>$p$</th>
<th>$V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly qualified teachers</td>
<td>Urban</td>
<td>70.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suburban</td>
<td>74.4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rural</td>
<td>71.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. Percentages represent teachers who are highly qualified in their main teaching assignment field.
Another 2 x 4 chi-square test was applied to investigate whether the percentage of highly qualified teachers in the main teaching assignment field was the same across the different percentages of minority student enrollment in schools (5% or less, 5% to 19%, 20% to 49%, 50% or more). Results indicated that the variation in the percentage of highly qualified teachers among schools with different percentages of minority student enrollment was significant, $\chi^2 = 101.91, p < 0.01$, Cramer’s $V = 0.09$. In the schools with less than 20% minority student enrollment, the percentage of highly qualified teachers was 76%, whereas in the schools with 50% or more minority students, the percentage of highly qualified teachers was only 65.9% (see Table 13), indicating a big gap in the provision of highly qualified teachers. The results also revealed a trend that schools with more minority students were less likely to have highly qualified teachers. For example, schools with 50% or more minority students were more likely to have more under-qualified teachers than schools with only 5-19% minority students. For a graphic view of Research Question 1, see Appendix B.

Table 13

<table>
<thead>
<tr>
<th>Percentage of Minority Students</th>
<th>$\chi^2$</th>
<th>df</th>
<th>$p$</th>
<th>$V$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>&lt; - 5%</td>
<td>5-19%</td>
<td>20-49%</td>
<td>50% - &gt;</td>
</tr>
<tr>
<td>Highly qualified teachers</td>
<td>76%</td>
<td>76%</td>
<td>73.3%</td>
<td>65.9%</td>
</tr>
<tr>
<td></td>
<td>101.91</td>
<td>3</td>
<td>&lt; 0.01</td>
<td>0.09</td>
</tr>
</tbody>
</table>
Research Question 4

Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, are there any significant differences in their perceptions on their preparation for teaching related to the following seven teaching areas: (1) classroom management, (2) instructional methods, (3) subject knowledge, (4) technology, (5) planning lessons, (6) assessing students, and (7) selecting teaching materials?

Corresponding with this research question, a one-way between-subjects multivariate analysis of variance (MANOVA) was performed to investigate group differences in teachers’ perceptions on their preparation for teaching. The total number of secondary new teachers who reported to have main teaching assignments is 3,148. Missing values were excluded in the analysis using the Listwise deletion method, which resulted in the total number of secondary new teachers is 2,993. Seven dependent variables that measured teacher preparation for teaching were used: (1) classroom management, (2) instructional methods, (3) subject knowledge, (4) technology, (5) planning lessons, (6) assessing students, and (7) selecting teaching materials. In the 1999-2000 SASS questionnaire for public school teachers, teachers were asked to rate how well they were prepared in these seven teaching areas in their first year of teaching. All the seven areas were measured on a 4-point scale (1 = “not at all prepared,” 2 = “somewhat prepared,” 3 = “well prepared,” and 4 = “very well prepared”). The independent variables were two groups of new secondary teachers: highly qualified teachers ($N = 1,673$) vs. under-qualified teachers ($N = 1,320$), see Table 14 for descriptive statistics. The $p$ value for multivariate analysis of variance was significant at the 0.05 level, since it is a customary set for behavioral science (Hinkle, Wiersma & Jurs, 1998).

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## Descriptive Statistics of the New Secondary School Teachers for Multivariate Analysis of Variance (MANOVA)

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Highly Qualified Teachers</th>
<th>Under-Qualified Teachers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 1673)</td>
<td>(n = 1320)</td>
<td>(N = 2993)</td>
</tr>
<tr>
<td>Handle a range of classroom management or discipline situations</td>
<td>Mean 2.68, SD 0.81</td>
<td>Mean 2.58, SD 0.84</td>
<td>Mean 2.64, SD 0.83</td>
</tr>
<tr>
<td>Use a variety of instructional methods</td>
<td>Mean 2.98, SD 0.75</td>
<td>Mean 2.80, SD 0.81</td>
<td>Mean 2.90, SD 0.78</td>
</tr>
<tr>
<td>Teach your subject matter</td>
<td>Mean 3.32, SD 0.72</td>
<td>Mean 3.20, SD 0.81</td>
<td>Mean 3.27, SD 0.76</td>
</tr>
<tr>
<td>Use computer in classroom instruction</td>
<td>Mean 2.60, SD 0.92</td>
<td>Mean 2.56, SD 0.99</td>
<td>Mean 2.59, SD 0.95</td>
</tr>
<tr>
<td>Plan lessons effectively</td>
<td>Mean 3.12, SD 0.74</td>
<td>Mean 2.89, SD 0.83</td>
<td>Mean 3.02, SD 0.79</td>
</tr>
<tr>
<td>Assess students</td>
<td>Mean 2.96, SD 0.74</td>
<td>Mean 2.81, SD 0.78</td>
<td>Mean 2.90, SD 0.76</td>
</tr>
<tr>
<td>Select and adapt curriculum and instructional materials</td>
<td>Mean 2.82, SD 0.79</td>
<td>Mean 2.69, SD 0.84</td>
<td>Mean 2.76, SD 0.82</td>
</tr>
</tbody>
</table>

The result of the descriptive statistics showed that, of 2,993 secondary new teachers who reported to have a main teaching assignment field, 1,673 (56%) of them were highly qualified in the field of their main teaching assignment. The result also showed that on average new teachers did not feel well prepared to perform most of the teaching areas. As showed in Table 14, the mean scores on five of the seven teaching areas were below three. Only on two of the teaching areas: teaching subject matter ($M = 3.27$) and planning lessons ($M = 3.02$), new teachers felt that they were well prepared. The highest mean score was observed on the area of teaching subject matter ($M = 3.27$) and the lowest mean score was on the area of using computer in classroom instruction ($M = 2.58$). It was noted that the mean score on each of the areas for the new teachers who were highly qualified was higher than those of the new teachers who were not highly qualified.

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Before conducting the multivariate analysis of variance, preliminary assumption testing was conducted to check for normality, outliers, homogeneity of variance-covariance matrices, multicollinearity and linearity. Normality was checked through SPSS using the Explore option of the Descriptive Statistics menu. Test of Normality using Kolmogorove-Smirnov statistics indicated a significant result for all the dependent variables, all $p$'s < 0.001, suggesting a violation of the assumption of normality. With a large sample size, this was quite common (Tabachnick & Fidell, 2001). However, the visual examination of the actual shape of the distribution for each group appeared to be reasonably normally distributed. This was also supported by an inspection of the normal probability plots (Normal Q-Q Plots). A reasonably straight line suggested a normal distribution. The inspection of the Boxplot of the distribution of the scores for the two groups did not indicate any outliers.

The results of the Box's Test of Equality of Covariate (performed through SPSS MANOVA as part of the major analysis) indicated a violation of the assumption of homogeneity of variance-covariance matrices, $p = 0.001$. However, Tabachnick and Fidell (2001) warned that Box’s $M$ tends to be too strict when having a large sample size. Multicollinearity was assessed through the determinant of the within-cells correlation matrix, as can be seen in Table 15, the correlations (Pearson) among the dependent variables were statistically significant, all $p$’s < 0.01 and ranged from 0.231 to 0.610 in magnitude. Therefore, there was no evidence of multicollinearity. Linearity was examined through SPSS, which involved splitting the file by the independent variable and then generating scatterplots between each pair of the dependent variables. The results
Table 15
Correlations among the Seven Dependent Variables
for Multivariate Analysis of Variance (MANOVA)

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Classroom</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td></td>
<td>0.44</td>
<td>0.23</td>
<td>0.23</td>
<td>0.41</td>
<td>0.45</td>
<td>0.41</td>
</tr>
<tr>
<td>B. Instruction methods</td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C. Subject matter</td>
<td>0.23</td>
<td>0.40</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D. Technology</td>
<td>0.23</td>
<td>0.34</td>
<td>0.28</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E. Plan lessons</td>
<td>0.42</td>
<td>0.58</td>
<td>0.36</td>
<td>0.29</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F. Assess students</td>
<td>0.45</td>
<td>0.50</td>
<td>0.34</td>
<td>0.24</td>
<td>0.61</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>G. Select materials</td>
<td>0.42</td>
<td>0.54</td>
<td>0.36</td>
<td>0.29</td>
<td>0.54</td>
<td>0.57</td>
<td>1.00</td>
</tr>
</tbody>
</table>

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

indicated that all the dependent variables in each group reasonably balanced distributed, revealing no cause for worry for linearity.

Before describing the statistical results related to question 4, it is important to discuss the practical significance of the findings. One reason for a small \( p \) value is a large sample size \( (N = 2,993) \). Therefore, in this study, it was necessary to calculate the effect size. The effect size statistic provided by SPSS is Eta Squared. Although it is labeled eta squared in the SPSS output, the information provided by SPSS on this statistic suggests that it is actually partial eta squared that is given (Pallant, 2001). The results of the multivariate analysis indicated that there was a statistically significant effect, Wilks’ Lambda = 0.987, \( p < 0.001 \), Eta Squared = 0.013, suggesting that there was a mean difference in the combination of the seven outcome variables between the two groups of teachers. Teachers with different preparation and qualifications in their subject taught differed in their perceptions on how well they were prepared to teach. An inspection of the mean scores indicated that teachers who were highly qualified in their subjects taught
perceived that they were better prepared than those who were not highly qualified on the combined seven teaching areas (see Table 14). However, the effect size (Eta Square = 0.013) was very small according to the generally accepted criteria (Cohen, 1988). The value of 0.013 represented only 1.3 per cent of the variance in preparedness explained by the two groups of new teachers. Thus, the results of this analysis may be more statistically significant than practically significant.

After obtaining the significant result on this multivariate test, variable-based post-hoc procedure, $F$ tests were performed to test the between-subject effects on each dependent variable separately at a Bonferoni adjusted alpha level of 0.0071, which was intended to reduce the risk of Type I error. Since $F$ test was known to be sensitive to violations of equal population covariance matrices, the equality of variances was examined as part of univariate $F$ tests. Examination of the variance, Levene’s test, indicated a violation of equal variances for six of the seven dependent variables. Tabachnick and Fidell (2001) suggested setting a more conservative alpha level for determining significance for that variable in the univariate $F$ test if the assumption of equality of variances was violated. This was another reason why a stringent Bonferoni adjusted alpha level of 0.0071 was set, rather than the conventional 0.05 for the univariate $F$ tests in the follow-up procedure in this study.

The results of univariate $F$ tests indicated there were statistically significant differences between the two groups of teachers in six of the seven dependent variables, see Table 16 for a summary of univariate $F$ tests. An inspection of the mean scores indicated that teachers who were highly qualified in their main teaching assignment felt slightly better prepared in most of the teaching areas except in the area of using computer...
Table 16

Summary of Univariate $F$ Tests for the Follow-up Procedure of Multivariate Analysis of Variance (MANOVA)

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>$F$</th>
<th>$p$</th>
<th>Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handle a range of classroom management or discipline situations</td>
<td>6.378</td>
<td>1</td>
<td>6.378</td>
<td>9.380</td>
<td>= 0.002</td>
<td>0.003</td>
</tr>
<tr>
<td>Use a variety of instructional methods</td>
<td>24.170</td>
<td>1</td>
<td>24.170</td>
<td>39.788</td>
<td>= 0.000</td>
<td>0.013</td>
</tr>
<tr>
<td>Teach your subject matter</td>
<td>10.885</td>
<td>1</td>
<td>10.885</td>
<td>18.765</td>
<td>= 0.000</td>
<td>0.006</td>
</tr>
<tr>
<td>Use computer in classroom instruction</td>
<td>1.194</td>
<td>1</td>
<td>1.194</td>
<td>1.312</td>
<td>= 0.252</td>
<td>0.000</td>
</tr>
<tr>
<td>Plan lessons effectively</td>
<td>39.995</td>
<td>1</td>
<td>39.995</td>
<td>65.025</td>
<td>= 0.000</td>
<td>0.021</td>
</tr>
<tr>
<td>Assess students</td>
<td>17.050</td>
<td>1</td>
<td>17.050</td>
<td>29.732</td>
<td>= 0.000</td>
<td>0.010</td>
</tr>
<tr>
<td>Select and adapt curriculum and instructional materials</td>
<td>11.950</td>
<td>1</td>
<td>11.950</td>
<td>18.012</td>
<td>= 0.000</td>
<td>0.006</td>
</tr>
</tbody>
</table>

in classroom instruction. Since the effect sizes for each of the univariate $F$ tests was every small, no strong conclusion can be made in terms of the difference in new teachers’ perceptions on preparedness between the two groups of teachers.

Overall, the result of the multivariate analysis of variance showed that there was a statistically significant multivariate effect, indicating a significant mean difference in the combination of the seven outcome variables between the two groups of teachers. Teachers who are highly qualified felt better prepared than those who were not highly qualified did. In addition, the results of univariate $F$ tests indicated a significant mean deference between the two groups of teachers in six of the seven teaching areas. An inspection of mean scores for those six teaching areas indicated that teachers who were highly qualified felt better prepared than those who were not highly qualified did. However, the effect sizes of the multivariate analysis of variance and the follow-up
univariate $F$ tests were very small. Therefore, the statistically significances were of little practical significances.

Chapter Summary

In this study, I examined teacher quality by investigating the percentage of secondary school teachers who were highly qualified in the main teaching assignment field and in each field they taught, focusing on all subjects, the core subjects, and the subfields of science. I also investigated the variations in the percentage of highly qualified teachers by school locations and by minority student enrollments. In addition, I investigated if there was a relationship between teacher quality and teacher preparedness among the new secondary teachers.

First, as far as main teaching assignment field was concerned, I found that overall 72.8% of secondary teachers were highly qualified. The percentages of highly qualified teachers who taught the core academic fields as their main teaching assignment were between 73.2% and 79.1%. The percentage of highly qualified teachers who taught the subfields of science as their main teaching assignments ranged from 31% to 60.1%.

Second, when the focus was shifted to examine highly qualified teachers in each subject taught, the percentages of highly qualified teachers dropped dramatically. The percentages of highly qualified teachers in the core subjects were between 59.5% and 65.2%, and in the subfields of science the percentages were between 15.7% and 47.8%. Table 17 is a summary of the results of Research Question 1 and 2.

Third, the investigation of highly qualified teachers in relation to school locations and minority student enrollment in schools revealed that urban and rural schools were
Table 17

Percentage of Highly Qualified Secondary Teachers in All Subject Fields, Core Fields, and Subfields of Science, by Main Teaching Assignment and by Each Subject Taught

<table>
<thead>
<tr>
<th>Subjects</th>
<th>By Main Assignments</th>
<th>By Each Subject Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>All subject fields</td>
<td>72.8%</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>75.7%</td>
<td>61.9%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>79.1%</td>
<td>63.2%</td>
</tr>
<tr>
<td>Math</td>
<td>73.2%</td>
<td>59.5%</td>
</tr>
<tr>
<td>Science</td>
<td>75.4%</td>
<td>65.2%</td>
</tr>
<tr>
<td>Chemistry</td>
<td>42.5%</td>
<td>31.1%</td>
</tr>
<tr>
<td>Physics</td>
<td>42.3%</td>
<td>23.4%</td>
</tr>
<tr>
<td>Earth Science</td>
<td>31%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Life Science</td>
<td>60.1%</td>
<td>47.8%</td>
</tr>
<tr>
<td>Physical Science</td>
<td>41.6%</td>
<td>30.3%</td>
</tr>
</tbody>
</table>

disadvantaged in comparison with their suburban counterparts and schools with higher percentage of minority student enrollments were disadvantaged in comparison to schools with lower level of minority student enrollments. These findings indicated that, in urban and rural schools and in schools with more minority students, there were lower percentages of highly qualified teachers.

Finally, the result of the multivariate analysis of variance indicated that there was a significant statistical difference between the new highly qualified secondary teachers and those who were not highly qualified in their perceptions on preparedness. The Results of univariate $F$ tests also showed that there were significant statistical differences between the new highly qualified secondary teachers and those who were not highly qualified in their perceptions on preparedness in most of the teaching areas. However, the effect sizes, which were calculated using eta squared to determine the practical
significance of the inferential statistical findings, were very small. Therefore, no strong conclusions can be made regarding the relationship between the quality of new secondary school teachers and their perceptions on preparation for teaching.

Overall, the results showed that substantial secondary school teachers were not highly qualified in the subjects they taught, particularly, in the subfields of science. There were variations in the distribution of highly qualified teachers by school locations and by schools with different percentages of minority students in schools. Although, new secondary school teachers who were highly qualified in their main teaching assignment felt slightly better prepared than those who were not highly qualified did in most of the teaching areas, the similar means of the two groups of teachers and the small effect sizes did not allow strong conclusions to be made. The discussion and implications of the study derived from the findings will be presented in Chapter V.
CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Introduction

This chapter contains a summary of this study on teacher quality and teacher preparedness in public secondary public schools. The findings of the study both confirm and challenge previous research findings related to teacher quality. Implications of the study are discussed and recommendations for future research are provided.

Summary

The purpose of this study is to examine teacher quality, distribution of teacher quality and the relationship of teacher quality and teachers' perceptions on their preparation for teaching. The 1999–2000 Schools and Staffing Survey (SASS) for public school teachers was used to investigate to what extent secondary public school teachers were highly qualified in the subject they taught, particularly in the core academic subjects and the subfields of science. Distribution of the highly qualified teachers by school locations and by percentages of minority student enrollment in schools was examined. Finally, the relationship between the quality of new teachers and their perceptions on their preparedness was investigated.

Specifically, the following research questions were answered through completion of this study:
1. According to teacher's main teaching assignment field, what is the percentage of highly qualified secondary teachers in: (a) all main teaching assignment fields, (b) core academic fields, and sub-fields of science?

2. According to each subject taught, what is the percentage of highly qualified secondary teachers in: (a) core academic fields and (b) sub-fields of science?

3. According to teachers' main teaching assignment field, is the proportion of highly qualified secondary teachers the same for (a) different school locations and (b) different percentage of minority students in schools?

4. Between the two groups of new secondary teachers: highly qualified in their main teaching assignment field vs. not highly qualified in their main teaching assignment field, are there any significant differences in their perceptions on their preparation for teaching related to the following seven teaching areas: (1) classroom management, (2) instructional methods, (3) subject knowledge, (4) technology, (5) planning lessons, (6) assessing students, and (7) selecting teaching materials?

Secondary public school teachers who were assigned to teach 9th through 12th grades from a nationally representative sample were included in this study. New secondary school teachers in this study were defined as those who had less than three years of teaching experience. Both descriptive and inferential statistics were applied in this study. Descriptive statistics were used to identify the percentages of highly qualified teachers in the subjects they taught. Chi-Square tests were employed to examine the distribution of highly qualified teachers by school locations and by percentages of minority student enrollment in schools. Multivariate analysis of variance was used to
determine the relationship between the quality of new teachers and their perceptions on their preparedness.

Conclusions and Discussion

The findings of this study both confirm and challenge previous research on teacher quality. The following is a list of findings that are consistent with previous literature related to teacher quality. First, a considerable number of secondary public school teachers who taught the core academic fields, particularly the subfields of science were not highly qualified, yet. Second, there were variations in the supply of highly qualified teachers across different schools. Urban schools and schools with a higher percentage of minority students were much less likely to be staffed with highly qualified teachers. Third, new teachers who were highly qualified in their main teaching assignment feel slightly better prepared than those who are not highly qualified did. The following sections gave a detailed discussion of the findings.

Highly Qualified Teachers in their Main Teaching Assignment Field

This study found that, during 1999–2000 school years, overall 72.8% of secondary public teachers were highly qualified in their main teaching assignment field, indicating that these teachers had both a full state certification and a major in their main teaching assignment field. The percentages of highly qualified teachers who taught core academic fields as their main teaching assignments were between 73.2 % and 79.1%. The percentage of highly qualified teachers who taught the subfields of science as their main teaching assignment was ranged from 31% to 60.1%. In the research literature, few
studies have been found to combine teacher's certification status and subject preparation
(academic major) in the investigation of teacher quality in their main teaching
assignments by the core fields as well as the subfields of science. However, previous
studies that examined teachers' preparation and qualifications by looking at the specific
teacher's characteristics separately did provide valuable information for this study. The
study of Lewis et al. (1999) showed that most of the teachers (more than 92 percent) were
fully certified in the field of their main teaching assignment. Shen and Poppink (2003)
had similar findings regarding teachers' certification status in their main teaching
assignments. Research on teachers' subject preparation in the core fields of their main
teaching assignments indicated that, in grades 9 through 12, teachers who reported having
an undergraduate or graduate major or minor in their main teaching assignment field
accounted for over 90 percent (Lewis et al., 1999). According to U.S. Department of
Education (1994), in 1988, totally 92 percent of all public elementary and secondary
teachers were reported to had a certification in their main teaching assignment and among
them, 71.6 percent reported to have a major in their main teaching assignment field, and
in 1991, totally, 94.8 percent of all public elementary and secondary teachers had a
certification and 72.8 percent also had a major in their main teaching assignments.

When comparing the findings of the previous research on teachers' qualifications
in their main teaching assignment field, the finding of this study tends to suggest what
most of the teachers need to become highly qualified teachers in their main teaching
assignment field was a major rather than a teaching certification. One important finding
of this study was, on average, more than half of secondary school teachers who taught
those subfields of science as their main teaching assignments did not meet the
requirements of highly qualified teachers as defined in this study. A teacher's main assignment field refers to the field in which he or she teaches the most classes during a school day. It is expected that teachers hold the highest level of qualifications in this field. However, the findings of this study showed that overall 27.2% of secondary teachers in public schools had not been highly qualified yet in their main teaching assignment. The percentage of under-qualified teachers was surprisingly higher for those who taught the subfields of science. This concluding information about the condition of teachers' qualifications should arouse an alert for consideration among policymakers.

**Highly Qualified Teachers in Each Subject Taught**

In American schools, many teachers' classroom responsibilities encompass other subject matter fields beyond their main teaching assignment field. When the focus of this study was shifted on examining highly qualified teachers in each subject field they taught rather than the field of their main teaching assignment, the percentages of highly qualified teachers dropped dramatically. The percentages of highly qualified teachers in the core subjects were between 59.5% for math and 65.2% for general science, and in the specific subfields of science, the percentages of highly qualified teachers were between 15.7% for earth science and 47.8% for life science. The findings of this study revealed that many secondary teachers taught one or more subject fields without a proper certification or preparation in those fields, especially those teachers who taught the subfields of science. The findings are in accordance with the study by Seastrom, et al. (2002). Seastrom et al. demonstrated that in school year 1999-2000 one-third or fewer of the high school students in English, mathematics, and social science classes had teachers...
who did not have a major and certification in the subject area taught. The percentages were much higher for each specific subfield of science, which ranged from 45 percent for biology/life science classes to 79 percent for geology/earth science.

Ingersoll (1996) examined the issue of out-of-field teachers (a teacher teaching the subject without at least an undergraduate or graduate minor in the subject). He found that in the school year of 1990-1991, secondary schools (7th - 12th grades) had unacceptable high rates of out-of-field teachers in core academic subjects—32.1 percent for math, 18.7 percent for science, 18.9 percent for social studies and 23.2 percent for English. Jerald (2002) reported that the nation made no progress in reducing this problem between 1993-94 and 1999-2000. The findings of this study confirm that the problem of out-of-field teaching remains widespread and still prevailing in secondary public schools. Based on these results, it is of no doubt that, the mandate of highly qualified teachers under NCLB is surely affecting many teachers, especially those who are teaching the subjects of science in the secondary schools.

In terms of percentage of highly qualified teachers in the core academic subjects, the finding of this study was quite consistent with those reported by some of the previous studies on this topic. The percentage of highly qualified teachers in the area of math was disadvantaged in comparison with the areas of English and social studies. Though the percentages of highly qualified teaches in general science is as high as 65.2 percent, the percentages of the subfields of science were as low as 15.7 percent for earth science. Given the previous research findings which showed that in math and science, particularly at the secondary level, rigorous subject-area training and pedagogical training of teachers
have positive effect on students’ achievement, more efforts should be made to improve the qualities of secondary school teachers in these areas.

The investigation of highly qualified teachers in relation to school locations and the percentages of minority student enrollment in schools revealed that urban and rural schools were disadvantaged in comparison with their suburban counterparts, and schools with higher level of minority student enrollments were disadvantaged in comparison to schools with lower level of minority student enrollments. These findings indicated that, in urban and rural schools and in schools with more minority students, there were lower percentages of highly qualified teachers. The findings of this study were supported by many other studies on the distribution of teacher quality across different schools (Bishop, 2002; Ingersoll, 1996; Jerald & Ingersoll, 2002; Shen & Poppink, 2003; Shen et al., 2004). In high-poverty and high-minority schools students were much more likely to be assigned to a teacher who does not have minimal academic qualification or training in the subject being taught (Jerald & Ingersoll, 2002; Bishop, 2002). Urban schools in comparison to suburban and rural schools had a higher percentage of uncertified teachers (Shen & Poppink, 2003) and schools at risk had less-qualified new teachers (Shen et al., 2004).

Teacher Quality and Teachers’ Perceptions on their Preparation for Teaching

This study showed that among 2,993 new secondary teachers who were assigned main teaching assignments, 44 percent of them were found underqualified, while the percentage of all secondary teachers who was not highly qualified in their main teaching assignment accounted for 27 percent. This finding is in agreement with Ingersoll’s (2004)
and Shen and Poppink’s (2003) regarding the quality of new teachers. Ingersoll indicated that new teachers were more often assigned to teach subjects out of their fields of training than experienced teachers. Shen and Poppink also found that the percentage of new teachers who did not have a certificate was much higher than that of the total teachers without a certificate.

This study revealed that, on average, new teachers did not feel very well prepared on most of the teaching areas studied, particularly in the areas of educational technology. This finding is consistent with the previous study that found that overall less than half of American teachers reported feeling very well prepared to meet most of the teaching requirements and only 20 percent of teachers reported feeling very well prepared to integrate educational technology into classroom instruction (Lewis et al., 1999). Imbimbo’s and Silvermail’s study (1999) concluded that overall new teachers felt the need for better preparation before entering the classroom.

Investigating the relationship between the quality of new teachers and their preparedness, this study found that teachers who were highly qualified in their main teaching assignment felt slightly better prepared than those who were not highly qualified in their main teaching assignment field in six of the seven teaching areas. However, the mean differences of the two groups of teachers on their perceptions on their preparedness across the seven teaching areas were very small and the effect sizes of the statistical analysis were close to zero. Though statistical difference was obtained, no strong conclusions could be drawn.

Previous research on new teachers’ perceptions on their preparedness showed that new teachers who were prepared in teacher education programs felt significantly better
prepared across most dimensions of teaching than those who entered teaching through alternative programs or without preparation (Darling-Hammond, 2002). Some previous study also found that those teachers who entered teaching with little professional education had greater difficulties in the classroom and they tended to leave teaching at higher rates than those with professional training (Darling-Hammond, 1992, 2000a, Grossman, 1989).

In sum, the findings of this study are quite consistent with the findings of the previous studies on teacher quality in public secondary schools. Percentages of highly qualified teachers in the core academic fields and in each subfield of science in secondary public schools are far from satisfactory. In some of the subfields of science, the percentage of highly qualified teachers was extremely low. In addition, urban and rural schools, as well as schools with high levels of minority enrollment, had lower percentages of highly qualified teachers. In terms of the quality of new teachers, only 56 percent of new secondary teachers were highly qualified in their main teaching assignment field. Although highly qualified teachers felt slightly better prepared than those who were not highly qualified in their main teaching assignment fields, overall, new teachers did not perceive themselves to be very well prepared for teaching. Given the findings of this study, teacher quality in public secondary schools poses a serious challenge to educators and educational policymakers, among others.

Implications

This study investigated teacher quality and teacher preparedness in public secondary schools using a nationally representative teacher sample, which allows
findings to be generalized to the national secondary school teacher population. Highly qualified teacher variable is defined based on the NCLB’s requirements for a highly qualified teacher in secondary schools, which combined teachers’ certification and their academic majors. This study differs from many of the previous studies that examined teachers’ characteristics (such as teachers’ certification status or teachers’ academic major) separately. This study evaluated teacher quality from variety of strategies; teacher quality in main teaching assignments, in each subject taught, across different schools, teacher quality among new teachers and its relationship with their perceptions on preparedness. The findings of the study can add to national understanding of the problem of teacher quality and provide new information to the teacher profile of secondary school teachers as well.

The findings of this study have implications for policies related to highly qualified teachers in secondary schools, teaching assignments, school staffing, the student achievement gap, preparation and retention of new teachers. First, the challenge to ensure a highly qualified teacher for all students lies in providing highly qualified teachers for all students in all the subjects taught. The SASS 1999-2000 data clearly indicate that many teachers are not highly qualified in the core academic fields, particularly in the subfields of science in secondary public schools. The data suggests an urgent need to support all the teachers in becoming highly qualified in their subject areas, especially those who are teaching those subfields of science.

Second, one strategy to ensure a highly qualified teacher in each subject taught suggested by the study is to require all teachers to obtain a major in each of their subject taught. This study found that many of the secondary teachers are not highly qualified in
their subject taught; however, based on the previous research, the lack of highly qualified teachers in the subject taught may not be due to a lack of teachers’ certifications or academic degrees, but a lack of a major in teachers’ subject area. With the recent movement in a number of states to strengthen teacher certification standards, in the 1999-2000 school year, most teachers held a full teaching certificate (Ingersoll, 2004; Shen & Poppink, 2003). Studies showed that almost all secondary school teachers have at least a bachelor’s degree (Lewis et al., 1999). However, research showed that only two-thirds of high school teachers had a major in an academic field (Lewis et al., 1999) and only 68 percent to 76 percent of teachers (depending on the subject) had a bachelor’s degree in their subject area. Ingersoll (1996, 2004) also reported that a large number of secondary teachers did not have a major or minor in their teaching field. Given that secondary teachers must be knowledgeable about the subjects they teach if they are to help all students achieve high academic standard, policy-makers must take actions to implement the new federal requirement of highly qualified teachers by requiring all teachers not only obtain a certification to teach but also a major in all the subjects taught.

Third, the study shows that it is common that secondary school teachers are assigned to teach other fields in addition to the field of their main assignments. Among 12,624 secondary school teachers, 7,682 of them were assigned to teach the core academic field in addition to the field of their main assignments (see Table 9). This study also indicates that teachers who are assigned to teach the core fields as well as the subfields of science are less likely to be highly qualified than those who are assigned to teach these fields as their main teaching assignments. According to Ingersoll (1996), out-of-field teaching in core fields was common in public schools since relatively large
percentages of high school teachers taught at least one core subject without a major or
minor in the subject taught. Why were so many secondary teachers assigned to teach a
subject field that they did not have adequate preparation or qualifications? Many people
assumed that there was a deficit in teacher supply. However, Ingersoll (2004) pointed out
that “the way schools are organized and teachers are managed accounts for as much of
the problem of out-of-field teaching as do inadequacies in the supply of teachers” (p.17).
Ingersoll (2004) found such factors as the quality of principal leadership, average class
sizes, teacher recruitment and hiring strategies of the schools and districts were all related
to the amount of out-of-field teaching in schools. The results of this study implied that to
ensure highly qualified teachers for all students, policy-makers need to put an end to the
practice of assigning out-of-field teaching and to create a fit between teachers’
professional training and their teaching assignment.

Fourth, consistent with many previous studies, this study found urban schools and
schools with more minority students were less likely to have highly qualified teacher in
their subject taught. Such a situation deserves special attention among policymakers and
researchers because students’ achievement in these disadvantaged schools was very
sensitive to the quality of their teachers (Sanders & Rivers, 1996). The key to raising
student learning and closing achievement gaps lies in access to a highly qualified teacher
for all students and equal distribution of highly qualified teachers across different types
of schools. Again, these findings seem to raise a serious equity issue in staffing urban,
suburban, and rural schools and schools with different levels of minority student
enrollment. Regarding the existing student achievement gap and teacher quality gag,
Ansell and McCabe (2003) suggested states and school districts should track and inform
the public about the distribution of qualified teachers across different types of schools and try to match highly qualified teachers with high-need schools.

Finally, the findings about the quality of new teachers and their preparedness should also sound a note of caution among policy makers. Although statistical significance was detected, the small mean difference and effect size did not allow strong conclusions to be made regarding the relationship of the quality of new teachers and their perceptions of their preparedness. However, the descriptive statistics showed that the percentage of those who were not highly qualified in the subject taught is higher among new teachers than among all teachers. The study also showed that on average new teachers did not perceive themselves to be well prepared to meet most of the requirements for teaching. Given the research findings that revealed 40-50% of new teachers quit teaching after five years (Ingersoll, 2003), and turnover was higher among teachers who were less qualified (Shen & Poppink, 2003), this study suggests a need for teacher education or other teacher preparation programs to prepare teachers more effectively and a need for schools or school districts to hire new teachers who are highly qualified.

Recommendations for Future Research

This study of teacher quality provides important information regarding highly qualified teachers, distribution of highly qualified teachers, the quality of new teachers and their perceptions on preparedness in the secondary public schools. However, teacher quality is a complex issue. This study does not address the concerns such as how teacher preparation and qualifications affect teachers’ actual classroom teaching practice or
students' learning and achievement. For future studies of teacher quality, the study suggests the following:

First, to continuously track the development of highly qualified teachers and provide information to the public and policy makers about teacher quality and the distribution of teacher quality across different types of schools, a profile of highly qualified teachers or teacher quality need to be developed. Researchers should be encouraged to continuously utilize large-scale national data like SASS for the future research on teacher quality. SASS collects data from a large and statistically representative sample of American schoolteachers and can yield the most recent and reliable information regarding teacher quality. The 2005-2006 SASS data has been collected and will be released soon. Future studies using this survey data can further inform the public, states and school districts about teacher quality status.

Second, it is recommended that future studies on teacher quality should also look at teachers' actual classroom teaching practice to see how teachers' preparation and qualification affect their teaching practice.

Third, it is recommended that future studies on teacher quality connect teachers' preparation and qualification to students' learning in classroom.

Forth, future studies on teacher quality should use a range of methods in data collection and data analysis so that a more rich and in-depth information can be obtained in terms of the complexity of the issue of teacher quality. In addition to survey questionnaire, in-person interviews, focus groups with school or district administrators, teachers, students, parents; classroom observations, teachers' tests and students' learning outcomes can be used for data collection or analysis.
Finally, future studies on highly qualified teachers should develop clearly identifiable measures and should focus on how highly qualified teachers can make a difference in terms of their teaching practice and student learning.
Appendix A

Human Subjects Institutional Review Board
Letter of Approval
Date: October 18, 2005

To: Sue Poppink, Principal Investigator
   Jianping Shen, Co-Principal Investigator
   Mozhideh Bruss, Co-Principal Investigator
   Xuejin Lu, Student Investigator for dissertation

From: Mary Lagerwey, Ph.D., Chair

Re: HSIRB Project Number 05-10-04

This letter will serve as confirmation that your research project entitled “Teacher Quality and Teacher Preparedness in Secondary Schools: Evidence from SASS 1999-2000” has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: October 18, 2006

Walwood Hall, Kalamazoo, MI 49008-5455
Phone: (269) 387-8293 Fax: (269) 387-8278

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Appendix B

Graphic Representation of Teacher Quality and Teacher Preparedness in Public Secondary Schools
Question 1 -- Highly Qualified Teachers by Main Teaching Assignment in Secondary Public Schools (9-12), (Analysis with Relative Weight on).

Total public secondary school teachers, N = 12,624

Teachers having main teaching assignments, n = 11,791; 93.4%

Highly qualified teachers (HQT), n = 8,582; 72.8%

HQT in English
n = 1398; 75.7%
(N = 1847)

HQT in Math
n = 1164; 73.2%
(N = 1590)

HQT in Social Studies
n = 1102; 79.1%
(N = 1393)

HQT in Science
n = 1063; 75.4%
(N = 1411)

HQT in Chemistry
n = 128; 42.5%
(N = 302)

HQT in Earth Science
n = 35; 31%
(N = 114)

HQT in Life Science
n = 368; 60.1%
(N = 612)

HQT in Physical Science
n = 294; 41.6%
(N = 707)

HQT in Physics
n = 54; 42.3%
(N = 127)
Research 1-1— Highly Qualified Teachers in the Core Fields by Main Teaching Assignment

Question 1-2 — Highly Qualified Teachers in the Subfields of Science by Main Teaching Assignment

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Question 2 -- Highly Qualified Teachers by Each Subject Taught in Secondary Public Schools (9-12), (Analysis with Relative Weight on)

Total public secondary school teachers, N = 12,624

- HQT in English
  n = 1362; 61.9%
  (N = 2201)

- HQT in Math
  n = 1193; 59.5%
  (N = 2205)

- HQT in Social Studies
  n = 1148; 63.2%
  (N = 1817)

- HQT in Science
  n = 1801; 65.2%
  (N = 1659)

  - HQT in Chemistry
    n = 139; 31.1%
    (N = 447)

  - HQT in Earth Science
    n = 39; 15.7%
    (N = 250)

  - HQT in Life Science
    n = 385; 47.8%
    (N = 805)

  - HQT in Physical Science
    n = 311; 30.3%
    (N = 1021)

  - HQT in Physics
    n = 64; 23.4%
    (N = 272)
Question 2-1—Highly Qualified Teachers in the Core Subjects by Each Subject Taught

![Bar chart showing the percentage of highly qualified teachers in core subjects.]

<table>
<thead>
<tr>
<th>Subject</th>
<th>Percentage of Highly Qualified Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>61.9%</td>
</tr>
<tr>
<td>Social Studies</td>
<td>63.2%</td>
</tr>
<tr>
<td>Math</td>
<td>59.5%</td>
</tr>
<tr>
<td>Science</td>
<td>65.2%</td>
</tr>
</tbody>
</table>

Core Subjects

Question 2-2—Highly Qualified Teachers in the Subfields of Science by Each Subject Taught

![Bar chart showing the percentage of highly qualified teachers in subfields of science.]

<table>
<thead>
<tr>
<th>Sub-Field of Science</th>
<th>Percentage of Highly Qualified Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>31.1%</td>
</tr>
<tr>
<td>Physics</td>
<td>23.4%</td>
</tr>
<tr>
<td>Earth Science</td>
<td>15.7%</td>
</tr>
<tr>
<td>Life Science</td>
<td>47.8%</td>
</tr>
<tr>
<td>Physical Science</td>
<td>30.3%</td>
</tr>
</tbody>
</table>

Sub-Fields of Science
Question 3-1--Highly Qualified Teachers in Main Teaching Assignment by School Locations

![Chart showing percentage of highly qualified teachers by school location]

Question 3-2--Highly Qualified Teachers in Main Teaching Assignment by Percentage of Minority Student Enrollment in Schools

![Chart showing percentage of highly qualified teachers by minority student enrollment level]
Research Question 4--Descriptive Statistics for New Secondary Teachers

<table>
<thead>
<tr>
<th>Rating Scale</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<tbody>
<tr>
<td>Highly Qualified Teachers</td>
<td>2.68</td>
<td>2.98</td>
<td>3.32</td>
<td>2.6</td>
<td>3.12</td>
<td>2.96</td>
<td>2.82</td>
</tr>
<tr>
<td>Under Qualified Teachers</td>
<td>2.58</td>
<td>2.8</td>
<td>3.2</td>
<td>2.56</td>
<td>2.89</td>
<td>2.81</td>
<td>2.69</td>
</tr>
</tbody>
</table>

Means on Seven Teaching Areas

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Appendix C

Technical Notes: SASS Sample Design and Weighting
Technical Notes

Characteristics of SASS Sample Design

Based on Tourkin et al., (2004), SASS is not a simple random sample (SRS). An SRS of size \( n \) is “a sample of \( n \) units chosen in such a way that every collection of \( n \) units from the sampling frame has the same chance to be chosen” (Moore, 1996, p. 12). An SRS is obtained by a method that gives every possible sample of size \( n \) the same chance of being the sample. In this case, not all teachers in the United States had an equal probability of selection.

SASS employs complex sample design. In SASS complex sample design, different sample rates across different states and affiliations lead to different probabilities of selection. Different probabilities of selection within states and affiliations lead to different probabilities of selection. A complex sample design requires the use of sampling weights for estimation and requires special methods of variance estimation. If the data come from a survey with a complex sample design, unweighted statistics will be biased because some cases (e.g., over-sampled minorities) will be over-represented in the population. Weights bring cases back to their correct proportions within the population.

There are several reasons for using sampling weights. Weights compensate for not collecting data from the entire population (i.e., not all teachers are included) and for using a complex sample design (i.e., not all SASS teachers have an equal probability of selection). Weights adjust for differential selection probabilities, adjust for differential nonresponse (i.e., not all sampled SASS teachers responded) and are used when estimating characteristics of a population. Nonresponse is “the failure to obtain data from a unit selected for sample” (More, 1996, p. 46).
The *sampling weight* is the number of cases in the population that the selected respondent represents (i.e., the inverse of the selection probability), see Table 1 for an example.

**Table 1**

<table>
<thead>
<tr>
<th>Public Schools</th>
<th>California</th>
<th>Delaware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>8,011</td>
<td>161</td>
</tr>
<tr>
<td>Sample size</td>
<td>464</td>
<td>66</td>
</tr>
<tr>
<td>Inverse prob. of selection</td>
<td>17.3</td>
<td>2.4</td>
</tr>
</tbody>
</table>

In this example, 464 of the 8,011 public schools in California were sampled and 66 of the 161 public schools in Delaware were sampled. Assuming that no nonresponse and no other sampling factors, the average weight for schools in California would be $17.3(8,011/464)$ and average weight for schools in Delaware would be $2.4(161/66)$.

Differential sampling rate leads to unequal weighting when generating estimates. SASS public schools sampled to be representative at the national and state levels. Within states, number of public schools varies from ~150 to over 8,000. Sample size required to obtain state reliable estimates (with acceptable level of sampling error) varied from 66 to 464.

If SASS utilized a simple random sample and everyone responded (no nonresponse), each public school would have a weight of approximately 8.46 ($83,729/9,893$), see Table 2.
Table 2
SASS Sampling Weights: Sample v. Population

<table>
<thead>
<tr>
<th>Public Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
</tr>
<tr>
<td>Population</td>
</tr>
</tbody>
</table>

Weights also account for differential response rates. Initial weights take into account selection probabilities assuming all sampled schools will respond. Final public school weighed response rates by state vary from 77.9% to 97.3%. Certain types of schools may be more or less likely to respond and weights are adjusted so these schools are not over- or under-represented. Weighting account for the reality that not all sampled school respond. Therefore, weights reflect probability of selection as well as response rates, see Table 3.

Table 3
An Example of Weighting

<table>
<thead>
<tr>
<th></th>
<th>California</th>
<th>Delaware</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse of prob. of selection</td>
<td>17.3 (8,011/464)</td>
<td>2.4 (161/66)</td>
</tr>
<tr>
<td>Sample</td>
<td>464</td>
<td>66</td>
</tr>
<tr>
<td>Respondents</td>
<td>379</td>
<td>52</td>
</tr>
<tr>
<td>Average adjustment</td>
<td>1.22 (464/379)</td>
<td>1.27 (66/52)</td>
</tr>
<tr>
<td>Average final weight</td>
<td>21.1 (17.3*1.22)</td>
<td>3.0 (2.4*1.27)</td>
</tr>
</tbody>
</table>
The Final Weight for Public School Teachers

The general purpose of the weighting is to produce population estimates from the SASS sample data. That process includes adjustment for nonresponse using respondents’ data, and adjustment of the sample totals to the frame totals to reduce sampling variability.

Definition of Teacher Weight

The final weight for public school teachers is the product of:

(Basic Weight) and (School Sampling Adjustment Factor) and (Teacher Sampling Adjustment Factor) and (School Noninterview Adjustment Factor) and (Teacher-withinschool Noninterview Adjustment Factor) and (Frame Ratio Adjustment Factor) and (Teacher Adjustment Factor) where:

Basic Weight is the inverse of the probability of selection of the teacher.

School Sampling Adjustment Factor is an adjustment that accounts for unusual circumstances that affect the school’s probability of selection, such as a merger, split, or duplication.

Teacher Sampling Adjustment Factor is an adjustment that accounts for the experienced teachers from non-BIA/non-public charter schools who were subsampled out during mail nonresponse follow-up. Subsampling was necessary because the nonresponse follow-up workload was considerably higher than expected, overwhelming available interviewing resources. If a teacher who was subject to the subsampling process subsequently returned a questionnaire by mail, he/she was excluded from the subsampling process and was processed along with other interviewed teacher records. Records subsampled out and not returning a questionnaire by mail were excluded from the sample. Records subsampled in and not returning a questionnaire by mail were kept in the sample and had an appropriate teacher sampling adjustment factor applied.
School Non-interview Adjustment Factor is an adjustment that accounts for schools that did not have teachers selected because TLFs were not provided by the school. It is the weighted (the product of the school basic weight and the school sampling adjustment factor) ratio of total eligible in-scope schools to the total in-scope schools providing teacher lists, computed within cells.

Teacher-within-school Non-interview Adjustment Factor is an adjustment that accounts for sampled teachers that did not respond to the survey. It is the weighted (product of all previously defined components) ratio of the total eligible teachers to the total eligible responding teachers computed within cells.

Frame Ratio Adjustment Factor is a factor that adjusts the sample estimates to known frame totals of number of teachers. For the set of non-certainty schools, the factor is the ratio of the frame estimate of the total number of teachers to the weighted (product of all previously defined components) sample estimate of the total number of teachers. These factors are computed within cells. The sample estimate uses the frame count of the number of teachers in the school. For public schools, the 1997–1998 CCD was used as the frame and the teacher counts were in terms of FTEs. For private schools, the 1997–98 PSS was used as the frame and teacher counts were in terms of headcounts. Teachers from certainty schools were assigned a factor of 1.0.

Teacher Adjustment Factor is a factor that adjusts for the inconsistency between the estimated number of teachers from the SASS school data files and the SASS teacher sample files. It is the ratio of the weighted number of teachers from the school data file for a cell to the weighted number of teachers on the teacher data file for a cell. The weight is the product of all previously defined components. This factor ensures that teacher estimates from the teacher file will agree with the corresponding teacher aggregates from the school file (after imputation) since the teacher file counts are being adjusted to agree with the school counts.
The Relative Sample Weight for Public School Teachers

The relative sample weight for public school teachers is produced based on the final weight for public school teachers (relative weight = teacher final weight * sample size/population). The use of the relative sample weight can not only approximate the population but also adjust the population down to the actual sample size of the study. According to Shen (1997), the findings of the study may be generalized to the national population of secondary public school teachers with relative sample weights.

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