AN EXPLORATORY ANALYSIS OF SCHOOL, TEACHER, AND STUDENT CHARACTERISTICS AT EARLY COLLEGE HIGH SCHOOLS AND SELECTED HIGH SCHOOLS IN NORTH CAROLINA

A Dissertation
by
LINDSAY RUGGLES

Submitted to the Graduate School
Appalachian State University
In partial fulfillment of the requirements for the degree of
DOCTOR OF EDUCATION

May 2016
Educational Leadership Doctoral Program
Reich College of Education

AN EXPLORATORY ANALYSIS OF SCHOOL, TEACHER, AND STUDENT CHARACTERISTICS AT EARLY COLLEGE HIGH SCHOOLS AND SELECTED HIGH SCHOOLS IN NORTH CAROLINA

A Dissertation
by
LINDSAY RUGGLES
May 2016

APPROVED BY:

_____
Sara Olin Zimmerman, Ph.D.
Chairperson, Dissertation Committee

_____
Les Bolt, Ph.D.
Member, Dissertation Committee

_____
Tracy Goodson-Espy, Ed.D
Member, Dissertation Committee

_____
Audrey Dentith, Ph.D.
Director of the Doctoral Program in Educational Leadership

_____
Robin Groce, Ph.D.
Interim Dean, Reich College of Education

Abstract

AN EXPLORATORY ANALYSIS OF SCHOOL, TEACHER, AND STUDENT CHARACTERISTICS AT EARLY COLLEGE HIGH SCHOOLS AND SELECTED HIGH SCHOOLS IN NORTH CAROLINA

Lindsay Ruggles
B.A., University of North Carolina at Charlotte
M.A., Appalachian State University
Ed.D, Appalachian State University

Dissertation Committee Chairperson: Sara Olin Zimmerman, Ph.D.

This study was an exploratory analysis of how school, teacher, and student characteristics impact student achievement at 34 ECHSs and 56 selected traditional high schools in North Carolina. The Early College High School Initiative (ECHSI) was officially launched in 2002 and was specifically designed to target students who are statistically underrepresented in higher education, such as low-income students, students of color, English language learners, and first-generation college students. In NC, high school reform efforts have become a well-known strategy employed by the state to achieve higher postsecondary degree attainment rates. The ECHSI is one high school reform effort in NC that has spread widely throughout the state. The study utilized the database from the North Carolina Education Research Data Center (NCERDC), to examine a randomly drawn sample of 2,175 high school students who took the Algebra I EOC test during the 2008-2009 school year. The researcher chose to utilize data from the NCERDC because it is longitudinal and links student outcomes to multiple teachers, programs, and schools over time. Three logistic regressions were conducted to determine the predictive ability of school, teacher, and student variables on school type (ECHS or control). The school level variables that were predictive

of whether a school was an ECHS or not included eligibility for Title I, student gender, student ethnicity, and free/reduced price lunch status. The teacher level variables that were significant predictors included teacher licensure area, licensure route, licensure status, and experience. The student level variables that impacted school type were student grade level, Algebra I subject area, Algebra I achievement and scale scores, participation in extracurricular activities, and attendance. Suggestions for future evaluation of the ECHSI are discussed.

Acknowledgments

To my committee chair, Dr. Sara Olin Zimmerman, I thank you for the opportunity to conduct research at Appalachian State University. Your guidance on this project as well as other projects I've worked on has been invaluable. I appreciate the many opportunities you've afforded me during graduate school to grow academically and professionally. Thank you for being so accommodating and willing to help when I've needed it the most.

To the remainder of my committee, thank you so much for your time spent reviewing this dissertation research. Dr. Les Bolt, thank you for all your work on the data set, as well as your patience answering all of my questions about quantitative methods. Your confidence in my ability to complete this study helped immensely. Dr. Tracy Goodson-Espy, your ideas and detailed feedback on my drafts was greatly appreciated.

Thank you to my wonderful parents and my sister who gave me unwavering support when I needed it the most. Thank you especially to my mom, Carol, who never complained even after reading my drafts countless times. Thanks also to Neel, as well as other family and friends not mentioned here that have supported me over the years.

Table of Contents

List of Tables

Chapter One

Introduction

Chapter One provides an overview of educational attainment in the United States and discusses the development of high school reform efforts, such as the Early College High School Initiative (ECHSI). The chapter discusses the statement of the problem, the research questions in the study, and the purpose and significance of the study. Limitations of the study conclude the chapter.

Overview

In 1940, over half of the U.S. population had completed no more than an eighth grade education (Synder, 1993). Furthermore, only 6% of males and 4% of females had completed four years of college. However, after World War II, college enrollment increased as many war veterans took advantage of the G.I. Bill of 1944. Proposed out of fear of post-war unemployment, the U.S. Congress passed the *Servicemen's Readjustment Act of 1944*, commonly known as the G.I. Bill, which promised to pay for college for any returning veteran who enrolled.

During the 1940s and 1950s, more than half of young adults completed high school and the median educational attainment of 25 to 29-year-olds rose to 12.3 years (Synder, 1993). The U.S. Census Bureau (2015) defines "educational attainment" as the highest level of education that an individual has completed. Educational attainment is distinct from the level of schooling that an individual is attending or enrolled in. By 1960, 40% of males had completed high school and 10% had completed four years of college (Synder, 1993). For women, the proportion completing high school was about the same, but only 4% had completed four years of college. From the middle 1970s to 1991, the educational attainment

for all young adults remained virtually stable, with no change among whites, blacks, males, and females.

From 1992 to 2002, college enrollment increased each year, rising 15% before stabilizing between 1992 and 1998 (Institute of Education Sciences, 2015). However, from 2002 to 2012, college enrollment rose 24%. The literature on postsecondary enrollment has consistently found that college enrollments reflect national economic changes and trends, such as the Great Recession (Dunbar et al., 2011). The Great Recession lasted from December 2007 to June 2009, during which the economy lost 5.6 million jobs for Americans with a high school diploma or less (Murray & Klinger, 2013). During the recession, jobs requiring an associate's degree or some college declined by 1.75 million, while the number of jobs for Americans with a bachelor's degree or above actually grew by 187,000.

Unfortunately, post-recession data indicates that recovery never came to those whose highest level of education is a high school diploma or below (Carnevale & Smith, 2012). In fact, since January 2010, the economy has lost an additional 230,000 jobs in this category. On the other hand, jobs requiring an associate degree have grown by 1.6 million and almost recovered to pre-recession levels (Carnevale & Smith, 2012). Jobs for those with a bachelor degree have accelerated in growth—adding two million jobs in the recovery.

Although jobs requiring a college degree have accelerated in growth, some cite the unemployment rates of recent college graduates as evidence that the value of college degrees is diminishing (Abel, Deitz, & Su, 2014). From 1990 to 2013, the unemployment rate averaged 4.3% for recent college graduates, compared with 2.9% of all college graduates. Historically, rates of unemployment are not uncommon for college graduates just after they obtain their degree (Abel et al., 2014). However, the relatively high unemployment

experienced by recent college graduates should not prompt us to diminish the value of a college education in helping young workers find jobs. In 2010, just after the recession, around 88% of 23 and 24 year old college graduates were employed (Baum, Ma, & Payea, 2013). For high school graduates in the same age group, the rate of employment was only 65%; for high school dropouts it was only 42%. At the peak of U.S. unemployment rates in 2010, the unemployment rate for young workers without degrees was nearly 16%, more than double the unemployment rate of 7% for new college graduates (Abel et al., 2014).

Research on employment suggests that recent college graduates have an advantage in the labor market simply because they have a college degree (Burning Glass Technologies, 2014; Carnevale, Strohl, & Gulish, 2015). The Center for Education and the Workforce reports that a bachelor's degree is often required as a starting point for jobs that require more training, and ultimately more pay (Carnevale, Strohl, & Gulish, 2015). Burning Glass Technologies, a Boston-based employment firm that analyzes job advertisements, reports that employers are more likely to replace workers who do not have bachelor's degrees with those who do (Burning Glass Technologies, 2014). Furthermore, many employers are screening applicants by requiring bachelor's degrees for positions that do not require, nor are likely to require, the kind of training one would get obtaining a bachelor's degree. For example, in North Carolina, 49% of online job ads specifically sought out college graduates (Carnevale, Jayasundera, Repnikov, & Gulish, 2015). While the labor market has become more challenging, recent college graduates fare better in both good and bad economic times than young people who do not have a college degree (Abel et al., 2014; Baum et al., 2013; Carnevale, Strohl, & Gulish, 2015).

Obtaining a college degree appears to not only increase chances of employment during varied economic times, but also increase earnings potential (Julian, 2012). Between 1981 and 1991, the average income for males and females with four years of college rose by 11% and 45%, respectively (Synder, 1993). As a result, beginning in the 1980s, there was a widening of the income gap between those with less education compared to those with more education. Since the 1980s, the wage gap between people who have a college degree and people with only a high school diploma has nearly doubled (Hanford, 2011). In 2013, workers with four-year college degrees made 98% more an hour on average (Leonhardt, 2014). Lifetime earnings for workers with a college degree are about $1 million more than earnings of those with a high school diploma (Julian, 2012). Lifetime earnings for workers with a doctorate degree are approximately $1 million more than workers with a four-year degree.

Individuals with a college degree are more likely to be employed, earn more, and also be more satisfied with their life than non-college educated individuals (Carnevale, Smith, & Strohl, 2010). According to the Center on Education and the Workforce, college-educated individuals tend to be healthier and more satisfied with their jobs, perhaps because they have better health and retirement benefits than individuals who do not attend college (Carnevale et al., 2010). Furthermore, college-educated individuals are more likely to read to their children, helping them be better prepared for school. A wealth of evidence exists that increased educational attainment improves health, lowers crime rates, and produces citizens that participate in civic and democratic processes, such as voting and volunteering (Baum et al., 2013; Lumina Foundation, 2013).

According to the most recent U.S. Census (2013) data, 40% of working-age (ages 25-64) Americans have at least a two-year degree. In NC, 39.7% of working-age adults (ages 25-64) hold a two- or four-year college degree, slightly below the national average of 40% (Lumina Foundation, 2015). Each state has its own strategies and goals for increasing postsecondary degree attainment rates (North Carolina New Schools, 2013). According to the National Center for Education Statistics (2015), postsecondary education is defined as a "formal instructional program whose curriculum is designed primarily for students who are beyond the compulsory age for high school" (p. 1). Postsecondary education includes programs "whose purpose is academic, vocational, and continuing professional education, and excludes avocational and adult basic education programs (National Center for Education Statistics, 2015, p. 1).

In NC, high school reform efforts are a well-known strategy employed by the state to achieve higher postsecondary degree attainment rates. The Early College High School Initiative (ECHSI) is one high school reform effort in NC that has spread widely throughout the state.

The Early College High School (ECHS)

The origins of the Early College High School (ECHS) can be traced back to K-14 education models proposed long ago (Stern & Kysilka, 2008). In the 1930s and 1940s, Leonard Koos advocated for his "6-4-4" plan, which organized grades seven through ten in a junior high school and grades eleven through fourteen in a junior college (Stern & Kysilka, 2008). The theory was that the plan would remove the barrier between secondary and postsecondary coursework and benefit students and their families in several ways. The time

students needed to complete a college degree would be reduced, families would save money on tuition costs, and students would be exposed to a collegiate environment.

Koos' ideas of integrating high school and college, while a common topic in educational journal articles, failed to take off due in large part to Walter Crosby Eelles (Stern & Kysilka, 2008). Eelles, a professor of education at Stanford University, advocated for a separate two-year junior college and argued that Koos' four-year junior college went against the "psychology of the American people" (Stern & Kysilka, 2008, p. 95). By 1941, only 10 public school systems were operating under a 6-4-4 model. The idea of integrating high school and community college virtually disappeared for the next 30 years. In 1971, concern over high school dropout rates in New York City resulted in the development of the first Middle College, LaGuardia Middle College High School (New York City Department of Education, 2015). LaGuardia is still operational and targets students aged 16 through 20 who are identified by their middle schools as potential dropouts.

In the early 2000s, concern over unemployment resulted in a renewed interest in the concept of integrating high school and college (Gates Foundation, 2005). The Early College High School Initiative (ECHSI) was officially launched in 2002 with support from the Bill & Melinda Gates Foundation, the Carnegie Corporation of New York, the Ford Foundation, the W.K. Kellogg Foundation, the Dell Foundation, the Lumina Foundation for Education, the Walton Family Foundation, and other local foundations (Jobs for the Future, 2015). The ECHSI was specifically designed to target students who are statistically underrepresented in higher education, such as low-income students, students of color, English language learners, and first-generation college students (American Institutes for Research, 2006). Since 2002, the ECHSI has become a national movement that has resulted in over 280 ECHSs, serving

more than 80,000 students in 31 states and the District of Columbia (Jobs for the Future, 2015).

ECHSs are small, autonomous schools that are designed for students underrepresented in postsecondary education to simultaneously earn a high school diploma and up to two years of college credit—tuition free (Jobs for the Future, 2013). The ECHS model was based on the older Middle College model+. The similarities of ECHSs and Middle Colleges include: location on or near a two- or four-year college or university, small class size, a strong academic program, supportive environment, and a school design that targets students who are underrepresented in colleges. ECHSs take the model a step further by providing a coordinated course of study in which students can earn up to 60 college credits while in high school. ECHSs have been characterized as a "slingshot" approach, pushing struggling students to achieve more than traditional schools expect of them (Jacobson, 2005). Hoffman, Vargas, and Santos (2009) suggest that the ECHS is the most intensive accelerated learning option available to high school students.

In 2004, the ECHSI was launched in NC with partnership from the NC Department of Public Instruction (NCDPI), NC New Schools, the NC Independent Colleges and Universities, the NC Community College system, and the University of North Carolina (North Carolina New Schools, 2013). In 2005, the first 13 ECHSs opened in all three regions of NC. Since 2005, the number of ECHSs in NC has increased more than fivefold, from 13 to 76. NC has become a national leader in the development of ECHSs, currently serving a combined enrollment of more than 15,000 students in 71 counties and districts across the state.

Statement of the Problem

The renewed interest in integrating high school and college was due in large part to rising concern over postsecondary degree attainment rates. Recently, the Lumina Foundation (2015) reported on postsecondary degree attainment in the U.S. using data from the most recent year of the American Community Survey of the U.S. Census Bureau (2013). According to the report, the postsecondary degree attainment in 2013 was 40%, a slight increase from 39.4% the previous year. Unfortunately, other countries have first caught up, and then surpassed the U.S. in postsecondary degree attainment rates. According to data from the Organization for Economic Cooperation and Development (2014), the United States ranks 12th worldwide in postsecondary degree attainment for young people (ages 25-34). Korea, Japan, Canada, Ireland, the United Kingdom, Norway, and Israel are all among the countries that are now ahead of the U.S. in postsecondary degree attainment rates.

Postsecondary degree attainment has become not only an educational and political issue, but also an economic and social necessity. The U.S. Bureau of Labor Statistics (2013) projects that occupations requiring postsecondary education will grow 14% by 2022. According to the Center on Education and the Workforce, 65% of all U.S. jobs—almost two-thirds— will require some form of postsecondary education and training by 2020 (Carnevale & Smith, 2012). This translates into the need for 15 million college graduates by 2025 if the U.S. is going to equal the degree attainment in top-performing countries (The Council of State Governments, 2009). With the increasing need for individuals to obtain some level of higher education, the state of the U.S. high school system is a matter of great concern (Lumina Foundation, 2013). Educators, policymakers, and the public continue to be

concerned by high dropout rates and low postsecondary degree attainment rates, particularly among certain subgroups of students.

As the nation's population has become more diverse, it has become critically important to increase the postsecondary degree attainment rate among underrepresented groups. Among young adults (ages 25-29), postsecondary degree attainment rates have increased for all subgroups, but still vary significantly based on race/ethnicity, geography, and other factors (Institute of Education Sciences, 2015). Since 1988, the number of females in post baccalaureate programs has exceeded the number of males. From 1976 to 2012, the percentage of Hispanic college students rose from 4% to 15%, the percentage of Asian/Pacific Islander students rose from 2% to 6%, the percentage of Black students rose from 10% to 15% , and the percentage of American Indian/Alaska Native students rose from 0.7 to 0.9%. During the same period, the percentage of White students fell from 84% to 60%. Postsecondary degree attainment patterns for low-income Americans tell the same story (Lumina Foundation, 2014; National Center for Education Statistics, 2012). Low-income students are defined as those who participate in the federal National School Lunch Program, which provides free or reduced-price lunches to children each school day (U.S. Department of Agriculture, 2014). The National School Lunch Program is available to all eligible students living in the U.S., regardless of citizenship status. Students are "entitled to free lunches if their families' incomes are below 130% of the annual income poverty level guideline established by the U.S. Department of Health and Human Services and updated annually by the Census Bureau" (New America Foundation, 2014, p. 1). Students with a "family income at or below 185% of the poverty level are eligible for reduced-price lunches" (New America Foundation, 2014, p. 1).

Part of the challenge in increasing postsecondary degree attainment rates is getting students to first enroll in college. The gap in college enrollment rates among low-income and high-income students is well-documented in the literature (Bailey & Dynarski 2011; Lumina Foundation, 2014; National Center for Education Statistics, 2012). In 2012, the most recent year for which National Center for Education Statistics (NCES) figures are available, the NCES reported data on college enrollment based on family income. NCES defines "low-income" as the bottom 20% of all family incomes, high-income as the top 20%, and middle-income as the 60% in between (Desilver, 2014). According to NCES (2012), "50.9% of recent low-income high school completers (a category that includes both graduates and people who completed an equivalency degree and who are ages 16 to 24) were enrolled in a 2- or 4-year college" (p. 1). College enrollment rates among middle- and high-income students were 64.7% and 80.7%, respectively.

Although recent data exists on the relationship between family income and college enrollment, there is a lack of data on postsecondary degree attainment and family income (Chingos & Dynarski, 2015). The Pell Institution (2015) recently reported that 99% of college students in the top income quartile went on to complete a bachelor's degree, compared to 21% in the poorest quartile. While the findings received prominent media attention, Chingos and Dynarski (2015) argue that these statistics are wrong. The data from the Pell Institution (2015) was based on the monthly Current Population Survey (CPS), a joint effort between the U.S. Census Bureau and the U.S. Bureau of Labor Statistics (BLS). The problem with using data from the CPS is that the survey provides income of young adults' parents only if they are currently living at home or temporarily away from home (Chingos & Dynarski, 2015). Once a child forms their own household, they disappear from

their parents' CPS record. Chingos and Dynarski (2015) report there is "no data source that can be used to credibly and consistently measure these gaps on an annual basis" and "the federal government could solve this problem at low cost by supplementing surveys with administrative data" (p. 1).

While race and family income impact postsecondary degree attainment rates, so does gender. Since 2000, postsecondary degree attainment rates have been consistently higher for women (Institute of Education Sciences, 2015). In 2013, 37% of women had completed a bachelor's degree or higher, compared with 30% of men. Furthermore, 9% of females had completed a master's degree or higher, compared with 6% of males. Gender gaps in postsecondary degree attainment are even further exacerbated by recent changes in the economy that have resulted in the loss of middle-skill jobs in occupations traditionally held by men (Lumina Foundation, 2013).

Yet another postsecondary degree attainment gap emerges when examining the data on educational attainment for first-generation college-going students—those whose parents did not attend or complete college (Baum et al., 2013). First-generation students frequently enroll in colleges that are less selective and challenging, an enrollment pattern that significantly decreases the probability of graduating (Chen, 2005). First-generation students are also likely to drop out prior to graduating college due to attending part-time and other factors that have been shown to influence degree completion.

The patterns in educational attainment among subgroups of students are no different in NC. In 2014, the four-year cohort graduation rate (the percentage of students graduating from high school in four years or less), was 83.9%, the highest recorded since 2006 (North Carolina Department of Public Instruction, 2014c). While this record high shows

improvement in NC, the high school graduation rate and postsecondary degree attainment rate still vary significantly by subgroup.

According to the U.S. Census Bureau (2013), postsecondary degree attainment rates are significantly lower for Blacks, Hispanics, and Native Americans than for Whites and Asians. In 2013, postsecondary degree attainment rates by subgroup for adults (ages 25-64) were: Whites (44.39%), Asians (58.70%), Blacks (26.88%), Hispanics (15.65%), and Native Americans (23.65%). Postsecondary degree attainment rates are lower for first-generation and low-income students than for students who grow up in a high-income family and/or a family with college-educated parents.

The research shows that race, family income, gender, and first-generation status all play a significant role in postsecondary degree attainment (U.S. Census Bureau, 2013). However, what are the implications of the postsecondary degree attainment patterns nationally and in NC? Perhaps the clearest evidence of the implications comes from the fact that employers are struggling to find people with the skills they need to fill current job openings. In NC, over 40% of industry-wide employers cited lack of work experience, education credentials, and technical skills as their main difficulties in filling jobs (North Carolina Commission on Workforce Development, 2014). Seventy percent of manufacturers cited a lack of technical skills as a reason for difficulties in hiring, suggesting that advanced manufacturing techniques are dramatically increasing the demand for postsecondary education.

While employers need more educated employees, the overall U.S. labor force participation rate for men and women is declining (Castellano, 2013). The labor force participation rate, as defined by the U.S. Bureau of Labor Statistics (2014), is "the percentage

of the population [16 years and older] that is either employed or unemployed, (that is, either working or actively seeking work" (p. 1). One reason cited for the decline in the labor force participation rate is the aging and retirement of workers (Farley, 2015). As many older college educated people (ages 55-64) near retirement age, the young adult age group (ages 25-34) must participate in postsecondary education at an even greater rate to fill the job positions of the college-educated who are retiring from work (Colby & Ortman, 2014).

Compounding the loss of workers who are retiring is the decreasing number of students who are graduating from high school and enrolling in science, technology, engineering, and mathematics (STEM) fields. According to a National Science Foundation (NSF) report, "the nation is failing to meet the STEM education needs of U.S. students, with serious implications for our scientific and engineering workforce in the 21st century" (National Science Foundation, 2007, p. 5). Using international benchmarks, such as the Programme for International Student Assessment (PISA) test, NSF found that U.S. students are behind students in other industrialized nations in STEM critical thinking skills. When employers can't find people with the skills and credentials they need, the economy as a whole suffers and employment rates do not improve as quickly during economic recovery (Abel et al., 2014).

Purpose of the Study

The present study is an exploratory analysis of school, teacher, and student characteristics at ECHSs and comparable high schools in the same districts in NC. The study employed quantitative methods using the existing database at the North Carolina Education Research Data Center (NCERDC). Established in 2000, the NCERDC stores data from the NCDPI and the NCES (Duke University, 2015). The data analysis included the use of

descriptive, comparative, and inferential statistics. Parametric and non-parametric approaches were used, including chi-square and various general linear model techniques that were appropriate to the data.

The research was designed to utilize information regarding school, teacher, and school characteristics in order to analyze how these characteristics were impacting student achievement at ECHSs and comparable traditional high schools. The measure of student achievement was students' test scores on the Algebra I End-of-Course (EOC) test taken during the 2008-2009 school year. The school year 2008-2009 was selected because it was the most recent year in the accessed NCERDC dataset that included data from all students, schools, and teachers for the same class outcomes. In the study, there were 34 ECHSs and 56 randomly drawn comparable traditional high schools. The following research questions were examined in the study:

1. What are the effects of school level characteristics on student achievement at ECHS and control group schools?
2. What are the effects of teacher level characteristics on student achievement at ECHS and control group schools?
3. What are the effects of student level characteristics on student achievement at ECHS and control group schools?

Significance of the Study

The present study was significant for several reasons. First, the study contributed to the literature on high school reform efforts by being one of few studies conducted by a researcher independent of the ECHSI. Second, the location of the present study was significant because NC is a national leader in the implementation of ECHSs (North Carolina

New Schools, 2013). In addition, public high schools in NC administer EOC tests that measure student achievement in specific areas (North Carolina Department of Public Instruction, 2011c). Third, the study was significant because it examined the benefits and challenges of the ECHSI, which is still a relatively new high school reform effort. Finally, the study examined the distribution of teacher quality at ECHSs and traditional high schools, potentially helping address inequalities that still exist in education.

Over the last several decades, there have been a number of efforts at school reform and improvement in the U.S. However, Slavin (1989) observes that the cycle of reforms has—like a pendulum swing—continued to move from one fad to another with little evidence of national progress. In an effort to halt the frustrating cycle of reforms, national policies are encouraging extensive use of rigorous research methods (Borman, 2002). With funding from the Bill and Melinda Gates Foundation, several large scale evaluations have employed rigorous research methods to study the impact of the ECHSI (American Institute for Research & SRI International, 2009; Berger et al., 2013). However, Frumkin (2006) warns that findings should be viewed with skepticism when the funding for evaluation comes from the foundation implementing a program or initiative. Therefore, the study was significant because it is one of the few studies on ECHSs conducted by a researcher independent of the ECHSI.

The location of the study was significant because with 76 ECHSs, NC is currently a national leader in the implementation of ECHSs (North Carolina New Schools, 2013). However, since the implementation of the ECHSI in NC in 2004, few studies have been completed on these emerging institutions [ECHSs] and the consequences of their existence

(Williams & Southers, 2010). Study of ECHSs within NC added to the growing body of Early College research and aided in the evaluation of high school reform in NC.

The location of the study in NC was also significant because of the state's longstanding history of administering EOC tests in high school (North Carolina Department of Public Instruction, 2011c). Although many states administer tests at the high school level, most of these tests are in the form of comprehensive high school exit exams or minimum competency exams (Clotfelter, Ladd, & Vigdor, 2010). While such tests show that students meet some specified level of achievement to graduate, the material covered on the tests often goes well beyond that covered in a specific course. The material is also often at a relatively low level, one more appropriate to middle school rather than high school.

Unlike many other states, NC has a Standard Course of Study at the high school level that culminates in EOC tests that measure achievement in specific subjects, such as English, biology, and algebra (North Carolina Department of Public Instruction, 2011c). NC is one of the few states that have had EOC tests at the high school level for many years (Southern Regional Education Board, 2007). Therefore, NC served as an excellent site for a study of teacher characteristics and student outcomes. Analyzing EOC data provided insight into how NC ECHSs were faring in helping low-income and minority students demonstrate mastery of content. As a result, all high schools can develop ways to provide academic and social support that will help students graduate from high school and complete a college degree.

While preliminary data documents the benefits of ECHSs, less is known about the challenges of ECHSs. Since ECHS students are taking college classes, one challenge of the model is how the ECHS is impacting the learning environment at partnering colleges. A survey at 24 community colleges in NC showed that 88% of the chief academic officers

thought the ECHS created space issues for community colleges (Williams & Southers, 2010). Furthermore, community college instructors were not always prepared to accommodate young learners and voiced comments of misbehavior, lack of maturity, or lack of academic preparation among ECHS students. Scheduling conflicts are another issue since ECHS students are filling spots in classes at colleges where adult students attend. Therefore, research on the ECHS model was needed to ensure that reform efforts help high school students, but not at the expense of adult learners or college staff.

Another challenge of the ECHS model is that more high school students are encouraged to enroll in college courses (Jobs for the Future, 2013). However, the expanded access has resulted in lower pass rates for some college courses (Edmunds et. al, 2010). Students who are not prepared to take college courses, and do so anyway, may have a negative experience that potentially affects subsequent success in college, as well as interest in specific fields of study (Alaie, 2011). The present study was significant because the research findings will help leaders make more informed decisions to ensure that ECHS students are provided with the proper guidance and structure they need when taking college classes.

Finally, the study was significant because it examined the distribution of teacher quality at ECHSs and traditional high schools. ECHSs serve students that, research shows, suffer from a lack of equality in the distribution of teacher quality (Goldhaber, Lavery, & Theobald, 2014). There are several ways that research on teacher characteristics will help address inequalities in the distribution of teacher quality. First, parents and guardians will be able to make more informed educational choices for their children. Second, teachers will gain insight into how they can grow professionally and become better teachers. Third,

students will be more informed when making decisions about whether to enroll in an ECHS or a traditional high school. Lastly, administrators can make better decisions at ECHSs and traditional high schools if they know how different measures of teacher quality impact student achievement.

Limitations

The present study has several limitations with respect to the study sample, location, and the primary data source used in the study. First, the study utilized data collected from 34 ECHSs and 56 randomly drawn comparable traditional high schools during the 2008-2009 school year. While the researcher had access to all student data, a limitation of the study was that the researcher had no control over whether a student was admitted to the ECHS or a comparable traditional high school. Although some ECHSs admit their students through a lottery system, it is sometimes unclear how ECHSs that do not use a lottery admit their students (Cabarrus County Schools, 2015). Even when students are chosen for admission by random assignment, certain variables influence the Early College's decision to put them in the pool of eligible students to begin with. For example, some ECHSs automatically admit siblings of current students (J. Edmunds, personal communication, September 5, 2012; Wake County Public School System, 2015). Therefore, there may be pre-existing characteristics of the students admitted to ECHSs that influence student achievement.

A second limitation of the study was location. The study only examined ECHSs and comparable traditional high schools in NC, not the entire population of ECHSs implemented across the U.S. Therefore, results of the study may not be generalizable to other states because the ECHS philosophy may differ depending on the location of ECHSs. Also, the results of the study may not be generalizable to other states because EOC test data was used

to measure student achievement and some states administer a different test at the high school level in order to measure achievement.

Third, the present study is limited by any NCERDC data that was either lacking or not analyzed in the study. For example, the study only utilized NCERDC data from 2008-2009, the most recent year in the accessed dataset that included data from all students, schools, and teachers for the same class outcomes. Therefore, the study only analyzed a snapshot of data from selected ECHSs and comparable high schools and cannot determine how teacher characteristics impact students as they progress into the workforce or four-year college programs of study. The researcher also did not have access to any of the data on National Board Certification (NBC); therefore, it was not possible to examine the impact of NBC on student achievement at selected schools. Furthermore, given the short history of the ECHSI, the NCERDC also had limited data on postsecondary enrollment rates and other academic measures.

Summary

America's global competitiveness depends on the ability of our high school graduates to earn a postsecondary credential (Gates Foundation, 2005). College graduates are more likely than non-college graduates to be employed, earn more, and be healthier and more satisfied with their jobs (Abel et al., 2014; Baum et al., 2013; Carnevale et al., 2010; Carnevale et al., 2015; Hanford, 2011; Julian, 2012). Across the nation, states are struggling to increase postsecondary degree attainment rates (Jobs for the Future, 2013). Many states, such as NC, are redesigning high schools in an effort to increase postsecondary degree attainment rates so more people can gain employment and employers can hire the educated workers they need (North Carolina Commission on Workforce Development, 2014). The

ECHSI is one high school reform effort that has been implemented nationwide and in NC (North Carolina New Schools, 2013).

Chapter Two

Review of the Literature

Chapter Two, a review of the literature, is divided into several sections. The first section contains an overview of high school reform efforts in the U.S. and NC. The second section discusses the Early College High School (ECHS) model and reports preliminary student outcomes. Third, research on teacher quality is discussed and findings presented on how different measures of teacher quality impact student achievement. Fourth, literature is reviewed that pertains to the impact of school characteristics on student achievement. Suggestions for future research conclude the chapter.

Reform of High School Curricula in the United States

Fifteen years ago Bill Gates said, "Training the workforce of tomorrow with the high schools of today is like trying to teach kids about today's computers on a 50-year-old mainframe. It's the wrong tool for the time" (Gates Foundation, 2005, p. 1). Gates went on to say, "We designed these high schools; we can redesign them." In many states throughout the nation, this is exactly what is happening.

Throughout the nation, states have recognized that high schools must be redesigned in order to ensure that every student will be successful in completing a postsecondary degree (Gates Foundation, 2005). As a result, high schools have begun providing accelerated learning options for students to earn college-level credit during high school (The College Board, 2013). Accelerated learning options vary by state, but all 50 states have some type of accelerated learning option for students to earn college credit while in high school (Jobs for the Future, 2013). The present study focused on the accelerated learning option of the

ECHS. However, the researcher first provides an overview of all the accelerated learning options in NC that provide students with the opportunity to earn college credit in high school.

The first accelerated option, Advanced Placement (AP), is a program of courses offered by high schools that provide opportunities for students to earn college credit if they meet scoring requirements on a national test (The College Board, 2013). The second accelerated option, dual enrollment, allows students the opportunity to take college courses through programs, such as Huskins, Concurrent Enrollment, and Learn and Earn Online (North Carolina Department of Public Instruction, 2011b). Since the spring of 2012, these three programs have been combined into Career and College Promise (CCP), NC's dual enrollment program for high school students. CCP offers three pathways designed to give high school students a head start on college and career training. The three pathways that are offered are the College Transfer Pathway, the Career Technical Education Pathway, and the Cooperative Innovation High School Pathway.

In order to be on a College Transfer Pathway, students must be a junior or senior with a 3.0 GPA and demonstrate college readiness on an approved assessment or placement test (North Carolina Department of Public Instruction, 2011b). In a College Transfer Pathway, students can earn course credits that will transfer seamlessly to any public or participating private college or university. Students wishing to enroll in the Career and Technical Pathway must be juniors or seniors with a 3.0 GPA who have met certain course prerequisites. In the Career and Technical Pathway, students can earn credits towards a job credential, certificate, or diploma in a technical career. Tuition in the College Transfer Pathway and Career Technical Pathway is free, but students must pay for their books and tuition for summer semester courses.

The third pathway offered by CCP is the Cooperative Innovation High School (CIHS) Pathway (North Carolina Department of Public Instruction, 2011b). CIHSs have no more than 100 students per grade level and must partner with an institution of higher education to "enable students to concurrently obtain a high school diploma and begin or complete an associate degree program, master a certificate or vocational program, or earn up to two years of college credit within five years" (North Carolina Community College System, 2015, p. 1).

CIHSs are exempt from many of the requirements and restrictions of CCP, making such schools an appealing option for students who wish to enroll in classes outside of the preset pathways (North Carolina Department of Public Instruction, 2011b). Students attending CIHSs do not have to pay for tuition or books. Although all CIHSs share the same design principles, there are different models tailored to different needs. The present study examined one specific CIHS model, the Early College High School (ECHS).

The Early College High School (ECHS)

ECHSs are public schools funded by their school districts, as are traditional high schools (Jobs for the Future, 2013). In each ECHS, the middle grades are either included in the school or the school provides outreach to middle school students to promote awareness of the ECHS option. All ECHSs partner with either a two- or four-year institution of higher education, and in a few instances, both (Jobs for the Future, 2011). The ECHS and the institution of higher education partner together to design a rigorous and coherent course of study to help students make a smooth transition into college work.

Most ECHSs (50%) are located on a college campus and 47% of ECHSs are freestanding and located near a college campus (Jobs for the Future, 2011). Other ECHSs (3%) serve Native American students and are located on reservations. By partnering with an

institution of higher education, ECHS students build their identity as college participants, increasing the chance that they will continue on and complete a postsecondary degree (Jobs for the Future, 2013). Another strategy employed by ECHSs to increase postsecondary degree attainment rates is the enrollment process.

The enrollment of ECHSs reflects the overarching goal of the ECHSI, which is to increase the number of traditionally underrepresented students graduating from high school and completing college (Jobs for the Future, 2013). The most recent data, based on a three-year average from 2010 to 2013, showed that approximately 64% of students at ECHSs were either Black or Hispanic. Sixty-one percent were from low-income families and 39% were from higher-income families or had no reported income. The majority of students were first-generation college-going students (Jobs for the Future, 2013). Nearly a third of ECHSs received Title 1 funding, a federal program that awards funds to schools who serve a high percentage of low-income students. Approximately three fourths of ECHS students were first-generation students, meaning they would be the first in their families to graduate from college (Berger, Adelman, & Cole, 2010).

ECHSs share a common goal of enrolling students that are traditionally underrepresented in higher education (Jobs for the Future, 2013). However, each ECHS develops a unique vision and learning environment to best serve students (Jobs for the Future, 2011). ECHSs have a variety of missions or themes that include allied health and medicine, biotechnology, engineering, international business, liberal arts, linguistics, mathematics, science and technology, Native American culture, and teacher preparation (Jobs for the Future, 2006). Just like other ECHSs across the nation, each ECHS in NC has its own purpose and mission statement (Hall, 2008; Jobs for the Future, 2013). For example,

some ECHSs are STEM-focused, meaning they focus on preparing students for careers in science, technology, engineering, and mathematics.

ECHSs also vary in the grades they serve (Jobs for the Future, 2011). Fifteen percent of ECHSs serve students in middle grades and 62% serve students in grades 9-12. Thirteen percent include grade 13, allowing more time for students to prepare for college-level work or graduate with a high school diploma and an associate's degree. Some schools (9%), such as those that serve students who dropped out of a traditional school, are ungraded.

Although ECHSs differ in their purpose, location, or grades served, the ECHSI specifies five principles that all ECHSs nationwide are required to follow (Jobs for the Future, 2011). Table 1 lists these five core principles, which constitute the fundamental tenants of the initiative.

The need for the ECHSI is supported by evidence at the national and state level that minority, low-income, and first-generation students are less likely to complete college than White, high-income students with college-educated parents (Bailey & Dynarski, 2011; Baum et al., 2013; Chen, 2005; Institute of Education Sciences, 2015; Lumina Foundation, 2014; National Center for Education Statistics, 2012). However, now that the ECHSI has been implemented, what is the evidence that it works?

High School and Postsecondary Outcomes of Early College High Schools

The American Institutes for Research and SRI International (2009) have both partnered together to evaluate the ECHSI using qualitative and quantitative data sources. Data sources used by the American Institutes for Research and SRI International include surveys of students and administrative records from schools, districts, and states. Data on postsecondary outcomes comes from the National Student Clearinghouse (NSC).

Table 1

Five Core Principles of the Early College High School Initiative Nationwide

Design Principle	Definition
Core Principle 1	Early colleges are committed to serving students underrepresented in higher education.
Core Principle 2	Early colleges are created and sustained by a local education agency, a higher education institution, and the community, all of whom are jointly accountable for student success.
Core Principle 3	Early colleges and their higher education partners and community jointly develop an integrated academic program so all students earn one to two years of transferable college credit leading to college completion.
Core Principle 4	Early colleges engage all students in a comprehensive support system that develops academic and social skills, as well as the behaviors and conditions necessary for college completion.
Core Principle 5	Early colleges and their higher education and community partners work with intermediaries to create conditions and advocate for supportive policies that advance the early college movement (Jobs for the Future, 2011).

The most recent data on the ECHSI comes from a study that utilized data from the American Institutes for Research and SRI International (2009) to identify 10 ECHSs in five states that (a) operate exclusively as an ECHS, (b) had graduates during the study years, and

(c) employed and kept records of a lottery process to determine who would be offered admission to the program (Berger et al., 2013; Berger, Turk-Bicaki, Garet, Knudson, & Hoshen, 2014). The study included three cohorts of students: those who entered ninth grade in 2005-06, 2006-07, and 2007-08. The study period extended through the summer of 2013, as far as four years past high school for the oldest students.

Proficiency on state assessments. Early achievement data indicates that ECHS students are scoring higher on state-level reading and math exams, compared with students in the local districts of ECHS (American Institutes for Research & SRI International, 2009). In 2007-2008, ECHSs students scored 7% points higher than regular high school students on state assessments in both reading and mathematics.

Most recently, researchers found that admission to the ECHS had a statistically significant positive effect on English language arts achievement (Berger et al., 2013). After translating the standardized scores into percentiles, ECHS students scored at the 64th percentile in English language arts, while comparison group students scored at the 59th percentile. Admission to an ECHS did not have a significant impact on mathematics achievement. National data indicates that ECHS students are scoring higher than traditional high school students on state assessments, but how is the ECHS model impacting high school graduation rates?

High school graduation rates. In 2008, 66% of the students that started at an ECHS in 9th grade were expected to graduate on time (American Institutes for Research & SRI International, 2009). This estimate was 14% higher than the estimated rate of other high schools in the local districts of ECHSs. However, the expected graduation rate was based only on the 12 ECHSs that had four or five years of data available.

According to Jobs for the Future, 80% of ECHSs had a graduation rate in 2010 that was equal to, or higher than, their school district (Jobs for the Future, 2013). The average graduation rate for ECHSs was 84%, compared to 76% for their school districts. Another study analyzed high school graduation rates from 2005 to 2011 and found 86% of ECHS students graduated from high school, compared with 81% of comparison students (Berger et al., 2013). The most recent data, based on outcomes for thousands of students who attended about 100 ECHSs, found ECHS students were far more likely to graduate high school than students from traditional high schools (Jobs for the Future, 2014). Ninety percent of ECHS students received a high school diploma, compared with 78% of students nationally. The research indicates that ECHS students are graduating high school at higher rates than traditional high school students. However, how effective have ECHSs been in helping students accrue college credits while still in high school?

College credit accrual. During 2006-2007, 63% of ECHS students were enrolled in college courses, with 11th and 12th graders accruing an average of 22 and 31 credits, respectively (Jobs for the Future, 2013). In 2007, national survey data indicated that ECHS graduates earned an average of 23 college credits (American Institutes for Research & SRI International, 2009). Of the 19 ECHSs that had been open for at least four years, nine reported that some of the graduates had completed a high school diploma and received two years of college credit.

The number of ECHSs continues to grow, along with the percentage of students earning college credit (Webb & Mayka, 2011). In 2009, ECHS students earned an average of over 20 college credits, 44% earned at least a year of transferable college credit, and 25% earned two full years of college credit or an associate's degree (Jobs for the Future, 2011). In

2010, 23.3% of ECHS graduates earned an associate's degree or technical certificate (Jobs for the Future, 2013). Furthermore, more than half (56%) of ECHSs reported that students had earned two or more years of college credit. While efforts of the ECHSI appear to help students earn college credit, how is the accrual of college credit impacting postsecondary enrollment and completion after high school?

Postsecondary enrollment and attainment. In 2010, 5,414 students graduated from ECHSs across the country (Jobs for the Future, 2013). More than 250 ECHS graduates earned merit-based college scholarships and four students earned the prestigious Gates Millennium Scholarship. Based on a three-year average from 2010-2013, 71% of ECHS graduates enrolled in college the semester following high school graduation, compared with 54% of low-income graduates nationally (Jobs for the Future, 2014). The most recent data from the NSC indicated that postsecondary enrollment was 80% for ECHS students and 71% for comparison group students (Berger et al., 2013).

As one of the newest accelerated learning options, there is limited longitudinal data that documents ECHS graduates' postsecondary success in attaining a postsecondary degree. One national study has followed cohorts of ECHS students for two, three, or four years after they graduate high school (Berger et al., 2013). The impact of ECHSs on college degree attainment was found to be significantly stronger for female students, racial/ethnic minorities, and low-income students. Recently, Jobs for the Future (2014) reports that 86% of ECHS graduates who enrolled in college persisted for a second year, compared with 72% of college students nationally (Jobs for the Future, 2014). A few studies have found that, compared with students nationally, ECHS graduates are less likely to need remediation in

college, a key indicator for college future success (Berger et al., 2013; Webb & Gerwin, 2014).

Nationally, the evidence suggests that the implementation of the ECHS has been successful in helping underrepresented students graduate from high school with significant college credit, enroll in college, and perhaps persist in college at higher rates than traditional high school students (American Institutes for Research and SRI International, 2009; Berger et al., 2013, Jobs for the Future, 2011; Jobs for the Future, 2014). The national success is likely attributed to the consistency of all ECHSs, due to the requirement that all ECHSs adhere to the core principles of the ECHSI (Jobs for the Future, 2011). However, states do have some flexibility in implementing ECHSs so they can best serve students. What then, has been the impact of the ECHSI on student achievement in NC?

The Early College High School in North Carolina

The majority of the research on the ECHSI in NC comes from two sources: North Carolina New Schools (2013) and the SERVE Center at the University of North Carolina at Greensboro (Edmunds, Unlu, Glennie, Bernstein, & Smith, 2013). NC New Schools (2013), one of the largest public school innovation agencies in the country, partners with educators and districts to design schools using several organizational models, including the ECHS. Currently, NC New Schools partners with 76 ECHSs in NC. Another major source of research on the ECHSI in NC comes from an ongoing experimental study by the SERVE Center at the University of North Carolina at Greensboro (Edmunds et al., 2013). The study, now in its eighth year, is comparing the progress of more than 2,000 ECHS students to a control group of about the same number of students who enrolled elsewhere. All of the students in the study applied to the ECHS. Then, the applicants were randomly selected to

either the treatment group (students who attend an ECHS) or the control group (students who enrolled in other schools). The lottery-based randomization in the study ensured that the ECHS students and comparison students were similar at high school entry.

High School and Postsecondary Outcomes of Early College High Schools in North Carolina

The national data on the ECHSI indicates that ECHSs have had success in increasing high school graduation and college enrollment rates (Jobs for the Future, 2013). However, states can implement the ECHSs differently, while still adhering to the core principles of the ECHSI. Therefore, it is important to examine student outcomes of the ECHSI in NC.

Proficiency on state assessments. In NC, EOC tests are administered in high school as a way to sample students' knowledge of subject-related concepts that are specified in NC's Standard Course of Study (North Carolina Department of Public Instruction, 2011c). According to data from the 2011-2012 school year, 74% of ECHSs in NC had EOC proficiency greater than 95%, compared with only 15.2% of NC public schools (North Carolina New Schools, 2013). Ninety-two percent of ECHSs had EOC proficiency greater than 85%, compared with 39.5% of NC public schools. The EOC Composite Pass Rate, the schools' combined pass rates on the three required EOC exams, was 96% for ECHSs and 81.4% for NC public schools. Furthermore, over 90% of NC ECHS students passed the Algebra I EOC, compared with 71.9% of NC public school students. Completion of Algebra I is a critical step for college readiness and key for students to be on track for graduation (North Carolina New Schools, 2013).

The results of the SERVE study support the research of NC New Schools. ECHS students had higher course-taking and course-completion rates in Algebra I than control

group students (Edmunds et al., 2010). The difference between ECHS and control group students was 11 percentage points in Algebra I course-taking and six percentage points in Algebra I success. ECHS students did have higher course taking and completion rates of English I; however, the differences were not statistically significant.

By the end of the 9th grade year, almost all of the ECHS students (97.5%) had taken at least one college preparatory course (Geometry, Algebra I, Algebra II, and one math course beyond Algebra II) (Edmunds et al., 2010). On the other hand, only about three quarters of the control group had taken a college preparatory class by the end of the 9th grade. Furthermore, compared with the control group, a larger percentage of 9th grade ECHS students were progressing through a college preparatory track of study.

Data from the SERVE study also suggests that ECHSs are going a long way in closing performance gaps among subgroups (Edmunds et al., 2010). The gap between the percentages of minority and nonminority students successfully completing Algebra I and English I were smaller in ECHSs than in the control group. For example, the ECHS group showed 2% points separating minority and nonminority students' completion rates in Algebra I, compared with 13.6% points in the control group. Similarly, while there were no differences in English I completion among minority and nonminority students in the ECHS, the control group had a gap of 9.2% points.

Researchers have continued to track the 9th graders in the SERVE study and have also begun following the progress of an additional 1,044 9th grade students in cohort two of the study (Edmunds, Bernstein, Unlu, Glennie, & Arshavsky, 2011). In all core college preparatory subjects, 9th grade ECHS students progressed in higher proportions than students in the control group (Edmunds et al., 2012). Furthermore, in 10th grade, statistically

significantly more ECHS students had both taken and succeeded in Algebra II and biology than control group students. Overall, there is compelling evidence that ECHS students in NC are taking and succeeding in core college preparatory courses at higher rates than other high school students.

High school graduation rates. In terms of high school graduation, data from the SERVE study and NC New Schools shows that ECHSs in NC are outperforming traditional high schools (Edmunds et al., 2010; North Carolina New Schools, 2013). According to data from the 2013-14 school year, more than 50% of NC New Schools partner schools achieved high school graduation rates "exceeding 95%, with 88% posting rates above the state average of 83.8%" (North Carolina New Schools, 2014, p. 1). Among the NC Early Colleges with graduating cohorts in 2013 (62 schools), 74% achieved graduation rates of at least 95% and 25 schools had rates of 100% (North Carolina New Schools, 2013).

While the graduation rates of ECHSs are promising, what is more encouraging is the significant differences in graduation rates among subgroups of students (North Carolina New Schools, 2013). For example, minority ECHS students had graduation rates 12% higher than similar students in the control group. ECHS students who were first-generation college-going had a 10% edge; low-income ECHS students had a 9% edge.

College credit accrual. The data on students' college credit accrual indicates that ECHS students in NC are accumulating significant college credit while enrolled in ECHSs (North Carolina New Schools, 2013, 2014). During 2010-2011, students in ECHSs took a total of 48,900 classes–an average of four college classes per student (North Carolina New Schools, 2013). In 2013, more than 90% of ECHSs students completed college-level coursework and over 80% of ECHS graduates earned at least a year of college credit (North

Carolina New Schools, 2014). Fifty-five percent of graduates earned an associate degree or two years of transferable college credit (Edmunds et al., 2013). The percentage of ECHS students in NC earning an associate degree or two years of transferable college credit was close to double the national average of 30%.

Postsecondary enrollment and attainment. Similar to the national data on ECHS, limited longitudinal data exists on NC ECHS graduates' postsecondary enrollment and completion. However, researchers tracking ECHS and control group students in NC found that ECHS students are enrolling in four-year colleges at higher rates than control group students (North Carolina New Schools, 2013). Six years after starting 9th grade, 32% of ECHS graduates had enrolled in a four-year college, compared with 22% in the control group. In terms of college completion, 25% of ECHS graduates had earned an associate's degree six years after beginning 9th grade, compared with 1% of the control group.

In 2014, the Institute of Education Sciences (IES) awarded $1.2 million for researchers to continue their research on the ECHS model (Institute of Education Sciences, 2014). As a result, researchers will be able to further study how the ECHS model is impacting postsecondary enrollment, course performance, and degree attainment among NC students.

The underlying assumption of the ECHSI is that "engaging underrepresented students in a rigorous high school curriculum tied to the incentive of earning college credits will motivate them and increase their access to additional postsecondary education and credentials after high school" (Berger, Turk-Bicaki, Garet, Knudson, & Hoshen, 2014, p. 2). If engagement is measured by high school graduation and postsecondary enrollment rates, then many ECHSs have higher levels of student "engagement" than regular public high

schools (American Institutes for Research & SRI International, 2009; Edmunds et al., 2010; Edmunds et al., 2011; North Carolina New Schools, 2013). But, why is student "engagement" higher at ECHSs? In order to understand the implementation and success of the ECHS model, it is important to understand today's system of teacher quality and how it came about.

Elementary and Secondary Education Act (ESEA)

At the start of every school year, principals are faced with requests by parents for specific teachers. Extensive research supports what parents already know: a quality teacher is critical to a child's overall success (King, 2003; Sanders & Rivers, 1996). Peterson (2002) concludes, "No single school district activity beyond the moment-to-moment care of young people is more important than the hiring of talented, accomplished, and effective teachers" (p. 32).

In 1965, just after the passage of the Civil Rights Act, the Elementary and Secondary Education Act (ESEA) was signed into law by President Lyndon Johnson (U.S. Department of Education, 2006). The purpose of ESEA, a major federal law, was to authorize federal spending on programs that would improve the quality of elementary and secondary education. Specifically, the law allocated large resources to meet the needs of low-income children who required more educational services than children from affluent families.

The assumption behind the ESEA was that better educational services for the poor would move them out of poverty. However, the Coleman Report (1966) challenged this assumption. In one of the largest studies in history, Coleman found that virtually all the variability in how students performed was directly related to students' socioeconomic background. Coleman concluded that teachers' scores on vocabulary tests, educational

background, and their years of experience had little relation to student achievement. Critical analysis of Coleman's report revealed that he aggregated data at the school level, which can seriously distort data. The Coleman Report, while discredited by some, fueled debate about school effects and brought a great deal of attention to the topic of teacher quality (Bowles & Levin, 1968; Cain & Watts, 1970).

No Child Left Behind (NCLB)

The most recent iteration of the ESEA is the No Child Left Behind (NCLB) Act of 2001 (U.S. Department of Education, 2006). Signed on January 8th, 2002 by President George W. Bush, NCLB ensures accountability and flexibility, as well as increased federal support for education. At the core of NCLB is the premise that teacher excellence is vital to realizing improved student achievement. The NCLB Act further underlined the importance of having a high quality teacher by requiring that, by the end of the 2005-06 school year, all teachers be "highly qualified" (HQ). In general, a "highly qualified" teacher must have:

- A bachelor's degree (U.S. Department of Education, 2004, p. 10)
- Full state certification, as defined by the state
- Demonstrated competency, as defined by the state, in each core academic subject he or she teaches.

Standards for HQ status only apply to public school teachers who teach in the following core subject areas: English, reading, language arts, mathematics, science, foreign languages, civics and government, social studies, economics, arts, history, geography, and Kindergarten through grade six (U.S. Department of Education, 2004). Special education and English as a Second Language (ESL) teachers must also be HQ. The federal regulations do not apply to teachers in non-core subject areas, such as vocational teachers and physical education

teachers. ECHSs are public schools, so they must adhere to the federal guidelines of NCLB when hiring teachers (North Carolina New Schools, 2013).

The first requirement for HQ status, a bachelor's degree, is straightforward (U.S. Department of Education, 2004). In regards to the second requirement, each state can define certification according to its needs. Each state can also create alternative routes to certification. In terms of the third requirement, demonstrated subject competency, states have significant flexibility to design ways for teachers to demonstrate competency, especially for teachers with experience. Depending on the grade level they are working in, NC teachers can become HQ by:

1) Passing the required PRAXIS II test(s) in each academic subject in which the teacher teaches; or (North Carolina State Board of Education, 2013)
2) Successfully completing in each academic subject in which the teacher teaches
   (a) An undergraduate major; or
   (b) Coursework equivalent to an undergraduate major; or
   (c) A graduate degree in the core teaching subject area(s); or
   (d) Master's level licensure or above in the appropriate subject area; or
   (e) NBPTS certification in the related subject area(s)
3) Establishing HQ status through North Carolina High Objective Uniform State Standard for Evaluation (HOUSSE)
4) Establishing HQ status through another state's HOUSSE standard

HOUSSE can be used by teachers who are not "new to the profession" to establish HQ status (North Carolina State Board of Education, 2013). To become HQ through HOUSSEE, individuals must meet certain requirements. For example, individuals "must have taught

with a reciprocal state license, full-time for not less than six successive calendar months in one local education agency (LEA), charter school, or non-public institution" (p. 1). To be deemed HQ in a content area using HOUSSE, individuals must meet certain content standards and indicators.

In addition to being HQ, all professionals of public schools in NC must hold a professional educator's license for the subject or grade level they teach or for the professional education assignment that they hold (North Carolina Department of Public Instruction, 2014c). In general, there are three ways individuals can obtain a professional educator's license in NC. One way is to complete a state approved education program at a regionally accredited college or university. Another way is to complete another state's approved alternative route to professional educator's licensure, meet the federal requirements to be HQ, and earn a bachelor's degree from a regionally accredited college. The third way is through lateral entry. Lateral entry candidates must first be employed by a NC public school system and meet certain requirements (North Carolina Department of Public Instruction, 2014c). After receiving a lateral entry license, individuals must affiliate with either an approved teacher education program at a college or one of the Regional Alternative Licensing Centers (RALC) in NC to complete a plan of study. Individuals have three years to complete all coursework and required licensing exam(s).

In summary, all professionals of public schools in NC must have a professional educator's license and be HQ in order to teach (North Carolina Department of Public Instruction, 2014c). Although all of the regulations may seem excessive, the theory is that staffing schools with high quality teachers will result in improvements in student achievement. The hope is that the

regulations imposed by states and NCLB will force low-quality teachers out and ensure that all students have a highly qualified teacher.

Distribution of Teacher Quality

The need for NCLB came from the concern that nonwhite, poor, and low-performing students were being taught by less qualified teachers than high-income and high-performing students. Before the passage of NCLB, evidence showed this was indeed true (Lankford, Loeb, & Wyckoff, 2002). Teacher quality was not equitably distributed among schools. Nonwhite, poor, and low-performing students were more likely to be taught by less qualified teachers, as measured by experience and degree levels, licensure status, licensure exam performance, and college selectivity.

Unfortunately, recent studies provide evidence that the quality of teachers is still not equitably distributed among schools (Glazerman & Max, 2011; Goldhaber, Krieg, Theobald, & Brown, 2014; Goldhaber, Lavery, & Theobald; 2014; Kalogrides & Loeb, 2013; Sass, Hannaway, Xu, Figlio, & Feng, 2010). Clotfelter et al. (2010) found that the probability of having a novice teacher for Algebra I was higher for Black students than for White students, for males than for females, and for students with non-college educated parents. Black males were almost twice as likely as White females to have a lateral entry teacher for one of the core 9th or 10th grade courses. Similar findings were reported by Kalogrides and Loeb (2013). Sass et al. (2010) reported that while teachers at the top of the effectiveness distribution were similarly distributed across schools settings, there was a higher concentration of ineffective teachers in high-poverty schools.

In addition to having more novice and alternative entry teachers, minorities and low-income students are also less likely to be taught by a National Board Certified (NBC) teacher

(Goldhaber & Anthony, 2004). National Board Certification (NBC), or National Board for Professional Teaching Standards (NBPTS) certification, is an advanced teaching credential that complements, but does not replace, a state's teacher license (National Board for Professional Teaching Standards, 2014). NBC is a recognized indicator of HQ by NCLB. According to a report by the National Board for Professional Teaching Standards (2009), 42% of National Board Certified Teachers (NBCTs) were working in schools eligible for Title I funding. Furthermore, the report states that in recent years, half of new NBCTs taught in low-income schools. Unfortunately, other evidence disputes the claims in the NBPTS (2009) report.

Many studies have found that NBCTs are not randomly distributed among schools and students (Goldhaber & Anthony, 2004; Goldhaber & Hansen, 2007; Humphrey, Koppich, & Hough, 2005). Humphrey et al. (2005) found that in NC and Ohio, only 6% of NBCTs were working in high-minority and high-poverty schools. Furthermore, although minority teachers enter the NBC candidacy pool in numbers proportional to their representation in the U.S. teaching force, they earned certification at much lower rates than their White counterparts (Wayne, Chang-Ross, Daniels, Knowles, Mitchell, & Price, 2004). The disparities in certification rates could be attributed to the fact that minority candidates are more likely to teach in high-need and high-poverty schools where support structures are limited (Humphrey et al., 2005). Furthermore, urban schools have difficulty attracting the most talented teachers, minority or otherwise, because of poor working environments.

Even when NBCTs do teach in high-need schools, they may not have as much of an influence on student achievement as NBCTs in high-performing schools. Several studies found that NBCTs are engaged in leadership roles and mentor new teachers at higher rates

than non-NBCTs (Dagenhart, 2002; National Board for Professional Teaching Standards, 2001; O'Connor, 2003; Petty, 2002). However, high-need schools are not always taking advantage of the abilities of NBCTs. Vandevoort, Amrein-Beardsley, and Berliner (2004) found that few principals deliberately assign NBCTs to disadvantaged students in schools.

Research on the teacher labor market offers a number of theories that may explain the inequitable distribution of teacher quality. Traditional theories of labor economics suggests that an individual's working conditions in the workplace and compensation related factors influence his or her labor market decisions (Goldhaber, Destler, & Player, 2007). Since teachers are generally paid using a single salary schedule that does not account for the difficulty of the teaching assignment, prospective teachers tend to apply in districts that have better working conditions (Boyd, Lankford, Loeb, & Wyekoff, 2013). Prospective teachers also tend to do their student teaching at more advantaged schools, and the schools may use student teaching as a screening process to hire the most qualified prospective teachers (Goldhaber, Krieg, Theobald, & Brown, 2014).

Even with the passage of NCLB and state regulations, there is still evidence that teacher quality is not equitably distributed among schools (Goldhaber, Krieg, Theobald, & Brown, 2014; Kalogrides & Loeb, 2013). The inequitable distribution of teacher quality highlights the need for research on how various dimensions of teacher quality impact student achievement. Study of teacher quality is particularly important at ECHSs because these schools target subgroups of students that the research shows have lower-quality teachers more frequently than other students (Clotfelter et al., 2010; Kalogrides & Loeb, 2013, Sass et al., 2010). The following section discusses research on teacher characteristics that NCLB

recognize as HQ indicators and examines how these characteristics are impacting student achievement.

Teacher Characteristics

According to NCLB, a teacher can become highly qualified, or HQ in several ways (U.S. Department of Education, 2004). The present study examined several teacher characteristics that are recognized as indicators of HQ status by NCLB: Licensure route, level of educational attainment, licensure area and pedagogical content knowledge, and teaching experience.

Licensure route. According to NCLB, each state can define certification or licensure according to its needs (U.S. Department of Education, 2004). Each state can also create alternative routes to licensure. As a result, there are over 130 alternative routes nationwide, leaving the relationship between teacher preparation and teacher effectiveness an open question (National Research Council, 2010). In NC, licensure routes are frequently put into two categories: (1) regular (also known as traditional) certification and (2) alternative certification or lateral entry (North Carolina Department of Public Instruction, 2014c).

Prior to 2006, a third category existed in NC and other states (Clotfelter et al., 2010). Temporary or emergency permits were issued to individuals in an attempt to address the mounting teacher shortage crisis (Clotfelter et al., 2010; Simmons & Mebane, 2005). However, research has shown that schools with higher percentages of teachers on emergency permits had lower achieving students (Darling-Hammond, 2006; Fetler, 1999). Due to the regulations under the NCLB Act of 2001, temporary and emergency permits are not issued in elementary education or core academic subjects in middle and high school. Teachers who

had a temporary or emergency permit had until the end of the 2005-06 school year to obtain certification and HQ status.

According to the National Research Council (2010), the classification of teachers into preparation categories is challenging because definitions of teacher preparation programs vary across states and change over time. A traditional licensure route program is typically a university-based program where individuals receive instruction on content and pedagogy, and ultimately an undergraduate degree in education and a teaching license (Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014). While there is substantial diversity in alternative entry programs, a specific feature that defines alternative entry programs is that "at least some of the required training on how to teach occurs after the individuals have entered the classroom" (Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014, p. 8).

In NC, the two most prominent alternative entry routes are the lateral entry program and Teach for America (TFA). Other alternative route programs include the North Carolina Innovative Statewide Program to Improve the Recruitment of Educators (NC INSPIRE), North Carolina Teachers of Excellence for All Children (NC TEACH), and Visiting International Faculty (VIF) (Simmons & Mebane, 2005; University of North Carolina, 2014).

Enacted in 1985, the lateral entry policy in NC encourages the entry of individuals into the teaching profession who are "skilled individuals from the private sector" (North Carolina General Assembly, 1985, Article 20). The Teach for America (TFA) program recruits college graduates and professionals from all backgrounds to teach for two years in urban and rural public schools (Henry, Bastian, Fortner, Kershaw, Purtell, Thompson, & Zulli, 2014; Teach for America, 2012).

In addition to developing alternative pathways, states have also begun to offer reciprocal licensing agreements with other states in hopes of filling shortages and improving students' performance (North Carolina Department of Public Instruction, 2014c). Reciprocity agreements have been enacted for many years and exist in all states, but vary by state and change frequently. NC does not have 100% reciprocity with any state, so out-of-state teachers seeking licensure must complete certain requirements.

Alternative routes and reciprocal licensing agreements have had notable effects on the composition of the teacher workforce (Feistritzer, 2011). From 1999 to 2006, the number of teachers who entered teaching through alternative routes increased fivefold. By 2010, 39% of teachers who had entered in the last five years did so through alternative routes. In 2010, approximately 15% of public teachers in NC entered teaching through an alternative pathway and 29% were prepared in traditional programs outside the state (Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014).

Out-of-state teacher preparation. The influx of out-of-state teachers into the profession has resulted in recent studies that compare the effectiveness of in-state prepared teachers compared with out-of-state teachers (Bastian & Patterson, 2014; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014; Sass, 2011). In Florida, Sass (2011) found that compared with in-state prepared teachers, out-of-state prepared teachers were less likely to pass the state's certification exams. In the state of Washington, Goldhaber, Liddle, and Theobald (2013) found out-of-state prepared teachers to be no more or less effective than in-state prepared teachers. On the other hand, Bastian and Patterson (2014) found that, in NC, out-of-state prepared teachers were less effective in elementary and high school grades and had high levels of attrition.

The research on teacher preparation and the labor market suggests several explanations for why out-of-state teachers may be less effective than in-state prepared teachers. The first explanation is that out-of-state teachers may have less human capital, which is the skills and knowledge of workers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Reininger, 2012). In-state teachers may have more human capital because they have learned the curriculum and engaged in teaching practices in settings that match their classroom placement (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009). Second, the effectiveness of out-of-state teachers may be offset by teacher turnover (Boyd et al., 2006). The most effective out-of-state teachers may have less of a commitment to the state they are teaching in and leave to teach closer to home.

Study of in-state versus out-of-state preparation programs and teacher effectiveness in NC is important because the number of out-of-state teachers has increased 36% since 2001 (Henry, Bastian, Fortner, Kershaw, Purtell, Thompson, & Zulli, 2014). Out-of-state teachers are now the second largest source of teachers in NC public schools. Consequently, significant resources are being spent on staff development and more research is needed to fully understand how out-of-state teachers are impacting student achievement. The influx of out-of-state teachers has also complicated the complex issue of traditional versus alternative licensure routes.

Traditional and alternative routes. Decades of research have shown substantial variation in teacher effectiveness and further sparked debates between those who support traditional teacher preparation and those who stress the need for alternative pathways into teaching to meet the demand for teachers and increase diversity in the teacher workforce

(Aaronson, Barrow, & Sander, 2007; Coleman, 1966; Darling-Hammond, Berry, & Thoreson, 2001; Gordon, Kane, & Staiger, 2006; Nye, Konstantopoulos, & Hedges, 2004).

Research findings on the effects of specialized alternative entry pathways, such as TFA, have been mixed (Boyd et al., 2006; Darling-Hammond, Holtzman, Gatlin, & Heilig, 2005; Decker, Mayer, & Glazerman, 2004; Kane, Rockoff, & Staiger, 2008; National Center for Education Evaluation and Regional Assistance, 2013; Raymond, Fletcher, & Luque, 2001; Xu, Hannaway, & Taylor, 2007). Over time, the evidence suggests that TFA corps members are effective at promoting student achievement growth, particularly in mathematics and science and at the secondary level (Decker et al., 2004; Henry, Bastian, & Smith, 2012; Xu et al., 2007). Xu et al. (2007) even suggested that the TFA teachers' effect exceeds the impact of additional years of experience in teaching.

Overall, four broad findings emerged from the research on traditional and alternative licensure routes (Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014). First, regularly certified teachers appear to be more effective during the early stages of their career and in high school mathematics and science (Bastian & Patterson, 2014; Boyd et al., 2006; Clotfelter et al., 2010; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014). However, the returns of a traditional licensure route are generally small and dissipate with teacher experience, limiting the efficacy of the credential as an indicator of teacher quality (Boyd et al., 2006; Clotfelter et al., 2010; Decker, Mayer, & Glazerman, 2004; Kane et al., 2006; Strategic Data Project, 2012b). Second, there is more variation in teacher effectiveness within preparation pathways than between them, suggesting that variables other than preparation may have greater effects of a teacher's classroom success

(Boyd et al., 2006; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014).

The third finding from the research on licensure routes is that alternative entry programs have the potential to make the teaching workforce more diverse (Hasselkorn & Hammerness, 2008). Individuals may choose to enter the teaching profession through an alternative route program because it is more convenient and costs substantially less than traditional university-based teacher programs (Boyd et al., 2006). For example, alternative route programs often offer financial assistance to individuals and provide them with an opportunity to earn a salary throughout their training. Alternative route programs may also be attractive to professionals from various fields who wish to continue their studies in order to enter the teaching profession (North Carolina Department of Public Instruction, 2014c). Research indicates that alternative programs that prepare career changers to teach have the ability to attract potential teachers that are more diverse—in age, gender, race, ethnicity, and prior experience—than those drawn to teaching as a first career (Hasselkorn & Hammerness, 2008).

Fourth, persistence patterns indicate alternative entry teachers are more likely to leave the profession than traditionally licensed teachers (Allen, 2003; Boe, Bobbitt, Cook, Whitener, & Weber, 1997; Cochran-Smith & Zeichner, 2005; Darling-Hammond, 2006; Darling-Hammond & Bransford, 2005; Henry et al., 2012; National Commission on Teaching and America's Future, 2003; Shen, 2003; Teitel, 2004; Wilson, Floden, & Ferrini-Mundy, 2002). For example, most TFA corps members exit the profession after fulfilling the program's two-year teaching commitment (Bastian & Patterson, 2014; Donaldson & Johnson, 2010; Henry et al., 2012). According to a recent evaluation of teacher preparation

programs, TFA corps members were the least likely to persist for three or five years in NC public schools. Bastian and Patterson (2014) found alternatively certified teachers in NC attrite at higher rates than traditional licensed teachers. Further research is needed to understand the effectiveness and persistence of teachers entering the profession with different forms of preparation.

Advocates of alternative licensure routes emphasize that these routes attract a diverse group of individuals to the teaching profession, including those who wish to make a career change into teaching (Hasselkorn & Hammerness, 2008). Individuals leaving a career and transitioning into the teaching workforce may bring with them certain HQ indicators, such as a graduate degree. Other individuals may pursue a graduate degree after entering the teaching profession because of salary incentives or a desire to learn more about education.

Graduate degree. Over the last 50 years, the number of teachers with master's degrees has nearly doubled (U.S. Department of Education, 2010). Currently over half of teachers have a master's degree. One reason for the increase is that some school districts award higher salaries, 11% more on average, to teachers with master's degrees. Effective 2014-15, NC eliminated future increases in pay for teachers in some districts who obtain an advanced degree, unless the teacher's job requires an advanced degree or the teacher started working on the degree before August 2013 (North Carolina Department of Public Instruction, 2014c). In the past, NC teachers received a 10% pay raise for having a master's degree. NC teachers also received pay raises for having an advanced (sixth year degree) or a doctorate degree.

The majority of research on graduate degrees and teacher effectiveness suggests that

teachers with graduate degrees are no more effective than their colleagues without degrees (Aos, Miller, & Pennucci, 2007; Clotfelter et al., 2010; Chingos & Peterson, 2011; Harris & Sass, 2007; Strategic Data Project, 2012a; Strategic Data Project, 2012b). Except for positive correlations between possession of a master's degree and elementary math achievement found by a few studies, recent research indicates insignificant associations between teachers' graduate degrees and student achievement in math and reading (Betts, Zau, & Rice, 2003; Dee, 2004; Nye et al., 2004).

Some studies have even found a negative relationship between teachers' graduate degrees and student achievement (Clotfelter et al., 2010, Rowan, Correnti, & Miller, 2002). The most obvious explanation for the negative effects of advanced degrees at the elementary level is that the more educated teachers are, the less they can simplify and clarify their advanced understanding to young students. Another explanation is that there are only a small number of teachers with certain advanced degrees, such as a PhD (Clotfelter et al., 2010). Therefore, the findings may say more about the characteristics of teachers who have a PhD, rather than the potential effectiveness of teachers with PhDs.

With the exception of a few studies, there is no evidence that teachers' possession of a graduate degree is correlated with improved student achievement (Clotfelter et al., 2010). However, Goldhaber and Brewer (1997) found that, at the high school level, teachers' advanced degrees did impact student achievement if the advanced degree was specific to the subject being taught. Therefore, content knowledge appears to be particularly important at the high school level, where stronger content skills are needed to teach difficult concepts.

Pedagogical content knowledge. Shulman (1986) first introduced the phrase "pedagogical content knowledge", which created a wave of scholarly articles on the

importance of teachers' knowledge of subject matter. Prior to the idea of pedagogical content knowledge, teacher knowledge was separated into two categories: (1) subject matter knowledge (e.g. procedural or conceptual knowledge) and (2) knowledge of teaching (e.g. knowledge of lesson planning and classroom management). Pedagogical content knowledge offered a new way to investigate teacher knowledge that linked pedagogical knowledge to a specific subject area.

The impact of teachers' knowledge has been the topic of many research studies at the elementary, middle, and high school level (Aaronson et al., 2007; Betts et al., 2003; Frome, Lasater, & Cooney, 2005; Goe, 2007; Hill, Rowan, & Ball, 2005; Mullens, Murnane, & Willett, 1996; Rockoff, Jacob, Kane, & Staiger, 2008). At the elementary level, several studies found that student achievement scores are positively correlated with teachers' mathematical content knowledge (Hill et al., 2005; Mullens, Murnane, & Willett, 1996). One study at the elementary level found that teacher knowledge was multidimensional, in that it was possible for a teacher to have subject matter knowledge, but lack the knowledge needed to teach mathematics (Hill, Schilling, & Ball, 2004).

Teachers' pedagogical content knowledge appears to impact student achievement more as students progress through middle school and high school (Betts et al., 2003). At the secondary level, researchers found a strong relationship between content knowledge and pedagogical knowledge (Krauss, Neubrand, Blum, & Baumert, 2008). In another study, moderate correlations were found between teachers' subject matter knowledge and knowledge of teaching mathematics (Delacruz, Chung, Heritage, Vendlinski, Bailey, & Kim, 2007).

The pedagogical content knowledge of high school teachers is important for several reasons. In mathematics, less knowledgeable teachers tend to focus on algorithms rather than on the underlying mathematics concepts (Ma, 1999). In science, teachers with deeper content knowledge are more likely to engage students by posing questions, suggesting alternative explanations, and proposing additional inquiries (Sanders, Borko, & Lockard, 1993). A plethora of research studies indicate that teacher completion of an undergraduate or graduate major in mathematics is associated with higher student achievement in middle school and high school (Aaronson et al., 2007; Betts et al., 2003; Frome et al., 2005; Goldhaber & Brewer, 2000; Monk, 1994; Rowan, Chiang, & Miller, 1997; Wenglinsky, 2000). Monk (1994) and Wenglinsky (2000) identify a similar trend in science.

In conclusion, the evidence suggests that teachers' pedagogical content knowledge impacts student achievement, particularly at the middle and high school grades and in the subjects of math and science. The pedagogical content knowledge of teachers comes mostly from prior experiences in school and the teacher preparation program they participated in (Aaronson et al., 2007). On the other hand, National Board Certification (NBC) is a credential that specifically emphasizes mastery of content knowledge and can only be earned after teaching for three years (National Board for Professional Teaching Standards, 2014). Therefore, it is important to examine the impact of NBC on student achievement to determine the power it might hold in indicating a teacher's level of expertise in the subject he or she teaches.

National Board Certification (NBC). The NBC process is designed to recognize effective teachers who meet NBPTS standards which are based on what teachers should know and be able to do to advance student learning (National Board for Professional

Teaching Standards, 2014). The NBC process is voluntary and is available nationwide for PreK–12 teachers who pay a fee to the NBPTS. In 2014, NC placed second behind Washington State for the total number of newly NBC teachers (North Carolina Department of Public Instruction, 2014c). NC teachers may choose to pursue NBC because they receive a 12% pay raise for obtaining NBC. Obtaining NBC may also be an advantage to out-of-state teachers who wish to become HQ in NC (North Carolina Department of Public Instruction, 2014c). The NBC process takes well over a year and is more difficult to obtain than state licensure (National Board for Professional Teaching Standards, 2014).

Although the NBC system has achieved some recognition as a viable model for identifying quality teachers, many have questioned how effective it is at distinguishing teachers who are more accomplished at improving student learning. One problematic issue of the NBC process is that assessors may not always agree on the criteria for assessing teacher performance (Ballou, 2003). Furthermore, candidates do not necessarily have to perform well on the assessment center exercises. For example, a candidate who scored a one on every assessment center exercise could still score a 4 on each portfolio component and exceed the 2.75 score needed for certification.

Another issue of NBC is that the assessment process relies heavily on the candidate's written commentary (Ballou, 2003; Hess, 2004). As a result, the NBC process may not necessarily measure teaching performance, but rather the literary performance of the candidate (Hess, 2004). Another criticism is that the NBC process relies heavily on self-reflection, a model of professional development that may not be appropriate for some teachers (Ballou, 2003; Hess, 2004). The Board also does not offer any feedback to candidates other than numeric scores, due to time and legal issues (Ballou, 2003; National

Board for Professional Teaching Standards, 2014). Given that candidates never receive any feedback beyond a numerical score, it is questionable how much the NBC process enhances teacher performance.

Despite the criticisms of NBC, many studies found that NBC teachers are positively correlated with student achievement (Bond, Jaeger, Smith, & Hattie, 2000; Cavalluzzo, 2004; Chingos & Peterson, 2011; Clotfelter et al., 2010; Goldhaber & Anthony, 2004; National Board for Professional Teaching Standards, 2012; Salvador & Baxter, 2010; Strategic Data Project, 2012a; Strategic Data Project, 2012b; Vandevoort, Amrein-Beardsley, & Berliner, 2004). A few studies found that the positive impact of having a NBCT is even greater for minority students and low-income students in the earlier grades (Cavalluzzo, 2004; Goldhaber & Anthony, 2004). Salvador and Baxter (2010) found that NBCTs were significantly more effective than their non-NBC peers in teaching Algebra II, biology, civics and economics, chemistry, and geometry. Similarly, Cavalluzzo (2004) found that high school students who had a NBCT made greater gains in mathematics.

One possible reason for the positive impact of NBC on student achievement is that through the NBC process, teachers have demonstrated that they have strong subject matter knowledge of the subject(s) they teach. One study found that students of NBCTs were almost twice as likely to achieve deeper learning outcomes (Smith, Gordon, Colby, & Wang, 2005). NBCTs also had stronger writing abilities and fostered a deeper understanding through their instructional design and classroom assignments than non-NBCTs. Another study found that students of NBCTs were more than twice as likely to demonstrate a richer understanding of unit objectives as students of non-NBCTs (Bond, Jaeger, Smith, & Hattie, 2000).

A few studies on NBC and student achievement found mixed or statistically non-significant results. In NC, using EOG data, Sanders, Ashton, and Wright (2005) found that students of NBCTs did not have significantly better rates of academic progress than students of other teachers. Several studies found that the effect of NBCTs varies by subject and grade level (Goldhaber & Anthony, 2004; Harris & Sass, 2007; Sanders et al., 2005).

The main concern over using NBC as an indicator of teacher quality is that the evidence is unclear on whether the NBC process itself improves teacher effectiveness. Some studies examined student achievement of teachers prior to NBC, as well as after certification to determine whether the NBC process does impact teacher effectiveness (Clotfelter et al., 2010; Goldhaber and Anthony, 2004; Harris and Sass, 2007). Clotfelter et al. (2010) found evidence that suggested that teachers appeared to become better teachers as a result of the NBC process. Other studies found that teachers' effectiveness did not significantly change during or after the NBC process (Goldhaber & Anthony, 2004; Harris & Sass, 2007). Interestingly, Goldhaber and Anthony (2004) found that the effectiveness of teachers may actually decrease during the year they are applying for NBC. Goldhaber and Anthony hypothesize that the 200 or more hours involved in preparing application materials for NBC may take away from class preparation time and thus have a negative effect on student achievement during the application process.

Teachers who have undergone the assessment process of NBC, as well as the assessors, consistently cite the experience as the most powerful professional development of their careers and believe they are better teachers as a result of the process (Berry, 2004; Darling-Hammond, 1998). In a survey administered by the NBPTS in 2001, 92% of candidates reported that the NBC process made them a better teacher (National Board for

Professional Teaching Standards, 2001). More recently, a 2007 nationwide survey of NBCTs found that more than 90% claimed the process of NBC improved their teaching (Berry, 2007). The debates on the impact of graduate degrees and NBC on student achievement are particularly heated because teachers receive pay raises for having these credentials. Another teacher characteristic that determines a teacher's salary is years of teaching experience.

Teaching experience. Across the nation, teaching experience determines salary schedules and drives teacher transfer policies that prioritize seniority (North Carolina Department of Public Instruction, 2014c). In NC, teaching experience is used to determine salary pay and generally counts all years of teaching whether in the state of NC, or elsewhere. The underlying assumption is that experience promotes teacher effectiveness, but is this really the case?

On average, brand new teachers are less effective than those with some experience under their belt (Chingos & Peterson, 2011). Beginning teachers are most likely less effective because they are new to the profession and are encountering the complexity of real-life teaching for the first time. In a study of elementary teachers, teachers with zero to one year of experience improved math scores significantly more slowly than teachers with 10 or more years of experience (Betts et al., 2003). Aaronson et al. (2007) found similar results at the high school level. Many research studies have found that new teachers are generally less effective than teachers with some experience (Chingos & Peterson, 2011; Clotfelter, Ladd, & Vigdor, 2006; Clotfelter et al., 2010; Hanushek, Kain, & Rivkin, 2001; Harris & Sass, 2007; Kane et al., 2006).

The majority of the research suggests teachers show the greatest productivity gains during their first few years of teaching (Strategic Data Project, 2012b). In a study by Harvard University, elementary and middle school teachers became most effective during their first two to three years in the classroom. Similarly, Kane et al. (2006) found teaching experience impacts student achievement the most in the first two years of teaching. The productivity gains of beginning teachers can be attributed to several things. One is mentoring, which most states provide in some form to beginning teachers (North Carolina Department of Public Instruction, 2014c). Beginning teachers are also likely to gain new coping strategies and skills that help them prevent and manage everyday problems (Moir, 2011).

While teachers show the greatest productivity gains in their first few years of teaching, after several years their performance tends to level off. In a comprehensive analysis of 60 studies, Greenwald, Hedges, and Laine (1996) found that most of the benefits of teaching experience were realized after only a couple of years in the classroom. Similarly, Grissmer, Flanagan, Kawata, & Williamson (2000) found positive effects on student achievement of teachers who had at least two years of experience, but no evidence to indicate that additional years of experience impacted student achievement. Gordon et al. (2006) found that elementary teachers experience large gains in effectiveness between their first and second year of teaching, smaller gains between the second and third year, and no substantial improvement after the third year in the classroom.

At the high school level, Clotfelter et al. (2010) found that most of the achievement gains associated with teacher experience occur in the first two years of teaching. The largest effects were observed for student achievement in mathematics and biology. Studies by

Harris and Sass (2007) and Clotfelter et al. (2010) both found that, beyond the first several years of teaching, there was no effect of teaching experience on high school achievement.

Other studies found evidence that the effects of teacher experience are evident for a longer period of time. Data from the Los Angeles Unified School District (LAUSD) showed that elementary and middle school math teachers made substantial growth in effectiveness during their first five years in the classroom (Strategic Data Project, 2012a). In fact, the gain in teacher effectiveness was roughly equivalent to three additional months of instruction in a calendar year. Murnane and Phillips (1981) found that teachers positively impacted elementary student achievement during their first seven years of teaching. At the high school level, Ferguson (1991) found that students taught by teachers with more than nine years of experience had significantly higher test scores than students whose teachers had five to nine years of experience.

The effect of teaching experience on student achievement may taper off because there is little to no additional learning on the job after the first few years (Clotfelter et al., 2010). Another reason is that the more effective teachers leave the teaching profession (Goldhaber et al., 2007; Harris & Sass, 2007). Clotfelter et al. (2010) tested this interpretation by conducting an analysis that factored out the losses in average effectiveness that occur because of the departure of more effective teachers. The findings indicate that teachers who stay on the job continue to become more effective. Although this supports the argument that more should be done to keep experienced teachers in the teaching force, it should not be implied that an experienced teacher is significantly more effective than a teacher with limited experience. The attrition of more effective teachers largely offsets the effects of teacher experience on student achievement (Clotfelter et al., 2010).

Up until now, the research reported has pertained to how teacher characteristics impact student achievement. In the next section, the impact of school characteristics on student achievement is discussed.

School-Level Characteristics

Schools, just like the teachers within them, have different characteristics. As part of the ECHSI, Early Colleges in NC have particular design features that set them apart from traditional high schools (Jobs for the Future, 2013). Some of these school characteristics are obvious, such as the mandated maximum enrollment of 100 students per grade level. Other design features of the ECHSI leave room for states to have flexibility when implementing an ECHS. The following section presents research on several school-level characteristics and discusses how these characteristics align with the design principles of the ECHSI.

Teacher demographics. As the U.S. has become more and more diverse, concern has grown about the number of teachers of color in America's classrooms (Bireda & Chait, 2011). The National Center for Education Statistics (2013) projected that, in the fall of 2014, the overall number of Hispanic, Black, and Asian students in public K-12 classrooms would surpass the number of White students. An estimated 50.3% of students enrolling would be minority school children. Although the diversity of students in K-12 has increased, the corps of classroom teachers has remained predominately White (National Center for Education Statistics, 2013). In the 2011-12 school year, 82% of public school teachers were White, while 7% were Black and 8% were Hispanic.

The disconnection between the diversity of the teaching workforce and the increasing diversity of the student population has been the topic of much research (Hanushek, 1992).

Overall, the research supports the notion that student achievement increases when students respond better and connect better to school and their education. Several studies have provided evidence that racial pairing of teachers and students significantly increases student achievement, particularly for Black and Hispanic students (Clewell, Puma, & McKay, 2005; Clotfelter et al., 2010; Dee, 2004; Evans, 1992; Hanushek, 1992). Farkas, Grobe, Sheehan, and Shuan (1990) discovered that Black students of same-race teachers displayed markedly lower rates of absenteeism. Clotfelter et al. (2010) found a large negative coefficient for a Black teacher teaching a White student or a Hispanic teacher teaching a non-White or non-Black student. The negative impact of a Hispanic teacher may be due to the small number of Hispanic teachers in the sample. However, the negative effect associated with Black teachers and White students is cause for concern.

Several studies examined the demographics of the teaching workforce at a school to determine how teacher diversity impacts student achievement (Ehrenberg & Brewer, 1995; Klopfenstein, 2005; Meier, 1993). For example, Ehrenberg and Brewer (1995) found that increasing the percentage of Black teachers in a school produced score gains for Black high school students, even when controlling for the nonrandom nature of teacher assignment to the schools. Klopfenstein (2005) found that enrollments of Black students in Algebra II rose significantly as the percentage of Black mathematics teachers in the school increased. For Hispanic students, Meier (1993) reported that increasing the Hispanic representation in a school district's teaching force reduced the assignment of Hispanic students to special education. Meier also found that a higher representation of Hispanic teachers increased Hispanic students' placement in classes for the gifted and lowered their rates of suspensions

and expulsions from school. The research indicates that Black and Hispanic students in particular benefit from attending a school that has a diverse teaching workforce.

Teacher diversity at the high school level also appeared to impact graduation and college-going rates. Pitts (2007) reported that students of color had significantly higher pass rates on high school graduation exams in school districts where the racial distribution of the teaching population was similar to that of the student population. Hess and Leal (1997) found that districts with a higher proportion of teachers of color had significantly higher overall college matriculation rates. Several studies found higher graduation exam pass rates among Hispanic students who attended schools with a greater representation of Hispanic teachers (Fraga, Meier, & England, 1986; Meier, 1993).

A few studies in the literature suggest that teacher demographics do impact student achievement, but only slightly (Aaronson et al., 2007; Ehrenberg, Goldhaber, & Brewer, 1995). Aaronson et al. (2007) found little compelling evidence that students performed better or worse with teachers that 'look like them', with the exception of Black male students. Egalite, Kisida, and Winters (2015) found small, but significant positive effects in reading when Black and White students were assigned to teachers of their own race. In math, the researchers found positive effects for Black, White, and Asian students assigned to teachers of their own race (Egalite et al., 2015). Perhaps the most important finding was that the effects of race matching were strongest for lower-performing Black and White students.

In addition to standardized test scores, there are other ways to gauge how teacher diversity impacts student success (Jobs for the Future, 2013). The ECHSI seeks to increase student success through three principles, or the three Rs: Rigor, Relevance, and Relationships (Jobs for the Future, 2013). Taken together, the three Rs cover the features of ECHSs that

are recommended for improving high school students' access to and success in college (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009).

Rigor. The ECHSI specifies that ECHSs are to provide rigorous instruction that will build students' content knowledge and learning habits (Berger et al., 2013). The literature suggests two general ways that teacher demographics impact the rigor of instruction. One explanation involves "passive" teacher effects, which are simply triggered by a teacher's race, class, or gender, not by explicit teacher behaviors (Dee, 2004). A second explanation is "active" teacher effects, which are the actions by teachers that reflect unintended biases.

The most widely discussed example of a passive teacher effect is the "role model" effect (Dee, 2004). The role model effect occurs when students become more academically motivated by the presence of a demographically similar teacher. The rationale for the role model effect is evident in several studies of pre-service and in-service teachers of color (Guyton, Saxton, & Wesche, 1996; Johnson, 2007; Jones, Young, & Rodriguez, 1999; Ochoa, 2007). In all of these studies, teachers of color reported that serving as a role model for students was of central importance to them. Researchers who looked at the effects of teacher race on a variety of academic outcomes for students of color often mention role modeling as a possible explanation for the positive results they report (Dee, 2004; Evans, 1992; Hess & Leal, 1997; Pitts, 2007; Stewart, Meier, & England, 1989).

The second explanation for why teacher demographics influence academic rigor is active teacher effects (Dee, 2004). Active effects occur when unintended biases of the teacher result in differential treatment of students, without the teacher even being aware of it. Evidence suggests that race and gender play a role in how teachers communicate expectations to students (Jones & Dindia, 2004; Page & Rosenthal, 1990; Taylor, 1979). For

example, teachers are more likely to offer praise and remediation in response to comments by boys, but mere acknowledgment in response to comments by girls (American Association of University Women Educational Foundation, 1992; Kleinfield, 1998; Sadker & Sadker, 1994). Teachers were also found to teach math lessons at a faster pace and include more concepts when students were Asian and male, than when students were White and female (Page & Rosenthal, 1990).

The phenomenon of the "self-fulfilling prophecy" is often used to explain how passive and active teacher effects impact student achievement (Irvine, 1990). Passive and active effects influence how teachers perceive the abilities of students, which in turn impact the actions of students. England and Meier (1986) created the term "second-generation discrimination" to explain the inequalities that still exist in education because students are segregated into separate classes or groups based on perceived learning potential. England and Meier found that in school districts with high enrollments of Black students, incidents of second-generation discrimination decreased significantly in schools with higher proportions of Black teachers. Meier, Stewart, and England (1989) conducted a follow-up study and confirmed the original findings.

Race, gender, class, and other variables can influence how teachers perceive a students' learning potential. Several studies found evidence that Black and Hispanic students were more likely to be viewed unfavorably by a different-race teacher, but viewed more favorably by a same-race teacher (Dee, 2005, Ehrenberg et al., 1995; Oates, 2003). Unfavorable views of a student can lead teachers to be more likely to report that a student is disruptive or did not complete his or her homework. Dee (2004) found that teachers were

more likely to report that a student was disruptive or did not complete his or her homework when teacher and student genders did not match.

In addition to race and gender, even a student's name can influence the way teachers perceive their learning potential (Figlio, 2005). Figlio (2005) found that teachers treat students with unusual names differently. For example, a boy named Damarcus was less likely than his brother Dwayne to be referred to a gifted program, even when both students had identical test scores. Black teachers were less apt to form low expectations of students based on their unusual names than their White colleagues.

Teachers are often unaware of the different expectations they are communicating to students, which in turn has led to different views on the causes of achievement gaps among subgroups of students. When asked about the possible causes of the Black-White achievement gap, White teachers tend to cite misbehavior and lack of effort on the part of Black children, uncooperative Black parents, and problems in the Black home environment (Uhlenberg & Brown, 2002). On the other hand, Black teachers tend to believe that low teacher expectations were the primary contributor to the Black-White achievement gap. In summary, teacher demographics influence expectations of teachers, which in turn affect the academic rigor of instruction.

Relevance. The purpose of the relevance principle in the ECHSI is to engage students by helping them make real-world connections to the topics they are learning (Berger et al., 2013; Villegas & Lucas, 2002). Landmark studies in educational anthropology and cognitive science provide evidence of the importance of establishing links between home and school for learners (Heath, 1983; Moll, 1986; Tharp & Gallimore, 1988; Vygotsky, 1978).

In one study, researchers conducted site visits to ECHSs to understand how these schools were adhering to the core principles of the ECHSI (Duffy, Cassidy, Keating, & Berger, 2009). Researchers found that high school teachers at ECHSs emphasized the material's relevance to students' lives and provided support for learning the material. On the other hand, college professors presented information and placed most of the responsibility on the students to learn the material. Since ECHS students are taking both high school and college classes, it is important to consider that ECHS students are being taught by both high school teachers and college professors. Overall, the ECHSI's emphasis on relevance provides a solid rationale for increasing the diversity of the teaching workforce (Jobs for the Future, 2013).

Relationships. The ECHSI places a high priority on relationships between instructors and students as a way to support student engagement and achievement (Berger et al., 2013; Jobs for the Future, 2014; North Carolina New Schools, 2013). The research indicates that many teachers understand that relationships are key to improving student success. Several studies have documented that Black female teachers care for students in a "motherly" way at school, similar to the way that students' mothers care for them at home (Dixson & Dingus, 2008; Foster, 1989). Likewise, Lynn (2006) found that Black male teachers saw themselves as "other fathers" who used tough love and discipline to improve students' academic success. Hispanic teachers often create a family atmosphere in the classroom where the teacher is perceived by the students as a mother or godmother (Nieto, 1994; Rueda, Monzo, & Higareda, 2004). One study found that caring was the most consistent and powerful finding related to achievement for diverse students (Institute for Education in Transformation, 1992).

The sense of trust that caring relationships inspire allow students to feel at ease in their learning environment. If students are at ease in their learning environment, the risk of "stereotype threats" is lower (Steele, 1997). Stereotype threats can occur in any educational setting, where students experience an apprehension that hinders their willingness or ability to learn. For example, stereotype threats may occur when Black students interact with White teachers or female students interact with male teachers.

Several studies appear to confirm the existence of the stereotype threat phenomenon in education (Spencer, Steele, & Quinn, 1999; Steele & Aronson, 1995). In one study, students took a test that contained difficult items from the Graduate Record Exam (GRE) (Steele & Aronson, 1995). Black and White students performed similarly when they were told beforehand that the test was a laboratory problem solving task. However, Black students performed relatively worse than White students when told that the test was diagnostic of ability. Another instance of the stereotype threat was when researchers merely asked students to fill out a pretest demographic questionnaire that inquired about students' race (Steele & Aronson, 1995). Similar to before, Black students performed worse. Spencer et al. (1999) found evidence of the stereotype threat when female subjects underperformed on a math test when told the test produces gender differences, but did not underperform when told the opposite. Caring relationships between teachers and students can prevent stereotype threats and help students navigate the culture of the school (Irvine, 1990).

Studying teacher demographics at ECHSs is particularly important because ECHSs enroll large percentages of minority and low-income students (Jobs for the Future, 2013). As evident from the research, teacher demographics impact student achievement, but so do student demographics (Dee, 2004). Taken together, student and teacher demographics

influence educational settings and impact student learning. Therefore, it is critical to consider the demographics of students at ECHSs in order to fully understand how teacher characteristics are impacting student achievement.

Student demographics. A core principle of the ECHSI is that ECHSs serve students that are underrepresented in higher education (Jobs for the Future, 2011). However, given this central goal of the ECHSI, it is surprising to note that there is little research on how ECHSs recruit and select the students they enroll. Much of the data on recruitment and selection at ECHSs comes from a report prepared by the American Institutes for Research and SRI International (2005). Of the 24 ECHSs surveyed, 18 ECHSs worked with middle and high schools to recruit students. About one third worked with particular populations or community groups to recruit students. A small number advertised their school in a newspaper or radio. Most ECHSs used multiple strategies to recruit students.

Although ECHSs typically recruited students using particular criteria, these criteria and their level of specificity varied (American Institutes for Research & SRI International, 2005). About one third of the schools had explicit criteria for targeting specific populations of students. Other schools gave a priority to students from racial and ethnic minority groups or economically disadvantaged backgrounds. One third of the schools outlined various behavioral and motivational criteria, such as requiring no excessive disciplinary problems. Two schools sought out students who had exhibited behavioral and academic problems. Three schools formed committees for groups to select students, although it was unclear what criteria they used to make determinations. Nearly one half of schools cited academic considerations when asked about their selection criteria.

An online search conducted by the researcher revealed that most ECHSs in NC use a similar admission process, with some slight variations. Many schools, such as Gaston College ECHS, admit their students through a lottery system (Gaston County Schools, 2014). Other ECHSs, such as Cabarrus Kannapolis ECHS, do not use a lottery process (Cabarrus County Schools, 2015. For the schools that do not use a lottery process the criteria for admission varies by school. Some ECHSs, such as those in the Wake County Public School System (2015), give priority to siblings of an existing student. Most ECHSs require that potential students submit an application that gathers demographic information about the student and their family. In addition to an application, most ECHSs admit students based on a transcript review, writing and math assessment, references, and a personal interview (Cabarrus County Schools, 2015; Catawba County Schools, 2014; Durham Public Schools, 2015; Rockingham County Schools, 2014; Winston-Salem/Forsyth County Schools, 2014).

Given the goals and priorities of the ECHSI, the student population enrolled should meet or exceed the diversity of the broader local school-age population on basic demographic characteristics (Jobs for the Future, 2011). In 2005, over half of ECHSs enrolled percentages of underserved students that were similar to or higher than high schools in their school district (American Institutes for Research & SRI International, 2005). The most recent data, based on a three-year average from 2010 to 2013, showed that approximately 64% of students at ECHSs were either Black or Hispanic. Sixty-one percent were either from low-income families and 39% were from higher-income families or had no reported income. The majority of students were first-generation college-going students (Jobs for the Future, 2013).

After examining the literature, it is evident that there is significant variety in the processes used by ECHSs to admit students. Therefore, study of student demographics is

needed to ensure that ECHSs are adhering to the principles of ECHSI, which include enrolling students underrepresented in higher education. Furthermore, study of student demographics is needed because student and teacher demographics both impact learning in different ways. Another school characteristic that has the potential to impact student learning is class size.

Class size. The most influential study of class size was the Student Teacher Achievement Ratio (STAR) project that was conducted in Tennessee during the late 1980s (National Commission on Teaching & America's Future, 1996). Beginning in Kindergarten, students from various racial and socioeconomic backgrounds were randomly assigned to small and regular size classes in 79 schools across the state. In Krueger's (1999) analysis of data from the STAR study, students randomly assigned to small classes outperformed their classmates who were assigned to regular classes. The effect was equivalent to students in the smaller classes having received about three months more schooling than the students in the regular classes. The positive effects of class size were largest for Black students, economically disadvantaged students, and boys. In a follow-up study, students assigned to small classes at the beginning of elementary school were about two percentage points more likely to be enrolled in college at age 20 (Chetty, Friedman, Hilger, Saez, Schanzenback, & Yagan, 2010).

Overall, research evidence shows that class size is an important determinant of student achievement, particularly in the younger grades (Jepsen & Rivkin, 2009; Rivkin, Hanushek, & Kain, 2005; Zyngier, 2014). A few credible studies found no positive effects of class size on student achievement (Chingos, 2010; Dee & West, 2008; Hoxby, 2000). In studies of high school mathematics and science, researchers found that class size

significantly affects time spent using various instructional strategies. Teachers in larger classes reported using less time for small group and whole group instruction, as well as lower levels of time devoted to innovative instructional practices (Blatchford, Russell, & Brown, 2009; Rice, 1999). However, the majority of evidence on the possible advantages of small classes in the upper grades and high school is inconclusive (Zyngier, 2014).

Class size is an important school characteristic to consider for two reasons. One reason is that class size has been shown to influence student learning (Blatchford et al., 2009; Chingos & Whitehurst, 2011; Jepsen & Rivkin, 2009; Rivkin et al., 2005; Zyngier, 2014). Another reason is that states set their own limits on class size. For example, NC allocates funding for one teacher per 18 students (North Carolina Department of Public Instruction, 2009). After that, it is up to the district to allocate students within the district. The average K-3 class size in the public school district cannot be higher than 21 and each K-3 individual class size cannot be above 24 (North Carolina Department of Public Instruction, 2009). In NC, there is no limit on class size in grades 4-12.

Increasing the pupil/teacher ratio in the U.S. by one student saves at least $12 billion per year in teacher salary costs alone (Chingos & Whitehurst, 2011). However, although it comes at a cost, at least 24 states have mandated or promoted class-size reduction (CSR). In general, public high schools in NC do not have any limits on class size. However, ECHSs are different because the ECHSI requires that ECHSs enroll no more than 400 students and have no more than 100 students per grade level (North Carolina New Schools, 2013). Therefore, class size is an important school characteristic to examine when studying student achievement at ECHSs and regular high schools.

Areas of Needed Research

Compared with other dual enrollment programs that have existed and been the subject of many research efforts, the ECHS model is a relatively new concept. Consequently, there is an array of research opportunities to document the successes and struggles in the implementation of ECHSs.

Cost of ECHSs. In order to serve a population of at-risk students, the ECHS model has program elements that raise questions regarding how to cover the costs necessary to successfully run an ECHS (Webb, 2004). While preliminary data suggests ECHSs are achieving positive results, further research is needed to provide evidence of how students are fairing in postsecondary enrollment and degree attainment. As a result, ECHSs can determine ways to maximize student performance in the most cost efficient manner.

National Board Certification. In the present study, it was not possible for the researcher to obtain any data on NBC. Further research is needed to examine the distribution of NBCTs among ECHSs and traditional high schools. In addition, research is needed to document how NBCTs are impacting student achievement at ECHSs and traditional high schools.

Recruitment, selection, and enrollment at ECHSs. Data from several large scale studies indicate that ECHSs are successfully serving their target population of low-income and minority students (Berger et al., 2013; Edmunds, 2010). However, the selection criteria at ECHSs appear to vary from school to school, particularly at ECHSs that do not use a lottery system to admit students (Cabarrus County Schools, 2015). Are admission decisions based on student demographics, such as race and gender? Or, is students' prior academic achievement more influential in admission decisions? Additional research is needed to

examine differences and similarities in recruitment, selection, and enrollment at ECHSs nationwide.

Student engagement. Applying and attending an ECHS is optional, so even if a student is admitted they can choose to not attend an ECHS or leave the ECHS before graduating high school (North Carolina New Schools, 2013). The overall attrition rate at ECHSs (both transfers and dropouts) is comparable to national rates of high school leavers (Edmunds, Arshavsky, Unlu, Luck, & Bozzi, 2010). The main reasons given by ECHS leavers were challenges in meeting academic expectations and the lack of social or extracurricular activities.

Despite reporting a lack of social and extracurricular activities, ECHS students report being more actively engaged in school related activities than traditional high school students (Edmunds, 2010). Given that ECHSs target students who are underserved, more research is needed to examine student engagement and ensure students are receiving the necessary support to achieve success in an academically challenging program like the ECHS.

Working conditions. Although scarce, research on the experiences of those teaching in ECHSs has begun to surface. Roberts (2007) found that ECHS teachers felt more empowered than their peers at the state and district level. In Ohio and California, ECHS teachers reported having a working environment that instilled a familial atmosphere where students felt that they mattered (Wolk, 2005). However, Wolk suggests that the environment of ECHSs and the focus on relationships may place demands on teachers that can be emotionally taxing. Additional research is needed that illuminates the rewards and challenges faced by high school teachers and points towards the kinds of support needed to sustain teacher commitment over time.

Summary

The ECHSI is a nationwide high school reform effort that seeks to increase postsecondary degree attainment among students that are traditionally underrepresented in higher education (Jobs for the Future, 2013). Preliminary data suggests that ECHSs are serving their target population and also raising high school graduation and postsecondary attainment rates among subgroups of students (American Institutes for Research & SRI International, 2009; Berger et al., 2013). However, little is known about the teacher characteristics at ECHSs and how these characteristics could be helping or hindering the progress of the ECHSI.

Each state must adhere to the regulations of NCLB, which mandates that all public school teachers be highly qualified or HQ (U.S. Department of Education, 2006). The teacher characteristics that indicate HQ status, such as NBC, do appear to positively impact student achievement (National Board for Professional Teaching Standards, 2014). However, little is known about the characteristics of teachers at ECHSs and how these characteristics are impacting student achievement. Therefore, there is a particular need for research on teacher characteristics at ECHSs.

The research findings on licensure routes and teacher effectiveness have been mixed, but regularly certified teachers appear to be more effective during the early stages of their career (Bastian & Patterson, 2014). Alternative entry teachers also have higher attrition rates than regular licensed teachers (Henry et al., 2012; National Commission on Teaching and America's Future, 2003). With the exception of three studies, the research indicates that a teachers' graduate degree does not significantly impact student achievement (Betts et al., 2003; Clotfelter et al., 2010; Dee, 2004; Nye et al., 2004). However, in middle school and

high school, teachers' graduate degrees are positively correlated with student achievement if the degree is specific to the subject being taught (Goldhaber & Brewer, 1997).

Evidence suggests that NBC does identify effective teachers, but the impact of the NBC process on teacher effectiveness is unclear (National Board for Professional Teaching Standards, 2012; Harris & Sass, 2007). The effect of teaching experience appears to be strongest in the first few years of teaching (Greenwald et al., 1996; Gordon et al., 2006; Grissmer et al., 2000). The decline in performance among the most experienced teachers is most evident at the high school level, suggesting that this is where attention should be focused (Clotfelter et al., 2010).

Race, gender, and class are individual and school-level characteristics that influence interactions between teachers and students (Dee, 2004). At the individual level, race, class, and gender influence teacher expectations, teaching style, and teachers' ability to develop relationships with students (Steele, 1997). As a result, students have an experience that may or may not support and encourage them to continue in their academic endeavors. School-level factors, such as teacher diversity and class size, also impact student achievement (Chetty et al., 2010; Dee, 2004).

ECHSs serve a population of students that research shows are often taught by ineffective teachers, yet these are the students that benefit the most from having a high-quality teacher (Goldhaber et al., 2014. ECHSs have the odds stacked against them because they cost more to operate than traditional high schools and they enroll students that are at-risk (Jobs for the Future, 2013; Webb, 2004). However, ECHSs also have the potential to make a substantial difference in the individual lives of students who traditionally have suffered from inequalities in our educational system. Increasing high school graduation rates

and postsecondary degree attainment will positively impact individual lives and benefit our society as a whole (Carnevale, Strohl, & Gulish, 2015).

Chapter Three

Methodology

Introduction

Chapter Three describes the research design utilized to explore how school, teacher, and student characteristics impact student achievement at Early College High Schools (ECHSs) and comparable traditional high schools. The research goals and questions are presented and a description is given for the rationale of the design, the role of the researcher, data sources, participation selection, and the data analysis process. Validity, reliability, and generalizability are also presented. Ethical issues of the study conclude the chapter.

Pilot Study

The current quantitative study is an outgrowth from a pilot study conducted by the researcher as part of a qualitative methods course at Appalachian State University in Boone, NC. In the pilot study, the researcher interviewed five students who graduated from Caldwell Early College High School and were currently attending a four-year university. The focus of the pilot study was to learn about ECHS graduates' academic and social transition to a university.

The researcher transcribed each interview in its entirety and then used coding to reduce the data into manageable units. During the coding process, the researcher was able to organize similarities and differences in the interviewee's responses (Glesne, 2011). Bogdan and Bilklen (2007) describe data analysis as the systematic process of sifting and arranging all information to increase understanding of the data and enable the presentation of what has been discovered. What the researcher "discovered" was a recurring theme concerning the teachers at ECHSs. For example, several participants commented that the teachers "were

like parents" and "made everyone feel like a family". However, some of the ECHS graduates felt that the "close relationships" between teachers and students sometimes resulted in favoritism that affected the expectations that teachers held towards students. The pilot study was beneficial to the researcher because it helped narrow the research goals and questions of the present study on teacher characteristics at ECHSs.

Rationale for Quantitative Study

Particularly in the U.S. and the U.K., the lack of the use of quantitative methods in education research has resulted in the viewpoint that research in the field of education is not very influential or useful (Burkhardt & Schoenfeld, 2003; Kaestle, 1993). To address these concerns, the U.S. introduced legislation in 2001 that stipulates that all federally funded research must adopt scientifically based research methods (Eisenhart & Towne, 2003). While some see this as a step in elevating the status of educational research, others see it as privileging certain research methods, particularly experiments and randomized control trials. Experiments and randomized control trials can be difficult to conduct in educational settings because they are often not politically, administratively, or ethically feasible. Smith (2008) undertook an analysis of the published output of eight mainstream and well-regarded journals in the following fields: education, sociology, and social work. In the three education journals reviewed, around one third of the papers involved some use of quantitative methods. The papers that used secondary data analysis (80/192) comprised only a small subsection of the quantitative genre. The majority of the papers that included any analysis of secondary data were mostly based on the analysis of school examination data. While there were some exceptions, most of the papers did not utilize secondary data from other sources and only a small number of papers used secondary data from international sources. The overall analysis

of the use of numeric and secondary analytic techniques in the social sciences reveals that quantitative methods are underused in education research.

Prior to discussing the approach to secondary data analysis used in the study, the differences between primary and secondary data analysis is outlined. Boslaugh (2007) defines primary data as data that was collected for the specific purpose or analysis of the researcher or the research team. Secondary data, on the other hand, is data that already exists (Glaser, 1963). Consequently, secondary data analysis differs from primary data analysis in that the researcher is not involved in the recruitment of participants or in the collection of the data.

Nearly 50 years ago, Glaser (1963) first introduced the concept of secondary data analysis by discussing the potential of reanalyzing data "which were originally collected for another purpose" (p. 11). A more recent definition by Hewson (2006) describes secondary analysis as the "further analysis of an existing dataset with the aim of addressing a research question distinct from that which the dataset was originally collected and generating novel interpretations and conclusions" (p. 274). However, both of these definitions ignore the fact that secondary analysis can be used to reanalyze existing datasets for the purpose of answering original research questions with better statistical techniques or theoretical approaches.

The consensus among those looking for a definition of secondary analysis is that it should involve the analysis of someone else's data (Sobal, 1981). However, this definition can be disputed since reanalysis of one's own data could be secondary data analysis if it has a new purpose or is in response to a methodological critique (Schutt, 2012). A very general definition of secondary analysis offered by Jary and Jary (2000) is "any inquiry based on the

reanalysis of previously analyzed research data" (p. 510). Regardless of which definition one favors, secondary analysis makes use of data that has already been gathered or compiled in some way (Dale, Arber, & Procter, 1988).

According to Boslaugh (2007), there are different methods of locating and analyzing secondary data to address a specific research question or problem. The most common way to use secondary data for research is for the researcher to begin with the research question and then seek a dataset that will allow analysis of that question. Another method is to begin by selecting among the available secondary datasets and then formulate a research question that may be answered using the data chosen. In the present study, the researcher had several research questions and chose to obtain access to the NCERDC database before defining the questions in the research study. After obtaining access to the database, the researcher carefully examined the data and further developed the research questions presented in the study.

One advantage of working with secondary data is that the researcher saves time and money because someone else has already collected the data (Boslaugh, 2007). Therefore, researchers can spend the bulk of their time analyzing the data. Another advantage of using secondary data is the breadth of data available. The NCERDC has the resources, which few individual researchers have, that allows for the collection, storage, and management of all the data on North Carolina's public schools, students, and teachers. Yet another advantage of secondary data analysis is that the data collection process is done by individuals who specialize in that task and have high levels of expertise and professionalism.

A disadvantage of using secondary data, such the data from the NCERDC, is that it was not collected to answer the researcher's specific questions. Another disadvantage of

using secondary data is that the researcher did not participate in the planning and execution of the data collection process; therefore, they do not know exactly how it was conducted. Furthermore, secondary data may be not have been collected in particular geographical areas or during certain time periods.

In the present study, the researcher used quantitative methods to perform a secondary data analyses of data obtained from the NCERDC. The analyses sought to answer questions of vital importance to the field of education, including how teacher characteristics impact student achievement at ECHSs. The researcher chose to utilize data from the NCERDC because it is longitudinal and links student outcomes to multiple teachers, programs, and schools over time. All of the data from NCERDC was collected by the NCDPI using a standardized reporting format (Duke University, 2015). The NCERDC collects data from all the state's public schools, students and teachers; therefore, there is no lack of data from any geographical regions. Some of the NCERDC data dates back to the early 1990's, so there are some variables that were not collected until later on or were only collected in particular years. However, the study only utilized data from one school year, 2008-2009; therefore, missing data from particular years was not a concern.

Role of the Researcher

There are several ways that the researcher can use qualitative and quantitative methods to research phenomenon in the field of education (Steckler, McLeroy, Goodman, Bird, & McCormick, 1992). As discussed earlier in this chapter, the researcher conducted a qualitative pilot study, in which she interviewed several students who had graduated from an ECHS. After analyzing the qualitative findings from the pilot study, the researcher decided

to utilize quantitative methods to further investigate school, teacher, and student characteristics at ECHSs.

During the study, the researcher conducted an exploratory analysis using three logistic regressions to determine the predictive ability of school level variables, teacher level variables, and student variables on school type (ECHS or control). The researcher then ran follow up tests to learn more about the school, teacher, and student level variables that were significant predictors in the logistic regression analyses. The researcher attempted to maintain as much of a detached, objective view in order to understand the facts (Duffy, 1986). The researcher had no direct contact with subjects at all, consequently guarding against biasing the study and ensuring objectivity.

After completing the research study, the role of the researcher will be to communicate research findings through academic journals, professional conferences, and policy briefs and reports. In addition, the researcher will work collaboratively with the NCERDC to share and disseminate the research. Publishing the research will aid researchers and policy makers in the evaluation of high school reform efforts.

Study Purpose and Research Questions

The present study is an exploratory analysis of school, teacher, and student level variables at ECHSs and randomly drawn comparable high schools in the same districts in NC. Data was analyzed to determine how school, teacher, and student characteristics were impacting student achievement on the Algebra I EOC test during the 2008-2009 school year. The research was designed to utilize information from school, teacher, and student characteristics in order to make comparisons among ECHSs and comparable high schools.

Descriptive data was utilized to examine how school, teacher, and students characteristics related to student achievement.

The study utilized data from the NCERDC database that was collected during the 2008-2009 school year for 34 ECHSs and 56 randomly drawn comparable traditional high schools. The following research questions guided the study:

1. What are the effects of school level characteristics on student achievement at ECHS and control group schools?
2. What are the effects of teacher level characteristics on student achievement at ECHS and control group schools?
3. What are the effects of student level characteristics on student achievement at ECHS and control group schools?

Data Sources

The research project employed quantitative methods using the existing database at the NCERDC. Established in 2000, the NCERDC stores data collected from the NCDPI and the NCES (Duke University, 2015). The data from NCERDC, which dates back to the 1990's, includes information on the state's public schools, teachers, and students. The NCERDC conducts all activities in strict compliance with the Family Education Rights and Privacy Act (FERPA), a federal law that protects the privacy of student education records.

The NCERDC has provided researchers with the opportunity for policy-oriented research on topics such as: the minority achievement gap, the shortage of qualified teachers, the consequences of school accountability and choice, the academic performance of at-risk children, and problem behavior in schools (Duke University, 2015). In conclusion, the

NCERDC provides researchers with access to large databases that allow them to build on other researchers' work and connect with state and local policy makers.

Participation Selection

The present study utilized data from the 2008-2009 school year for 34 ECHSs and 56 randomly drawn comparable traditional high schools. At each of the 90 selected schools, participants were the students who took the Algebra I EOC test and teachers who taught Algebra I during the 2008-2009 school year. Data on school characteristics was used to provide descriptive data on the selected ECHSs and comparable high schools that offered Algebra I during the 2008-2009 school year.

Data Analysis Process

The data obtained from NCERDC was imported into IBM-SPSS Version 23.0. The data analysis process included the use of descriptive, comparative, and inferential statistics. Parametric and non-parametric approaches were used including chi-square tests and various general linear model techniques that are appropriate to the data. Parametric tests rely on assumptions about the distribution (i.e., assume a normal distribution) of the underlying population from which the sample was taken and about the parameters (i.e. means and standard deviations) of the assumed distribution (Hoskin, n.d.). Nonparametric tests do not rely on assumptions about the underlying population distribution. If the data truly has a normal distribution, nonparametric procedures generally have less power for the same sample size than the corresponding parametric procedure. Nonparametric procedures can also be more difficult to interpret than parametric procedures. All decisions on the statistical significance of the findings were made using a criterion alpha level of 0.05.

The General Linear Model (GLM) is a statistical linear model that is used in applied and social research (Trochim, 2006). The GLM is the foundation for the *t*-test, Analysis of Variance (ANOVA), Analysis of Covariance (ANCOVA) regression analysis, and many multivariate methods. In conclusion, the GLM can be used to summarize a wide variety of research outcomes, making it one of the most important tools in the statistical analysis of data.

Statistical procedures included the use of logistic regression to determine the school, teacher, and student characteristics that were predictors of ECHS enrollment. Unlike linear regression and other general linear models, logistic regression employs different assumptions with respect to linearity, normality, homoscedasticity, and measurement level (Statistic Solutions, 2015). First, logistic regression does not assume a linear relationship between dependent and independent variables (Spicer, 2004). As a result, logistic regression is an extremely robust analysis that allows one to "predict a discrete outcome, such as group membership, from a set of variables that may be discrete, continuous, dichotomous, or a mix of any of these" (Tabachnick & Fidell, 1996, p. 575).

Logistic regression can handle different types of independent variables because it applies a non-linear log transformation to the predicted odds ratio (Statistic Solutions, 2015). Logistic regression uses the criterion of maximum likelihood to determine outcomes, thus allowing for a minimum difference between a case's predicted probability of being in a category and its actual category (Spicer, 2004). While logistic regression does not require the dependent and independent variables to be related linearly, it does require that the independent variables be linearly related to the log odds. The linear relationship between the independent variables and the log odds is essential because, otherwise, the analysis will

underestimate the strength of the relationship and determine that the relationship is not significant, when in fact it is (Statistic Solutions, 2015). Solutions to this problem include the categorization of the independent variables or the use of discriminate analysis.

In contrast to logistic regression, discriminant analysis requires that the population variances and covariances for all independent variables are equal across the dependent variable groups, known as homogeneity of variance-covariance matrices (Spicer, 2004). Logistic regression allows for more variance between groups and does not require that the predictors be normally distributed, linearly related, or have equal variance in each group. In the present analysis the dependent variable is a categorical dichotomous variable, i.e. students attended early college high school or not. Given that the categorical outcome variable violates the assumption of linearity in normal regression, a logistic regression was determined to be the most appropriate procedure for the analysis.

Another assumption of logistic regression is that the model be fitted correctly (Statistic Solutions, 2015). Data should be neither over fitted, nor under fitted. The correct fitting of data means that only important variables are included, but also that all important variables are included. To ensure the model is fitted correctly, backwards stepwise regression was used as the preferred method of exploratory analyses (Ader, Mellenbergh, & Hand, 2008). Stepwise regression methods were utilized because the NCERDC model used in the study lacks sufficient guidance for determining which independent variable might be a more important predictor than another for a particular screening outcome. The backwards stepwise regression began with a full model and variables were eliminated from the model in an iterative process. After elimination of each variable, the fit of the model was tested to ensure that the model still adequately fit the data. When no more variables could be

eliminated from the model, the analysis was completed and the researcher investigated the identified variables in more detail.

Validity, Reliability, and Generalizability in Quantitative Research

The three key concepts in quantitative methods are validity, reliability and generalizability. All three have to do with measurement and are discussed in the following section.

Validity

Validity is rooted deeply in a positivist tradition and has been part of the culmination of other empirical conceptions such as universal laws, evidence, activity, truth, actuality, deduction, reason, fact, and mathematical data (Winter, 2000). Golafshani (2003) provides the following explanation of what validity is in research:

> Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object? Researchers generally determine validity by asking a series of questions, and will often look for the answers in the research of others. (p. 1)

Wainer and Braun (1988) describe the validity that concerns quantitative researchers as "construct validity". The construct is the initial concept, notion, question or hypothesis that helps the researcher determine which data is to be gathered and how it is to be gathered. Wainer and Braun also emphasize that quantitative researchers actively cause or affect the interplay between construct and data so they can validate their investigation, usually by the application of a test or other process. As a result, the data may either support or reject this construct, which is then put forward as a theory or further hypothesis.

Internal and External Validity

Threats to internal and external validity can occur at the three major stages of the research process: research design/data collection, data analysis, and data interpretation (Onwuegbuzie, 2000). The following section discusses internal and externality validity and how threats to validity were addressed in the research study.

Gay and Airasian (2000) describe internal validity as "the condition that observed differences on the dependent variable are a direct result of the independent variable, not some other variable" (p. 345). One threat to internal validity is researcher bias which may occur when the researcher serves as the person implementing the intervention. Researcher bias may occur during data collection when the researcher has a personal bias that may be subconsciously transferred to the participants in such a way that their behavior is affected. Furthermore, the researcher could also affect study procedures or contaminate data collection techniques. During this study, the researcher disassociated as much as possible from the data collection process by using existing data provided by the NCERDC.

Another threat to internal validity is selection bias, which refers to differences between two or more of the comparison groups prior to the implementation of the intervention (Onwuegbuzie, 2000). While randomized studies reduce the threat of selection bias, randomized studies are difficult to conduct in natural educational settings. In this study, the focus was on a specific population of teachers and students at selected Early Colleges and traditional high schools. The researcher addressed selection bias by assessing the equivalency of groups by comparing groups with as many variables as possible.

One of the most frequent and pervasive threats to internal validity at the data collection stage is implementation bias (Onwuegbuzie, 2000). Implementation bias leads to

the protocol designed for the intervention not being followed in the intended manner. For example, poor attitudes of some of the individuals toward an innovation, such as the ECHS, may lead to the intervention protocol being violated. The researcher recognizes that the data used in the study was collected during the beginning stages of the implementation of the ECHSI. Therefore, it is important to acknowledge how time is a particular component of implementation bias that may affect the internal validity of the research study.

External Validity

Even if the findings of a study have high internal validity, this doesn't necessarily mean that the findings can be generalized outside the study context. Johnson and Christensen (2010) define external validity as "the extent to which the results of a study can be generalized to and across populations, settings, and times" (p. 291). In the present research study, the researcher strived to ensure the results were placed in a realistic context by thoroughly examining the scholarly literature prior to the study. The researcher recognizes that the results of the study are not necessarily generalizable to all populations. Therefore, the focus of the researcher is to present the findings in a way that focused on providing directions for future research, rather than making definitive conclusions.

Reliability

In the study, the researcher obtained data from the NCERDC. The data from the NCERDC was obtained through standardized reports submitted by the NCDPI and the NCES. Therefore, reliability was not a major concern in the research study.

Generalizability

According to Maxwell (1992) a main distinction between qualitative and quantitative research is generalizability. The ability to generalize findings to wider groups and

circumstances is considered to be of little, or no, importance for many qualitative researchers. While qualitative research often limits itself to internal generalizations, quantitative research attempts to deal with both internal and external generalizations.

Although quantitative research may allow for more generalizability than qualitative research, quantitative researchers must consider accuracy when making generalizations. While generalizations may relate to those to whom it is applied, they may not always actually describe the phenomena of any single case with accuracy. For example, generalizations are not always accurate in all situations, in the same way that a mean average score may not be the same value as any of the numbers of which it is an average.

Ethical Concerns

Informed Consent

In order to obtain access to the NCERDC data, procedures were followed to obtain informed consent from the NCERDC. These procedures included: submitting a proposal for use of the data, completing the Data Use Agreement, signing confidentiality agreements, and submitting a letter of support written by a faculty member (assuming responsibility for data security).

To protect the rights of individuals in the study, the researcher submitted an exemption request, as well as a request for non-exempt human participant research to the Institutional Review Board (IRB). The request for the non-exempt human participant research was part of a requirement by NCERDC that the researcher have proof of IRB approval at the expedited level prior to releasing any data. IRB approval was granted on March 19, 2012 and again on November 10, 2014. Both copies of IRB approval were submitted to the NCERDC.

Risks and Vulnerability

To minimize any potential risks, the data file and all work products were stored on a password protected, encrypted external drive secured in a locked file cabinet in a secured faculty office. Data was stored and analyzed on a secure system that prevented unauthorized access. Analysis of the data was conducted on password protected, non-networked laptop computers with all work products saved directly to the secure external drive. Access to the data file and work products were controlled and monitored via log by a faculty advisor. All electronic and paper data were destroyed on the project's end date.

Confidentiality

The researcher and doctorate committee members agreed to the Data Use Agreement provided by NCERDC. Data was used only for statistical analysis and no attempt was made to identify individuals. If the identity of a student or teacher was discovered inadvertently, the information was not used and was safeguarded or destroyed. Precautions were taken to avoid inadvertent disclosure of student identities.

Chapter Four

Results

The purpose of this study was to examine how school, teacher, and student level characteristics impacted student achievement on the Algebra I EOC test during the 2008-2009 school year at selected ECHSs and control group schools. Chapter Four reports the results of the study in four sections: demographic profile of students, analyses of school level characteristics, analyses of teacher level characteristics, and analyses of student level characteristics.

This study examined a sample of 2,175 high school students who took the Algebra I EOC test during the 2008-2009 school year. Of the 2,175 students, 1,027 (47.2%) were enrolled at an ECHS and 1,148 (52.8%) were enrolled at a randomly drawn traditional high school. The gender and ethnicity data for the study sample are outlined in Tables 2 and 3.

Table 2

Gender of Study Participants

Variable	N	Percent
Missing	36	1.6%
Female	1199	52.4%
Male	990	47.6%
Total		100

Table 3

Ethnicity of Study Participants

Variable	N	Percent
Missing	36	1.6%
Asian	28	1.3%
Black	745	33.5%
Hispanic	172	7.7%
American Indian	15	.7%
Multi-Racial	56	2.5%
White	1173	52.7%
Total	2225	100

It should be noted that White students made up the majority of all ethnic backgrounds at 52.7%, followed by Black students at 33.5%. Gender and ethnicity data in relation to ECHS enrollment are outlined in Tables 4 and 5.

Table 4

Gender in Relation to ECHS Enrollment

Variable	Enrolled at ECHS (N)	Enrolled at ECHS (Percent)	Enrolled at Traditional High School (N)	Enrolled at Traditional High School (Percent)
Missing	28	2.7%	5	.4%
Female	633	61.6%	552	48.1%
Male	366	35.6%	591	51.5%
Total	1027	100%	1148	100%

Table 5

Ethnicity in Relation to ECHS Enrollment

Variable	Enrolled at ECHS (N)	Enrolled at ECHS (Percent)	Enrolled at Traditional High School (N)	Enrolled at Traditional High School (Percent)
Missing	28	2.7%	5	.4%
Asian	17	1.7%	10	.9%
Black	349	34%	374	32.6%
Hispanic	81	7.9%	89	7.8%
American Indian	7	.7%	8	.7%
Multi-Racial	23	2.2%	31	2.7%
White	522	50.8%	631	55%
Total	1027	100%	1148	100%

Three logistic regressions were conducted to determine the predictive ability of school level variables, teacher level variables, and student variables on school type (ECHS or control). The purpose of the three logistic regression analyses was to identify the specific school, teacher, and student characteristics that were predictive of ECHS enrollment at the significance level of 0.05. The following results are organized by each of the three logistic regression analysis that were conducted. For each logistic regression analysis (school, teacher, and student), the researcher provides a chart of all the significant predictors included in that analysis, as well as report the significance of each variable. In addition, for each analysis, the researcher provides a codebook that includes each variable in the analysis and a

description of that variable. Table 6 provides the codebook for the variables in the school level analysis.

Table 6

Codebook for School Level Variables

TCYCLE	Testing cycle (e.g. Fall, Spring)
TITLEI	Title I eligible school
STITLI	School-wide Title I
REPG9	Whether this is student's first time in grade 9
EFFECT_DATE	Teacher's effective date of record (initial license or renewal)
GRAD_DATE	College graduation date of teacher
TST_DATE	Test date of teacher (i.e. PRAXIS)
EXPR	Experience status of teacher
ACH_LEVEL	Student's achievement level on Algebra I EOC
STATUS	NCES code for the school status (e.g. new, continuing)
PUPTCH	Calculated pupil/teacher ratio
LEPSTAT	Whether a student has limited English proficiency
SUBJCT	State course code subject area (indicates the state-defined subject area to which the activity can most closely be associated)
ACADLVL	State course code academic level (the academic level for which the activity was designed, NOT the academic level of the students enrolled)
SWD	Whether a student has a disability flag for AYP
EDS	Whether student is economically disadvantaged (eligible for free/reduced price lunch)
FRL	Whether student receives free/reduced lunch
TCH_SEX	Teacher sex
TCH_ETH	Teacher ethnicity
SEX	Student sex
ETHNICITY	Student race/ethnicity

Table 7

Codebook for Teacher Level Variables

PGM_LIC_TYPE_CD	License type code of teacher (e.g. C = Standard Professional II)
PGM_STS_CD	Program status code of teacher (e.g. 0 = Continuing)
PGM_BASIS_CD	Program basis code of teacher (e.g. 1 = Approved NC Education Program)
CLS_LVL_ELV_CD	Teacher's license class education level code (e.g. bachelor's degree, master's degree, sixth year (advanced), doctor's degree)
EDUC_LVL_CD	Educational attainment of teacher (e.g. 4 = Bachelor's)
EFFECT_DATE	Teacher's effective date of record (initial license or renewal)
GRAD_DATE	College graduation date of teacher
TST_DATE	Test date of teacher (i.e. PRAXIS)
TST_CD	Test code of teacher (numeric codes identifying the specific area of the test)
TCH_SEX	Teacher sex
TCH_ETH	Teacher ethnicity
EXPR	Experience status of teacher
ACH_LEVEL	Student's achievement level on Algebra I EOC

Table 8

Codebook for Student Level Variables

SEX	Student sex
ETHNICITY	Student race/ethnicity
GRADE	Student grade level
LEPSTAT	Whether a student has limited English proficiency
SWD	Whether a student has a disability flag for AYP
EDS	Whether student is economically disadvantaged (eligible for free/reduced price lunch)
FRL	Whether student receives free/reduced lunch
SPORTS	Student participation in sports activities
ACADCLUB	Student participation in an after school academic club
ARTS	Student participation in after school arts club
VOCCLUB	Student participation in after school vocational club
SERVICE	Student participation in service club (e.g. Civitans) after school
OTHACTV	Student participation in other after school activity
ACH_LEVEL	Student's achievement level on Algebra I EOC
REPG9	Whether this is student's first time in grade 9

A discussion of each logistic regression analysis provides narrative on the variables in that logistic regression analysis that were significant predictors. After the results of the logistic regression analysis are explained, the researcher discusses follow-up tests that were conducted in order to investigate the significant predictors further. In the next section the logistic regression analysis of school level variables is discussed.

Logistic Regression Analysis of School Level Predictors

A logistic regression was developed in order to determine the ability of school level variables in predicting school type (ECHS or control). The results of the school level logistic regression are outlined in Table 9.

Table 9

Logistic Regression Analysis by School Level Variables

Predictor			B	SE	Wald	Exp(B)	p
Testing cycle					50.23		.000
	Fall		1.54	.38	15.99	4.65	.000
	Spring		1.02	.16	42.62	2.78	.000
Eligible for Title I			1.15	.31	13.88	3.15`	.000
School-wide Title I	Yes				1.95		.163
	No		-.44	.31	1.95	.65	.163
Repeat 9th grade			2.30	1.14	4.04	9.92	.044
Years since effect date			.02	.01	2.29	1.02	.130
Years since college graduation			.13	.01	94.58	1.14	.000
Years since licensure test date (i.e. Praxis)			-.04	.01	10.82	.96	.001
Experience status		employed in this administrative unit last year			38.76		.000
		now entering first year of employment in education	-2.14	.55	15.26	.12	.000
		returned after absence from public education	-21.75	3669.39	.000	.000	.995
		employed last yr in another NC administrative unit	-21.00	13168.55	.000	.000	.999
		employed last yr in another state	-.91	.59	2.43	.40	.119
Algebra I achievement level		Level 1			15.02		.002
		Level 2	-.11	.30	.13	.90	.717
		Level 3	.70	.22	10.21	2.02	.001
		Level 4	.24	.18	1.63	1.27	.202
Status			-26.18	6459.56	.000	.000	.997
Pupil/teacher ratio			.44	.03	275.27	1.55	.000

Table 9 (continued)

Logistic Regression Analysis by School Level Variables

LEP Status	Not currently or never identified LEP			2.27		.519
	Exited LEP identification	.88	2.15	.17	2.40	.683
	Currently identified as LEP	-.06	2.26	.00	.94	.978
	Parental refusal of IPT testing	.44	2.20	.04	1.55	.84
Subject				88.43		.000
	2018-Foundations of Algebra	-3.07	.69	19.94	.05	.000
	2021- Introductory mathematics, Algebra 1-A	-2.46	.46	28.33	.09	.000
	2022-Algebra 1-B	-2.99	.41	52.86	.05	.000
	2023-Algebra I	-21.74	6149.51	.000	.000	.997
Academic Level	Standard version			41.95		.000
	honors/advanced/academically gifted	-2.36	.36	41.95	.10	.000
SWD	No			10.50		.005
	Exited within 2 years	.82	.29	8.24	2.28	.004
	Yes	-.11	.63	.03	.90	.859
EDS		.22	.25	.78	1.25	.378
FRL	Temporary			28.66		.000
	Free	-2.67	.53	25.59	.07	.000
	Reduced Pay	-.11	.28	.16	.90	.694
	Full Pay	-.18	.35	.27	.83	.601
Teacher Gender	Female			.66		.417
	Male	.16	.19	.66	1.17	.417
Teacher Ethnicity	Asian			.27		.992
	Black	-17.63	16170.84	.000	.000	.999
	Hispanic	-.11	.21	.27	.90	.604
	Multiracial	-18.48	10932.37	.000	.000	.999
	White	-20.98	8228.76	.000	.000	.998
Student Gender				26.48		.000
	Female	3.05	.66	21.57	21.14	.000
	Male	.38	.14	7.45	1.46	.006
Student Ethnicity	Asian			26.48		.000
	Black	.85	.73	1.35	2.34	.246
	Hispanic	.90	.18	25.32	2.47	.000
	Indian	.23	.35	.42	1.26	.515
	Multiracial	.32	.84	.15	1.38	.702
	White	.16	.39	.16	1.17	.69

Results of the logistic analysis indicated that the model provided a statistically significant improvement over the constant model. The model accounted for 69.70% of the total variance. Prediction success for the cases was 87.5%. The sample was comprised of 34 ECHSs and 56 control group schools that offered Algebra I during the 2008-2009 school year.

In the logistic regression analysis of school level variables, student gender was a significant predictor of ECHS and control group schools that offered Algebra I during the 2008-2009 school year, Wald(2, N=2175) = 26.16, $p < .001$. For student gender, female and male were both significant predictors, Wald(1, N=2175) = 21.57, $p < .001$ and Wald(1, N=2175) = 7.45, $p = .006$, respectively. The student ethnicity group of Hispanic was a significant predictor, Wald(1, N=2175) = 25.32, $p < .001$. The student ethnicity group of Asian was a significant predictor, Wald(5, N=2175) = 26.48, $p < .001$. However, the ethnicity group Asian was excluded from the discussion because the sample size was small (N=27).

The lunch codes temporary and free were both significant predictors of ECHS and control group schools that offered Algebra I during the 2008-2009 school year, Wald(3, N=2175) = 28.66, $p < .001$ and Wald(1, N=2175) = 25.59, $p < .001$, respectively. The student disability flag for AYP a significant predictor of students *not* having a disability flag, Wald(2, N=2175) = 10.50, $p = .005$. Another significant predictor was for students who had exited the disability flag within two years, Wald(1, N=2175) = 8.24, $p = .004$. However, this predictor was excluded from the discussion because the sample size was small (N=30). Repeating 9th grade was a significant predictor, Wald(1, N=2175) = 4.04, $p = .044$.

The logistic regression analysis of school level variables showed that the academic levels of standard and honors were significant predictors of ECHS and control group schools that offered Algebra I during the 2008-2009 school year, Wald(1, *N*=2175) = 41.95, $p < .001$ and Wald(1, *N*=2175) = 41.95, $p < .001$, respectively. Level one and level three of Algebra I achievement level were both significant predictors, Wald(3, *N*=2175) = 15.02, $p = .002$ and Wald(1, *N*=2175) = 10.21, $p = .001$, respectively.

The logistic regression analysis of school level variables showed that eligibility for Title 1 was a significant predictor of ECHS and control group schools that offered Algebra I during the 2008-2009 school year, Wald(1, *N*=2175) = 13.89, $p < .001$. Testing cycle was a significant predictor, Wald(2, *N*=2175) = 50.23, $p < .001$. For testing cycle, both fall of 2008 and spring of 2009 were significant predictors, Wald(1, *N*=2175) = 15.99, $p < .001$ and Wald(1, *N*=2175) = 42.62, $p < .001$, respectively. Pupil-teacher ratio was a significant predictor, Wald(1, *N*=2175) = 275.27, $p < .001$. State course code subject area was a significant predictor, Wald(4, *N*=2175) = 88.43, $p < .001$. For subject area, Foundations of Algebra I was a significant predictor, Wald(1, *N*=2175) = 19.94, $p < .001$. The subject area Algebra 1-A was also a significant predictor, Wald(1, *N*=2175) = 28.33, $p < .001$. The subject area Algebra 1-B was a significant predictor, Wald(1, *N*=2175) = 52.86, $p < .001$. However, the subject area Algebra 1-B was excluded from the discussion because the sample size was small (*N*=32).

The teacher experience level of employed in the same administrative unit last year was a significant predictor of ECHS and control group schools that offered Algebra I during the 2008-2009 school year, Wald(4, *N*=2175) = 38.76, $p < .001$. The teacher experience level of entering first year of employment in education was a significant predictor, Wald(1,

N=2175) = 15.26, $p < .001$. Teacher college graduation date was a significant predictor of ECHS and control group schools that teach Algebra I, Wald(1, *N*=2175) = 94.58, $p < .001$. Teacher test date was also a significant predictor, Wald(1, *N*=2175) = 10.82, $p = .001$.

The following section discusses the results of the follow-up tests that were conducted on the significant school level predictors. As mentioned previously, significant predictors were excluded from the discussion if the sample size was less than 60. The researcher utilized chi-square tests and cross-tabulations for significant predictors that were discrete or categorical. Independent samples *t*-tests were used to investigate significant predictors that were continuous.

Follow-up Analyses of Significant School Level Predictors

Relationship between Student Gender and School Type

A follow up analysis using Pearson's chi-square found a significant relationship between student gender and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (2, *N*=2175) = 67.95, $p < .001$. Crosstabs showed schools in the ECHS group had a significantly higher percentage (53.4%) of females enrolled, compared with control group schools (46.6%). The odds ratio from the logistic regression of school level variables indicated that schools in the ECHS group were 21.14 times more likely to enroll females, compared with control group schools. Control group schools had a significantly higher percentage of males enrolled (61.8%), compared with schools in the ECHS group (38.2%). The odds ratio from the logistic regression of school level variables indicated that control group schools were 1.46 times more likely to enroll males, compared with schools in the ECHS group.

Relationship between Student Ethnicity and School Type

A follow up analysis using Pearson's chi-square found a significant relationship between student ethnicity and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (4, N=2175) = 24.00, p = .001. Crosstabs showed schools in the ECHS group had a significantly higher percentage (7.9%) of Hispanics enrolled, compared with control group schools (7.8%). The odds ratio from the logistic regression of school level variables indicated that schools in the ECHS group were 2.47 times more likely to enroll Hispanics, compared with control group schools.

Relationship between School Eligibility for Title I and School Type

The purpose of Title I is to provide financial assistance to local educational agencies (LEAs) and schools with high numbers or percentages of children from low-income families (U.S. Department of Education, 2015). According to the Center for Child and Family Policy (2012), which houses the NCERDC data, a school eligible for Title I is designated under appropriate state and federal regulations as being eligible for participation in programs authorized by Title I of Public Law 103-382. Unless a participating school is operating a school-wide program, the school must focus Title I services on children who are failing, or most at risk of failing, to meet state academic standards (U.S. Department of Education, 2015). Schools that are enrolling at least 40% of children from low-income families are eligible to use Title I funds for school-wide programs designed to advance their entire educational programs in order to improve achievement for all students, particularly the lowest-achieving students.

A follow up analysis using Pearson's chi-square indicated a significant relationship between eligibility for Title I and school type (ECHS or control) for schools that offered

Algebra I during the 2008-2009 school year, X^2 (1, *N*=2175) = 48.32, $p < .001$. Crosstabs showed that schools in the ECHS group were significantly more likely to be eligible for Title 1 (78.5%), compared with the traditional high schools in the control group (65%). The odds ratio from the logistic regression of school level variables indicated that schools in the ECHS group were 3.15 times more likely to be eligible for Title 1, compared with control group schools. On the other hand, schools in the control group (21.5%) were significantly less likely to be eligible for Title I, compared with schools in the ECHS group (35%).

Relationship between Full-time Equivalent Teachers (FTE) and School Type

An independent samples *t*-test was conducted to compare the number of full-time equivalent teachers for schools in the ECHS and control groups that offered Algebra I during the 2008-2009 school year, $t(1179) = 72.08$, $p < .001$. The independent samples *t*-test showed a significant difference in the mean number of full-time equivalent teachers at schools in the ECHS group ($M = 9.02$, $S = 3.21$) and control group schools ($M = 70.97$, $S = 28.92$). During the 2008-2009 school year, control group schools employed significantly more full-time equivalent teachers, compared with schools in the ECHS group.

Relationship between Testing Cycle and School Type

A follow up analysis using Pearson's chi-square found a significant relationship between testing cycle of students taking the Algebra I EOC and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (2, *N*=2175) = 62.66, $p < .001$. Crosstabs analyses showed that schools in the ECHS group (51.6%) were significantly more likely to administer the Algebra I EOC test in the fall of 2008, compared with schools in the control group (37.5%). Odds ratios from the logistic regression analysis of school-level variables indicated that schools in the ECHS group were 4.65 times more

likely to administer the Algebra I EOC test in the fall of 2008. Crosstabs indicated that schools in the ECHS group were significantly less likely to administer the Algebra I EOC test in the spring of 2009. It is possible that schools that administered the EOC test in the spring are structured to allow students to take an Algebra I course that is yearlong, as opposed to just one semester. According to crosstabs, 43.7% of schools in the ECHS group administered the Algebra I EOC test in the spring of 2009, compared with 60.3% of schools in the control group. Odds ratios from the logistic regression analysis of school-level variables indicated that schools in the control group were 2.78 times more likely to administer the Algebra I EOC test in the spring of 2009.

Relationship between Pupil/Teacher Ratio and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between the pupil-teacher ratio at schools in the ECHS group and schools that offered Algebra I during the 2008-2009 school year, $t(1260) = -20.84$, $p < .001$. There was a significant difference in the mean pupil-teacher ratio for schools in the ECHS group ($M = 19.58$, $S = 5.79$) and control group schools ($M = 15.60$, $S = 2.07$). The results of the *t*-test showed that control group schools had a significantly lower pupil teacher ratio than schools in the ECHS group during the 2008-2009 school year. Another interpretation of the results of the *t*-test is that, during the 2008-2009 school year, control group schools were significantly more likely to have less students assigned to a full-time classroom teacher, compared with ECHS group schools.

Relationship between State Course Code Subject Area and School Type

A follow up analysis using Pearson's chi-square found a significant relationship between the state course code subject area and school type (ECHS or control) for schools that

offered Algebra I during the 2008-2009 school year, X^2 (4, *N*=2175) = 228.00, $p < .001$. During the 2008-2009 school year, crosstabs analyses indicated that control group schools (5.8%) were significantly more likely to enroll students in the Foundations of Algebra I course, compared with schools in the ECHS group (3.1%). Crosstabs also indicated that schools in the control group (17.9%) were significantly more likely to enroll students in Algebra 1-A, compared with schools in the ECHS group (2.4%).

Relationship between Teachers' College Graduation Date and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between teachers' college graduation date and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, $t(2121) = -11.13$, $p < .001$. *T*-test results showed a significant difference in the mean number of years since college graduation for teachers at schools in the ECHS group ($M = 18.95$, $S = 10.83$) and teachers at schools in the control group ($M = 13.87$, $S = 10.35$). During the 2008-2009 school year, teachers at schools in the ECHS group had a college graduation date that was an average of 5.08 years prior to the college graduation date of teachers at schools in the control group.

Relationship between Teachers' Test Date and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between the teachers' test date and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, $t(2173) = -5.87$, $p < .001$. *T*-test results showed there was a significant difference in the mean number of years since teachers' test date for schools in the ECHS group ($M = 15.07$, $S = 11.48$) and schools in the control group ($M = 12.25$, $S = 10.99$). Teachers at schools in the ECHS group had a test date that was an average of 2.82 years prior to the test date of teachers at schools in the control group.

Relationship between Teacher Experience Level and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the experience level of teachers and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (5, *N*=2175) = 175.94, $p < .001$. Crosstab analyses indicated that control group schools had significantly more teachers (78.3%) that were employed in the same administrative unit last year compared with schools in the ECHS group (75.5%). Crosstabs also indicated that control group schools were significantly more likely to employ teachers (8.1%) who were entering their first year of employment in education, compared with ECHS group schools (0%).

Relationship between Algebra I Achievement Level and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between Algebra I achievement level and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (3, *N*=2175) = 13.97, $p = .003$. Crosstabs showed that schools in the ECHS group had significantly less students who scored a level 1 (7.3%) compared with schools in the control group (11.8%). Crosstabs indicated that control group schools had significantly more students who scored a level 3 (42.1%), compared with students at schools in the ECHS group (42%). Odds ratios from the logistic regression analysis of school-level variables indicated that schools in the control group were 2.02 times more likely to have students score a level three, compared with schools in the ECHS group.

Relationship between Academic Level and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the academic level of the Algebra I activity students were assigned to and school

type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (2, *N*=2175) = 210.67, $p < .001$. It is important to note that the academic level variable is the academic level for which the activity was designed for students, NOT the academic level of the students enrolled. At control group schools, crosstabs showed that significantly more students were assigned to the standard version of Algebra I (95.3%), compared with students at schools in the ECHS group (73.2%). At schools in the ECHS group, crosstabs indicated that significantly more students were assigned to honors Algebra I (14.9%), compared with students at schools in the control group (1.6%). Regardless of the academic level of the activity, all of the students took the Algebra I EOC test during the 2008-2009 school year.

Relationship between Student Disability Flag for AYP and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the AYP disability flag for students and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (2, *N*=2175) = 26.52, $p < .001$. Crosstab analyses indicated that schools in the ECHS group had significantly more students (94.3%) who took the Algebra I EOC during the 2008-2009 school year and did *not* have a disability flag, compared with control group schools (88.2%).

Relationship between Free and Reduced Price Lunch Code and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the lunch code variable for students and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (4, *N*=2175) = 42.02, $p < .001$. Crosstabs found that control group schools had a significantly higher percentage of students (5.7%) who had a lunch code of temporary, compared with schools in the ECHS group (1%).

Crosstabs found that schools in the ECHS group had a significantly higher percentage of students (29%) receiving free lunch, compared with control group schools (23.8%).

Relationship between Students Repeating 9th Grade and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between repeating 9th grade and school type (ECHS or control) for schools that offered Algebra I during the 2008-2009 school year, X^2 (1, N=2175) = 18.95, $p < .001$. Crosstabs found that ECHS group schools had significantly less students (99.9%) who were repeating 9th grade, compared with control group schools (97.9%). Compared with schools in the ECHS group, control group schools were 9.92 times more likely to have students enrolled who were repeating 9th grade. In the next section the logistic regression analysis of teacher level variables is discussed, as well as follow-up analyses that were conducted to investigate further the significant teacher level predictors.

Logistic Regression Analysis of Teacher Level Predictors

A logistic regression was developed in order to determine the ability of teacher level variables in predicting teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year. The results of the teacher level logistic regression are outlined in Table 10.

Table 10

Logistic Regression Analysis by Teacher Level Variables

Predictor		B	SE	Wald	Exp(B)	p
License type code		-2.19	.30	54.67	.11	.000
Program status code	SP2			14.27		.003
	SP1	1.63	.68	5.69	5.12	.017
	Temporary	.26	.61	.19	1.30	.665
	Provisional	-7.62	11629.83	.00	.00	.999
Program basis code	Approved NC education program			23.38		.003
	Other approval	.58	.27	4.48	1.78	.034
	Reciprocal education-NASDTEC	.32	.29	1.22	1.38	.269
	Reciprocal based on contract	-20.64	13378.53	.00	.00	.999
	Reciprocal education-NCATE	.74	.32	5.37	2.09	.021
	Missing	-20.49	5667.83	.00	.00	.997
	Alt entry-exp nonteaching prof	-23.10	40192.97	.00	.00	1.00
	Lateral entry	-23.82	16403.15	.00	.00	.999
	Licensing by regional alt lic center	2.18	.49	20.09	8.88	.000
Licensure class education level code	Bachelors			.08		.775
	Masters	-.06	.20	.08	.94	.775
Educational attainment	Missing			9.40		.02
	Bachelors	-6.25	34566.92	.00	.00	1.00
	Masters	-1.96	30393.39	.00	.14	1.00
	Sixth year (advanced)	-3.09	30393.39	.00	.05	1.00
Years since effect date		.04	.02	4.04	1.04	.045
Years since college graduation		.08	.01	39.56	1.09	.000

Table 10 (continued)

Logistic Regression Analysis by Teacher Level Variables

Years since licensure test date (i.e. Praxis)		-.14	.02	36.28	.87	.000
Test code	Missing			102.82		.000
	Biology and general science	-1.36	18050.41	.00	.26	1.00
	Business education	-2.26	26178.607	.00	.10	1.00
	Chemistry, physics, and general science	39.45	16775.33	.00	1.36E+17	.998
	Content knowledge	42.29	13197.74	.00	2.32E+18	.997
	Early childhood education	19.44	12117.26	.00	276153156.2	.999
	Education in elementary school	40.08	14541.06	.00	2.56E+17	.998
	Elementary education- curr & assessment	17.32	12117.26	.00	33131681.40	.999
	GRE analytical exam	9.72	16801.18	.00	16583.70	1.00
	Library media specialist	19.83	17156.62	.00	410609096.4	.999
	Mathematics	13.01	18320.71	.00	447535.76	1.00
	Middle school English language arts	20.13	12117.26	.00	554129102.8	.999
	Performance based licensure	15.56	12117.26	.00	.03	1.00
	Physical education	19.65	31411.62	.00	5741107.89	1.00
	Reading	19.65	31411.62	.00	340800241.7	1.00
	Social studies	14.10	12117.26	.00	1323649	.999
Teacher gender				21.64		.000
	Female	-3.93	1.09	13.02	.02	.000
	Male	.42	.14	8.60	1.52	.003

Table 10 (continued)

Logistic Regression Analysis by Teacher Level Variables

Teacher ethnicity	Asian			8.69		.069
	Black	-20.45	16358.41	.000	.00	.999
	Hispanic	-.48	.16	8.69	.62	.003
	Multi-racial	-21.17	12032.60	.00	.00	.999
	White	-21.20	8550.57	.00	.00	.998
Experience status	employed in this administrative unit last year			29.22		.000
	now entering first year of employment in education	-5.78	1.07	29.08	.00	.000
	returned after absence from public education	-19.40	5287.61	.00	.00	.997
	employed last yr in another NC administrative unit	-6.94	26794.19	.00	.00	1.00
	employed last yr in another state	-5.82	1.08	28.81	.00	.000
Algebra I achievement level	Level 1			51.12		.164
	Level 2	-.33	.22	2.25	.72	.134
	Level 3	.14	.17	.67	1.15	.412
	Level 4	.00	.15	.00	1.00	.999

Results of the logistic analysis indicated that the model provides a statistically significant improvement over the constant model. The model accounted for 54.20% of the total variance. Prediction success for the cases was 75.1%. The sample was comprised of all the teachers who taught Algebra I during the 2008-2009 school year at selected schools.

In the logistic regression analysis of teacher level variables, teacher licensure area was a significant predictor of teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year, Wald(1, N=2175) = 54.67, $p < .001$. The logistic regression analysis showed that the program status codes of SP2, Wald(3, N=2175) = 14.27, $p = .003$ and SP1, Wald(1, N=2175) = 5.69, $p = .017$ were significant teacher level predictors.

Four of the program basis codes were significant predictors of teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year. The program basis code of approved NC education program was a significant teacher level predictor, Wald(8, N=2175) = 23.38, $p = .003$. The program basis code of other approval was a significant teacher level predictor Wald(1, N=2175) = 4.48, $p = .034$. The program basis code of reciprocal education program-NCATE was a significant teacher level predictor Wald(1, N=2175) = 5.37, $p = .021$. The program basis code of licensing by a regional alternative licensure center was a significant teacher level predictor Wald(1, N=2175) = 20.09, $p < .001$.

Teacher gender was a significant predictor of teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year, Wald(2, N=2175) = 21.64, $p < .001$. For teacher gender, both female, Wald(1, N=2175) = 8.69, $p = .003$ and male, Wald(1, N=2175) = 8.69, $p = .003$ were significant predictors. The Hispanic ethnicity group was a significant teacher level predictor, Wald(1, N=2175) = 28.68, $p < .001$. However, the

Hispanic ethnicity predictor was excluded from the discussion because the sample size was small (*N*=11).

Three of the experience levels were significant predictors of teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year. One predictor was whether a teacher was employed in the same administrative unit last year, Wald(4, *N*=2175) = 29.22, $p < .001$. Another teacher experience predictor was whether a teacher was entering their first year of employment in education, Wald(1, *N*=2175) = 29.08, $p < .001$. The last significant teacher experience predictor was for teachers who had been employed in another state the previous year, Wald(1, *N*=2175) = 28.81, $p < .001$. However, the experience level of being employed last year in another state was excluded from the discussion because the sample size was small (N=44).

Years since a teacher's effect date was a significant predictor of teachers who taught Algebra I in ECHSs or control schools during the 2008-2009 school year, Wald(1, *N*=2175) = 4.04, $p = .045$. Another significant teacher level predictor was for the number of years since a teacher's college graduation date, Wald(1, *N*=2175) = 39.56, $p < .001$. Years since a teacher's test date was also a significant teacher level predictor, Wald(1, *N*=2175) = 36.27, $p < .001$. The following section discusses the results of the follow-up tests that were conducted on the teacher variables that were significant predictors in the logistic regression analysis.

Follow-up Analyses of Significant Teacher Level Predictors

Relationship between Teacher Licensure Area and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between teacher licensure area and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year X^2 (1, *N*=2175) = 7.07, $p = .008$. Crosstabs

showed that teachers in the control group (85.7%) were significantly more likely to have a mathematics (9-12) licensure area, compared with teachers in the ECHS group (81.5%). On the other hand, ECHS teachers (18.5%) were significantly more likely to have a middle grades mathematics licensure area (6-9), compared with teachers in the control group (14.3%).

Relationship between Program Status Code and School Type

North Carolina requires that teachers be licensed to teach in public schools (North Carolina Department of Public Instruction, 2014). Standard Professional 1 (SP1) Professional Educator Licenses are valid for three years and are intended for teachers with 0-2 years of teaching experience. To be issued a SP1 Professional Educator's License, individuals must complete a state approved teacher education program from a regionally accredited college or university. Teachers from other states may complete another state's approved alternative route to licensure, meet the federal requirements to be designated as "Highly Qualified", and earn a bachelor's degree from a regionally accredited college.

After three or more years of teaching as an initially licensed teacher, individuals are issued a Standard Professional 2 (SP2) Professional Educator License, which is valid for five years (North Carolina Department of Public Instruction, 2014). Teachers who are fully licensed and "Highly Qualified" in another state who have three or more years of teaching experience in another state AND who meet NC State Board of Education approved licensure exam requirements OR have National Board Certification are issued the SP2 Professional Educator's license.

Follow up analysis using Pearson's chi-square found a significant relationship between program status code and school type (ECHS or control) for teachers who taught

Algebra I during the 2008-2009 school year, X^2 (3, *N*=2175) = 119.64, $p < .001$. According to crosstabs, teachers in the ECHS group (95%) were more likely to have an SP2 license, compared with control group teachers (85%). Crosstabs indicated that more control group teachers (15.6%) had an SP1 license, compared with teachers in the ECHS group (3%). Odds ratios from the logistic analysis of teacher level variables found that control group teachers were 5.12 times more likely to have an SP1 license, compared with teachers in the ECHS group.

Relationship between Program Basis Code and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between program basis code and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year X^2 (8, *N*=2175) = 110.90, $p < .001$. Crosstabs found that teachers in the ECHS group (55.8%) were significantly more likely to have a program basis code of approved NC education program, compared with teachers in the control group (54.3%). Crosstabs showed that control group teachers (21.7%) were significantly more likely to have a program basis code of other approval than teachers in the ECHS group (19.4%). Odds ratios from the logistic regression analysis of teacher level variables showed that control group teachers were 1.78 times more likely than teachers in the ECHS group to have a program basis code of other approval.

Crosstabs found that teachers in the control group (5.2%) were also significantly more likely to have a program basis of reciprocal education program-NCATE. However, it is important to note that there were no teachers in the ECHS group that had a program basis code of reciprocal education program-NCATE. Crosstabs showed that teachers in the control group (6.8%) were significantly more likely to have a program basis code of

licensing by a regional alternative licensure center, compared with teachers in the ECHS group (4.9%). Odds ratios from the logistic regression analysis of teacher level variables showed that control group teachers were 8.88 times more likely than teachers in the ECHS group to have a program basis code of licensing by a regional alternative licensure center.

Relationship between Teacher Gender and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between teacher gender and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year X^2 (2, N=2175) = 61.64, $p < .001$. Crosstabs showed that control group teachers were significantly more likely to be female (66.8%), compared with teachers in the ECHS group (61.4%). The control group also had significantly more teachers who were male (30.1%), compared with the ECHS group of teachers (26.7%). It is important to note that, for teacher gender, the ECHS group of teachers had a higher missing values percentage (11.9%), compared with the missing values percentage of the control group (3.1%).

Relationship between Teacher Experience and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between teacher experience level and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year X^2 (5, N=2175) = 175.94, $p < .001$. Crosstabs showed that control group teachers (78.3%) were significantly more likely to be employed in the same administrative unit last year compared with teachers in the ECHS group (75.5%). Crosstabs showed that control group teachers (8.1%) were significantly more likely to be entering their first year of employment in education, compared with teachers in the ECHS

group (0%). However, it is important to note that crosstabs showed that there were no teachers in the ECHS group who were entering their first year of employment in education.

Relationship between Teacher Graduation Date and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between years since teacher's college graduation date and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year, $t(2121) = -11.13$, $p < .001$. *T*-test results showed a significant difference in the mean number of years since college graduation for teachers at schools in the ECHS group ($M = 18.95$, $S = 10.83$) and control group teachers ($M = 13.87$, $S = 10.35$). ECHS group teachers had a college graduation date that was an average of 5.08 years prior to the college graduation date of control group teachers.

Relationship between Teacher Effect Date and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between years since the test date of teachers and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year, $t(2173) = -5.87$, $p < .001$. *T*-tests results showed there was a significant difference in the mean number of years since test date for teachers in the ECHS group ($M = 15.07$, $S = 11.48$) and teachers in the control group ($M = 12.25$, $S = 10.99$). Teachers in the ECHS group had a test date that was an average of 2.82 years prior to the test date of control group teachers.

Relationship between Teacher Test Date and School Type

Follow up analysis using an independent samples *t*-test found a significant relationship between years since teachers' test date and school type (ECHS or control) for teachers who taught Algebra I during the 2008-2009 school year, $t(2173) = -5.87$, $p < .001$.

T-tests results showed there was a significant difference in the mean number of years since teachers' test date for teachers in the ECHS group (M = 15.07, S = 11.48) and teachers in the control group (M = 12.25, S = 10.99). Teachers in the ECHS group had a test date that was an average of 2.82 years prior to the test date of teachers in the control group. In the next section the logistic regression analysis of student level variables is discussed, as well as follow-up analyses that were conducted on the significant student level predictors.

Logistic Regression Analysis of Student Level Predictors

A logistic regression was developed in order to determine the ability of student level variables in predicting students who took Algebra I in ECHSs or control schools during the 2008-2009 school year. The results of the student level logistic regression are outlined in Table 11.

Table 11

Logistic Regression Analysis by Student Level Variables

Predictor		B	SE	Wald	Exp(B)	p
Student gender				24.04		.000
	Female	2.30	.54	17.95	9.97	.000
	Male	.30	.10	8.37	1.35	.004
Student ethnicity	Asian			4.18		.523
	Black	.51	.45	1.28	1.67	.258
	Hispanic	.12	.12	1.09	1.13	.296
	American Indian	.26	.24	1.25	1.30	.264
	Multiracial	.15	.63	.05	1.16	.818
	White	-.29	.31	.92	.75	.337
Grade level				71.56		.000
	9^{th} grade	3.00	1.41	4.53	20.07	.033
	10^{th} grade	2.75	1.22	5.10	15.70	.024
	11^{th} grade	1.83	1.22	2.26	6.25	.133
	12^{th} grade	.88	1.25	.50	.48	2.41
LEP		.37	.31	1.38	.24	1.44

Table 11 (continued)

Logistic Regression Analysis by Student Level Variables

SWD (student with disability flag for AYP)	No			8.90		.012
	Exited within 2 years	.61	.21	8.61	1.83	.003
	Yes	.33	.45	.52	1.39	.472
EDS		.00	.20	.00	1.00	.985
FRL	Temporary			21.93		.000
	Free	-1.54	.40	14.50	.22	.000
	Reduced pay	.20	.20	1.01	1.23	.315
	Full pay	.11	.25	.19	1.11	.667
Sports		.91	.11	70.76	2.49	.000
Academic clubs		-.65	.19	11.10	.52	.001
Arts		-..03	.13	.06	.97	.807
Vocational clubs		.95	.26	13.11	2.59	.000
Service activities		-.76	.20	14.94	.47	.000
Other activities		-.48	.12	16.52	.62	.000
Algebra I achievement level	Level 1			8.44		.038
	Level 2	-.22	.21	1.12	.80	.290
	Level 3	.29	.15	3.57	1.33	.059
	Level 4	.05	.13	.13	1.05	.723
Repeat 9th grade		1.45	1.16	1.55	4.25	.213
Test date	Regular End-of-Year Testing May/June 2009			125.29		.000
	Fall Semester 4 X 4 2008/2009	-20.60	7109.82	.00	.00	.998
	Other Spring Administrations 2009	-20.44	7109.82	.00	.00	.998
	Spring Semester 4 X 4 2009	-.14	15801.49	.00	.87	1.00
	Year-round school 2009	-21.67	7109.82	.00	.00	.998

Results of the logistic analysis indicated that the model provides a statistically significant improvement over the constant model. The model accounted for 29.60% of the total variance. Prediction success for the cases was 69.6%. The sample was comprised of the 2175 students who took the Algebra I EOC test during the 2008-2009 school year at ECHSs and control group schools. The sample consisted of 1027 students who attended ECHSs and 1148 control group students who attended traditional high schools.

In the logistic regression analysis of student level variables, student gender was a significant predictor of school enrollment (ECHS or control)during the 2008-2009 school year, Wald(2, N=2175) = 24.04, $p < .001$. For student gender, female and male were both significant predictors, Wald(1, N=2175) = 17.95, $p < .001$ and Wald(1, N=2175) = 8.37, p = .004, respectively.

The logistic regression analysis of student level variables showed that several extracurricular activities were significant predictors of school enrollment (ECHS or control) during the 2008-2009 school year. Sports participation was a significant predictor, Wald(1, N=2175) = 70.76, $p < .001$. Participation in academic clubs was a significant predictor, Wald(1, N=2175) = 11.10, p = .001. Participation in vocational clubs was a significant predictor, Wald(1, N=2175) = 13.11, $p < .001$. Participation in service activities and other activities were significant predictors, Wald(1, N=2175) = 14.94, $p < .001$ and Wald(1, N=2175) = 16.52, $p < .001$, respectively.

In the logistic regression analysis of student level variables, a significant predictor of school enrollment (ECHS or control) during 2008-2009 was a student *not* having a disability flag for AYP, Wald(2, N=2175) = 8.90, p = .012. Another significant predictor was for students who had exited the disability flag within two years, Wald(1, N=2175) = 8.61, p =

.003. However, this predictor was excluded from the discussion because the sample size was small (*N*=30).

The free/reduced lunch code temporary was a significant predictor of school enrollment (ECHS or control) during the 2008-2009 school year, Wald(3, *N*=2175) = 21.93, $p < .001$. Free lunch was also a significant predictor, Wald(1, *N*=2175) = 14.50, $p < .001$. For Algebra I EOC achievement level, only level one was a significant predictor school enrollment (ECHS or control), Wald(3, *N*=2175) = 8.44, $p = .038$. Student grade level was a significant predictor, Wald(4, *N*=2175) = 71.56, $p < .001$. For student grade level, 9th grade was a significant predictor, Wald(1, *N*=2175) = 4.53, $p = .033$. Tenth grade was also a significant predictor, Wald(1, *N*=2175) = 5.10, $p = .024$. Test date was a significant predictor of school enrollment (ECHS or control), but only for the end of the year date, Wald(4, *N*=2175) = 125.29, $p < .001$. The following section discusses the results of the follow-up tests that were conducted on the student level variables that were significant predictors in the logistic regression analysis.

Follow-up Analyses of Significant Student Level Predictors

Relationship between Student Gender and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between student gender and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (2, *N*=2175) = 67.95, $p < .001$. In the sample of students who took the Algebra I EOC during the 2008-2009 school year, crosstabs showed that females were significantly more likely to be enrolled at a school in the ECHS group, rather than at a control group school. Crosstabs found that 53.4% of female students were enrolled in a school in the ECHS group, compared with 46.6% of female students at

control group schools. Odds ratios from the logistic analysis of student level variables suggested that female students were 9.97 times more likely to enroll in a school in the ECHS group, rather than at a control group school. Crosstabs found that males were significantly less likely to enroll at a school in the ECHS group. In the sample of students who took the Algebra I EOC during the 2008-2009 school year, crosstabs showed that 38% of male students were enrolled at a school in the ECHS group, compared with 61.8% of males at control group schools.

Relationship between Participation in Sports and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between sports participation and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (1, N=2175) = 62.92, $p < .001$. Crosstabs found that 44.3% of control group students participated in sports, compared with 27.8% of students in the ECHS group. Odds ratios from the logistic regression analysis of student level variables indicated that control group students were 2.49 times more likely to participate in sports, compared with students in the ECHS group.

Relationship between Participation in Academic Clubs and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between participation in academic clubs and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (1, N=2175) = 13.31, $p < .001$. Crosstabs indicated that ECHS group students (9.9%) were significantly more likely to participate in academic clubs, compared with students at control group schools (5.7%).

Relationship between Participation in Vocational Clubs and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between participation in vocational clubs and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (1, *N*=2175) = 15.08, $p < .001$. Crosstabs found that ECHS group students (5.9%) were significantly more likely to participate in vocational clubs, compared with students at control group schools (2.5%) Odds ratios from the logistic regression analysis of student level variables showed that ECHS group students were 2.59 times more likely to participate in vocational clubs during the 2008-2009 school year, compared with control group students.

Relationship between Participation in Service Activities and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between participation in service activities and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (1, *N*=2175) = 12.46, $p < .001$. Crosstabs indicated that significantly more ECHS group students (9.4%) participated in service clubs, compared with 5.5% of students at control group schools.

Relationship between Participation in Other Activities and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between participation in other activities and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (1, *N*=2175) = 28.59, $p < .001$. Students in the ECHS group (28.2%) were significantly more likely to participate in other activities, compared with control group students (18.6%).

Relationship between Student Disability Flag for AYP and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the student disability flag and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (2, *N*=2175) = 26.52, $p < .001$. Crosstabs found that significantly more ECHS group students (94.3%) did *not* have a disability flag, compared with control group students (88.2%).

Relationship between Free and Reduced Price Lunch Code and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between the free/reduced lunch code and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (4, *N*=2175) = 42.02, $p < .001$. Crosstabs indicated that control group students (5.7%) were significantly more likely to have a lunch code of temporary, compared with ECHS group students (1%). Furthermore, crosstabs found that ECHS group students (29%) were significantly more likely to have a lunch code of free, compared with control group students (23.8%).

Relationship between Algebra Achievement Level and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between Algebra I achievement level and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (3, *N*=2175) = 13.97, $p = .003$. Crosstabs showed that control group students (11.8%) were significantly more likely to score a level one, compared with ECHS group students (7.3%). The levels of the EOC test range from one through four, with one being the lowest score possible.

Relationship between Student Grade Level and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between student grade level and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (4, *N*=2175) = 89.89, $p < .001$. Crosstabs found that students in the ECHS group (83.7%) were more likely to take the Algebra I EOC test in 9th grade, compared with students enrolled in control group schools (67.3%). Odds ratios from the logistic regression analysis of student level variables indicated that students in the ECHS group were 20 times more likely to take the Algebra I EOC test in the 9th grade, compared with control group students. Crosstabs showed that control group students (26%) were more likely to take the Algebra I EOC test in 10th grade, compared with students in the ECHS group (14.4%). Odds ratios from the logistic regression analysis of student level variables indicated that control group students were 15.70 times more likely to take the Algebra I EOC test in 10th grade, compared with students in the ECHS group.

Relationship between Algebra I Test Date and School Type

Follow up analysis using Pearson's chi-square found a significant relationship between student test date and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year, X^2 (4, *N*=2175) = 186.52, $p < .001$. Crosstabs showed that students in the ECHS group (23.1%) were significantly more likely to take the Algebra test at the end of the 2008-2009 school year, compared with control group students (15.2%).

Relationship between Students' Days of Membership and School Type

An independent samples *t*-test was conducted to examine the relationship between students' number of days of school membership and school enrollment (ECHS or control) for

students who took the Algebra I EOC during the 2008-2009 school year. The results of the *t*-test showed a significant difference in the number of days of school membership for students in the ECHS group (M = 172.94, S = 10.90) and control group students (M = 171.24, S = 20.01), $t(1811) = -2.49$, $p = .013$. Students in the ECHS group had an average of 1.7 more days of school membership than control group students.

Relationship between Algebra I Scale Scores and School Type

An independent samples *t*-test was conducted examine the relationship Algebra I EOC scale scores and school enrollment (ECHS or control) for students who took the Algebra I EOC during the 2008-2009 school year for students who took the Algebra I EOC during the 2008-2009 school year. The results of the *t*-test found a significant difference in Algebra I EOC scale scores for the ECHS group students (M = 151.81, S = 8.24) and control group students (M = 150.56, S = 9.18), $t(2169) = -3.35$, $p = .001$. Students in the ECHS group had Algebra I EOC scale scores that were an average of 1.25 points higher than students in the control group.

The next section, Chapter Five, provides a synthesis of the data, as well as conclusions drawn from the data presented. The researcher discusses findings from analyses of school level variables, including how the results from the study compare with recent research findings on the ECHS. Chapter Five also discusses significant findings from the study concerning the teacher and student characteristics at ECHSs, and how those characteristics impacted student achievement on the Algebra I EOC test. Recommendations for future research are also discussed.

Chapter Five

Discussion and Policy Recommendations

Chapter Five provides a synthesis of the data, as well as conclusions drawn from the data presented. Recommendations for future research are discussed.

Synthesis of the Data

As discussed in previous chapters, postsecondary degree attainment has become not only an educational and political issue, but also an economic and social necessity. With support from the Bill & Melinda Gates Foundation and other organizations, the ECHSI is specifically designed to target students who are statistically underrepresented in higher education, such as low-income students, students of color, English language learners, and first-generation college students (American Institutes for Research, 2006). The present study examined how school, teacher, and student characteristics impacted student achievement during the 2008-2009 school year at 34 ECHSs and 56 control group schools in NC. Student achievement was measured by students' achievement level and scale scores on the Algebra I EOC test taken during the 2008-2009 school year. Algebra, which has been regarded as a gatekeeper course for higher level mathematics, has become a topic of particular interest in the mathematics education community (Capraro & Joffrion, 2006; Stein, Kaufman, Sherman, & Hillen, 2011).

The following research questions guided the study:

1. What are the effects of school level characteristics on student achievement at ECHS and control group schools?
2. What are the effects of teacher level characteristics on student achievement at ECHS and control group schools?

3. What are the effects of student level characteristics on student achievement at ECHS and control group schools?

The first research question examined how school level characteristics impacted student achievement at ECHS and control group schools. The first Core Principle of all ECHSs nationwide is that ECHSs are committed to serving students underrepresented in higher education (Jobs for the Future, 2011). In the study, the results showed that, of the schools that offered Algebra I EOC during the 2008-2009 school year, ECHSs were significantly more likely to enroll female students, compared with control group schools. In fact, odds ratios from the logistic regression analysis showed that female students were 9.97 times more likely to be enrolled in an ECHS, compared with a control group school. However, recent research has shown that, since 1988, the number of females in post baccalaureate programs has exceeded the number of males (Institute of Education Sciences, 2015). Therefore, for the selected ECHSs in NC, it would appear that, during the 2008-2009 school year, the ECHSI was not adequately serving the male students who are currently underrepresented in higher education programs. While the research on the ECHSI hasn't specifically addressed how gender affects enrollment at ECHSs, much discussion has been given to how the ECHSI is addressing the underrepresentation of minorities in higher education (Jobs for the Future, 2013).

The most recent national data on ECHSs, based on a three-year average from 2010 to 2013, showed that 64% of students at ECHSs were either Black or Hispanic (Jobs for the Future, 2013). In the present study of students who took Algebra I during the 2008-2009 school year, the results showed that, compared with control group schools, ECHS schools were serving slightly higher percentages of Hispanic students. However, the sample of

Hispanic students (N = 170) in the study was relatively small, compared to the total sample of 2,175 students. Surprisingly, no significance was found for any other ethnicity groups, including Black students. Therefore, the results did not support prior research that suggests that ECHSs are enrolling significantly higher percentages of minority students, compared with traditional schools (Jobs for the Future, 2013).

Another goal of the ECHSI is to target students that are low-income, English language learners, and first-generation college students (American Institutes for Research, 2006). At the school level, prior research from Jobs for the Future (2013) indicated that nearly a third of ECHSs received Title I funding. The results from the study suggested that ECHSs (78.5%) were significantly more likely to be eligible for Title I, compared with control group schools (65%). However, school-wide Title I was not a significant predictor, which indicates that control group schools were just as likely as ECHSs to operate a school-wide Title I program. The results from the study did indicate that of the students who took the Algebra I EOC during the 2008-2009 school year at selected schools, ECHS students (29%) were more likely than control group students (23.8%) to receive free lunch, an indicator of low-income status. Furthermore, ECHS students (5.7%) were also more likely than control group students (1%) to have a lunch code of temporary. While the ECHSI doesn't have a specific goal of targeting students who have disabilities, it is interesting to note that ECHSs were serving significantly more students who did *not* have a disability flag. Therefore, additional research is needed to determine opportunities for how the ECHSI can serve a wider spectrum of students, including those with disabilities.

As discussed in previous chapters, little research has been conducted on how teacher characteristics impact student achievement at ECHSs, so the second research question in the

study sought to add to the body of knowledge on this topic. In the study of teachers who taught Algebra I during the 2008-2009 school year, ECHS teachers (18.5%) were found to be more likely than control group teachers (14.3%) to have a middle grades (6-9) mathematics licensure area. On the other hand, control group teachers (85.7%) were more likely than ECHS teachers (81.5%) to have a high school mathematics (9-12) licensure area. Interestingly, the ECHS students that were taught by these teachers were 20 times more likely to take the Algebra I EOC test in their 9th grade year, compared with control group students who were more likely to take the test in the 10th grade. Therefore, students who take Algebra I in the 9th grade could be benefitting more from having a middle grades mathematics teachers, rather than a high school (9-12) mathematics teacher. In a course such as Algebra I that is a gatekeeper to more advanced mathematics courses, middle school (6-9) mathematics teachers might be more effective at communicating the content and instruction that is necessary for students to develop the conceptual and procedural understanding of Algebra. Another factor that might affect student learning is teacher experience, because less knowledgeable teachers tend to focus on algorithms rather than on the underlying mathematics concepts (Ma, 1999)

The majority of the research on teaching experience shows that new teachers are generally less effective than teachers with some experience (Chingos & Peterson, 2011; Clotfelter, Ladd, & Vigdor, 2006; Clotfelter et al., 2010; Hanushek, Kain, & Rivkin, 2001; Harris & Sass, 2007; Kane et al., 2006). Of the teachers who taught Algebra I during the 2008-2009 school year, ECHS teachers (95%) were significantly more likely than control group teachers (85%) to have a SP2 license, which is issued to teachers after three or more years of teaching as an initially licensed teacher (North Carolina Department of Public

Instruction, 2014). On the other hand, control group teachers (15.6%) were significantly more likely than ECHS teachers (3%) to have an SP1 license, which indicates that they have 0-2 years of teaching experience. A similar finding was that control group teachers (8.1%) were also more likely than ECHS teachers (0%) to be entering their first year of employment in education. Furthermore, compared with the control group teachers, ECHS teachers were more likely to have an earlier college graduation date, an earlier license effect date, and an earlier teacher test date. Overall, this suggested that ECHS group teachers had more teaching experience, compared with control group teachers. Therefore, the results of the study reinforced evidence from recent studies that showed that the quality of teachers is still not equitably distributed among schools (Glazerman & Max, 2011; Goldhaber, Krieg, Theobald, & Brown, 2014; Goldhaber, Lavery, & Theobald, 2014; Kalogrides & Loeb, 2013; Sass, Hannaway, Xu, Figlio, & Feng, 2010).

Clotfelter et al. (2010) found that the probability of having a novice teacher for Algebra I was higher for Black students than for White students, for males than for females, and for students with non-college educated parents. As mentioned previously, there were no significant differences in the percentage of Black students enrolled in Algebra I at each type of school, which suggests that, with the exception of Hispanic students, the ECHSI is not adequately addressing the issue of equitable distribution of teacher quality for minority students. Also troubling, is the fact that males were significantly more likely to be enrolled in a control group school, where they were more likely to have a novice teacher. Each ECHS can only serve a maximum of 400 students (Jobs for the Future, 2013). Therefore, if more experienced teachers are to be placed at an ECHS, more attention needs to be paid to ensure that the students at ECHSs reflect the population of students that have historically suffered

from the inequitable distribution of teacher quality. Another important finding from the study that related to the distribution of teacher quality was teacher licensure route.

ECHS teachers (55.8%) who taught Algebra I during the 2008-2009 school year were more likely to have earned licensure through an approved NC education program at ECHSs, compared with control group teachers (54.3%). However, research shows that from 1999 to 2006, the number of teachers who entered teaching through alternative routes increased fivefold (Feistritzer, 2011). By 2010, 39% of teachers who had entered in the last five years did so through alternative routes. In the present study, the control group teachers reflected the increasing population of teachers who earn licensure through alternative routes. Control group teachers (21.7%) were significantly more likely to have earned licensure through other approval, compared with ECHS teachers (19.4%). Research has shown that regularly certified teachers appear to be more effective during the early stages of their career and in high school mathematics and science (Bastian & Patterson, 2014; Boyd et al., 2006; Clotfelter et al., 2010; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014). ECHSs appeared to be more successful than control group schools at recruiting teachers who have earned licensure through an approved NC education program and who were also more experienced.

The researcher proposes several possible explanations for why ECHSs may have more teachers who earned licensure through an approved NC education program and who were also more experienced. One explanation may be that teaching positions in ECHSs are more desirable to higher quality teachers because of the small size of ECHSs or the specific population of students they serve. Interestingly, the pupil/teacher ratio was lower at control group schools, which suggests that ECHSs actually have more students assigned to each

classroom teacher. Compared with the ECHS schools (.1%) in the study, control group schools (2.1%) had significantly more students repeating ninth grade, which suggests that the students at ECHSs may have higher levels of academic achievement, compared with the population of students served at control group schools. Regardless of the reason, if the teaching positions are more desirable at ECHSs, reform may be needed to give quality teachers incentives to teach in traditional high schools.

Another explanation of why ECHSs have more experienced teachers who earned licensure through an approved NC education program is that, due to the small size of ECHSs, these schools are able to be more selective when hiring teachers. The mean number of full-time teachers at the schools in the study supported the possibility that ECHSs can be more selective when hiring teachers. Control group schools had a mean number of 70.97 full-time teachers, while the mean number of full-time teachers ECHSs group schools was only 9.02. If ECHSs are more selective when hiring teachers, traditional high schools might want to consider aspects of the ECHSI that could be implemented in a regular high school and make a school more attractive to a quality teacher.

ECHSs have been characterized as a "slingshot" approach, pushing struggling students to achieve more than traditional schools expect of them (Jacobson, 2005). Hoffman, Vargas, and Santos (2009) suggest that the ECHS is even the most intensive accelerated learning option available to high school students. The researcher didn't have any data on students' prior achievement levels; therefore, it was not possible to determine whether ECHSs were enrolling "struggling" students. The results from the study did show that ECHS students (83.7%) were significantly more likely to take the Algebra I EOC test in their 9th grade year, compared with control group students (67.3%). Even though ECHS students

were more likely to take the Algebra I EOC in the 9th grade, those ECHS students (7.3%) were significantly less likely to score a level one on the Algebra I EOC test, compared with control group students (11.8%). Also, ECHS students had Algebra I EOC scale scores that were an average of 1.25 points higher than students in the control group.

The findings about more ECHS students taking Algebra I in the 9th grade supports prior research that found that ECHS students were significantly more likely than control group students to take Algebra I or a higher mathematics course in the ninth grade (Edmunds, Bernstein, et al., 2012). The study also found that ECHS students (23.1%) were significantly more likely than control group students (15.2%) to take the Algebra I EOC at the end of the 2008-2009 school. As a result, it is possible that ECHSs are structured to allow students to take an Algebra I course that is yearlong, as opposed to traditional high schools that may just offer Algebra I in one semester. ECHS students were also less likely than control group students to enroll in the basic Algebra I classes, Foundations of Algebra I and Algebra 1-A.

Having students take Algebra I earlier, in the 9th grade rather than 10th grade, supports prior research that identified a "high math" ladder consisting—from highest to lowest—of calculus, pre-calculus, trigonometry, Algebra II, and less than Algebra II (Adelman, 2006). Adelman concluded that as a student climbed each rung of the high math ladder, the odds of completing a bachelor's degree increased by a factor of 2.59 to 1. Therefore, it would appear that ECHSs are supporting their goal of increased postsecondary enrollment by encouraging or perhaps requiring that the majority of 9th grade students take Algebra I in the 9th grade. However, the researcher had limited data on students' prior academic achievement in mathematics or performance during the course, which could impact achievement on the EOC test. The only data that was indicative of students' prior academic achievement was whether

the student was repeating the 9th grade when they took the Algebra I EOC test during the 2008-2009 school year. Significantly more control group students (2.1%) were repeating the 9th grade, compared to ECHS students (.1%). Based on the significant differences between the student groups (ECHS and control) and repeating the 9th grade, it does suggest that students' prior academic achievement influenced student enrollment in each school type. Also, unclear from the data available to the researcher is the percentage of students who enroll in an ECHS having already taken Pre-Algebra courses in the 7th or 8th grade.

The researcher proposes three possible explanations for why ECHS students may be more likely to take advanced versions of Algebra I earlier in their high school career. One explanation of why ECHS's are taking advanced versions of Algebra I is that ECHS students are higher performing to begin with, and therefore, would have successfully passed Algebra I earlier than other students even if they attended a traditional high school. A second explanation could be that ECHSs are more effective than traditional high schools at analyzing students' prior academic achievement and identifying students who can successfully take and pass Algebra I in the 9th grade. Additional research is needed on how ECHSs and traditional high school students identify whether students are prepared to take Algebra I in the 9th grade. Without the appropriate identification, 9th grade students miss out on valuable time in high school that they could have used to take higher level math courses. Recent studies in California and Charlotte-Mecklenburg, N.C. have also found that placing struggling students in Algebra doesn't improve their performance on state assessments, and can actually hurt their grade point averages and reduce the likelihood of their taking and passing higher math courses in high school (Clotfelter, Ladd, & Vigdor, 2012).

A third explanation as to why ECHS students are more likely to take advanced versions of Algebra I earlier in their high school career could be that the students are successfully passing advanced versions of Algebra I earlier because of aspects of the ECHS, such as the small school size or the emphasis on relationships (Jobs for the Future, 2013). Interestingly, the ECHS schools in the sample had a calculated pupil teacher ratio that was higher than control group schools. Since the larger classes did not appear to inhibit student achievement on the Algebra I EOC test, the results of the study related to a few studies that found no positive effects of reduced class size on student achievement (Chingos, 2010; Dee & West, 2008; Hoxby, 2000). Nonetheless, even in larger classes, the overall small school size of an ECHS may be influencing student engagement and supporting student success in Algebra I during the 9th grade.

The underlying assumption of the ECHSI is that "engaging underrepresented students in a rigorous high school curriculum tied to the incentive of earning college credits will motivate them and increase their access to additional postsecondary education and credentials after high school" (Berger, Turk-Bicaki, Garet, Knudson, & Hoshen, 2014, p. 2). In the research on the ECHSI, it is clear that the initiative places a high priority on relationships between instructors and students as a way to support student engagement and achievement (Berger et al., 2013; Jobs for the Future, 2014; North Carolina New Schools, 2013). Specifically, the ECHSI seeks to increase student success through three principles, or the three Rs: Rigor, Relevance, and Relationships (Jobs for the Future, 2013). Taken together, the three Rs cover the features of ECHSs that are recommended for improving high school students' access to and success in college (Tierney, Bailey, Constantine, Finkelstein, & Hurd, 2009). Therefore, it was important in the research study to examine in more detail

the significant findings that related to student engagement. In the present study, the variables that measured student engagement were participation in extracurricular activities and days of school membership. The researcher didn't have data on high school graduation and postsecondary enrollment rates, which may also indicate student engagement (American Institutes for Research & SRI International, 2009; Edmunds et al., 2010; Edmunds et al., 2011; North Carolina New Schools, 2013).

Student engagement in extracurricular activities was significantly higher at ECHSs for students who took the Algebra I EOC during the 2008-2009 school year. ECHS students were more likely than control group students to report participating in academic clubs, vocational clubs, service activities, and other activities. The results from the study were similar to findings from a previous study by Edmunds (2010). Edmunds found that, despite reporting a lack of social and extracurricular activities, ECHS students reported being more actively engaged in school related activities than traditional high school students (Edmunds, 2010). However, one concern parents and students often have about the ECHS is the perceived lack of opportunities to participate in sports at ECHSs. The results of the present study reflected this concern in that ECHS students were significantly less likely to participate in sports, compared with control group students. The lower participation rate in sports at ECHS could mean that either there are fewer opportunities to participate in sports at ECHSs or that sports may be less of a priority for students who choose to enroll in an ECHS. Whatever the reason, it does appear that, during the 2008-2009 school year, ECHSs were providing students with other extracurricular activities besides sports to keep them engaged in school.

In addition to being more engaged in school activities, ECHS students also had significantly better school attendance, compared with control group students. Research has shown that in schools where there is trust, caring, and support, there is higher attendance, higher student performance, and a lower rate of suspensions (Green, 1998; Strand & Peacock, 2002).

Based on student performance on the Algebra I EOC test and student attendance, the ECHSs that offered Algebra I during the 2008-2009 school year did perhaps have a more caring support system that might not be present at traditional high schools. However, in order for students to be able to benefit from the ECHS, they first have to decide to apply to an ECHS. If students have preconceived notions of ECHSs, such as a lack of sports teams, they might decide not to apply or enroll in an ECHS. In order to reach their target population of students, ECHSs need to understand student engagement in order to help middle school students recognize opportunities for student engagement at ECHSs. Although traditional high schools serve much larger populations of students than ECHSs do, traditional high schools can benefit from research on student engagement at ECHSs and possibly implement aspects of the ECHSI that will increase student engagement.

Conclusions

The goal of the ECHSI is to serve students who are underrepresented in higher education, such as low-income students, students of color, English language learners, and first-generation college students (Jobs for the Future, 2013). However, each ECHS can only serve a maximum of 400 students; therefore, there are still many students who will not apply, or apply, but not be accepted into an ECHS. Furthermore, since ECHSs vary so much in their admission processes, it is difficult to determine how successful ECHSs are in helping

low-performing students. If ECHSs are not serving low-performing students, these students will attend traditional high schools where the teachers may be less experienced. From an evaluation standpoint, there needs to be more data collection and reporting on how ECHSs are enrolling students to ensure that the ECHSI is serving a wide spectrum of students.

This study was unique because it examined an aspect of the ECHSI that little research has been done on, and that is the characteristics of those employed at ECHSs. If ECHSs are enrolling students that are statistically underrepresented in higher education, a key component to the success of these students will be the teachers that are working side by side with these students every day. Studies such as this, which provide a framework for replication, are beneficial to the ECHSI as they continue to work to serve at-risk students and raise postsecondary enrollment rates.

References

Aaronson, D, Barrow, L., & Sander, W. (2007). Teachers and student achievement in Chicago public high schools. *Journal of Labor Economics. 24*(1), 95-135.

Abel, J. R., Deitz, R., & Su, Y. (2014). Are recent college graduates finding good jobs? *Current Issues in Economics and Finance*, *20*(1), 1-8.

Adelman, C. (2006). *The Toolbox revisited: Paths to degree completion from high school through college*. Washington, D.C.: U.S. Department of Education. Retrieved from www.ed.gov/rschstat/research/pubs/toolboxrevisit/index.html

Ader, H. J., Mellenbergh, G. J., & Hand, D. J. (2008). *Advising on research methods: A consultant's companion*. Huizen, The Neatherlands : Johannes van Kessel Publishing.

Alaie, A. (2011). Early college high schools: Lessons learned in the college science classroom. *Urban Education, 46*(3), 426-439.

Allen, M. (2003). *Eight questions on teacher preparation: What does the research say? A summary of the findings*. Retrieved from http://www.ecs.org/html/educationissues/teachingquality/tpreport/home/index.asp

American Association of University Women Educational Foundation. (1992). *The AAUW report: How schools shortchange girls.* Retrieved from http://www.aauw.org/files/2013/02/how-schools-shortchange-girls-executive-summary.pdf

American Institutes for Research. (2006). *Early college high school initiative: 2003 to 2005 evaluation report*. Retrieved from http://www.earlycolleges.org/Downloads/ECHS_Eva_2003-2005.pdf

American Institutes for Research & SRI International. (2005). *Early college high schools: Early recruitment and selection strategies*. Retrieved from http://files.eric.ed.gov/fulltext/ED494922.pdf

American Institutes for Research & SRI International. (2009). *Six years and counting: The ECHSI matures*. Retrieved from http://www.earlycolleges.org/Downloads/AIR.SixYearsAndCounting.pdf

Aos, S., Miller, M., & Pennucci, A. (2007). *Report to the joint task force on basic education finance: School employee compensation and student outcomes*. Retrieved from http://www.wsipp.wa.gov/ReportFile/1000/Wsipp_Report-to-the-Joint-Task-Force-on-Basic-Education-Finance-School-Employee-Compensation-and-Student-Outcomes_Full-Report.pdf

Au, K. H. (1980). Participation structures in a reading lesson with Hawaiian children: An analysis of a culturally appropriate instructional event. *Anthropology and Education Quarterly, 11*(2), 91–115.

Bailey, M., & Dynarski, S. (2011). *Whither opportunity? Rising inequality and the uncertain life chances of low-income children*. New York: Russell Sage.

Ballou, D. (2003). Certifying accomplished teachers: A critical look at the National Board for Professional Teaching Standards. *Peabody Journal of Education*, *78*(4), 201-219.

Bastian, K. C., & Patterson, K. M. (2014). *Teacher preparation and performance in North Carolina public schools*. Retrieved from http://publicpolicy.unc.edu/files/2014/02/Teacher-Preparation-and Performance_FINAL.pdf

Baum, S., Ma, J., & Payea, K. (2013). *Education pays 2013: The benefits of higher education for individuals and society.* Retrieved from http://trends.collegeboard.org/education-pays

Berger, A., Adelman, N., & Cole, S. (2010). The early college high school initiative: An overview of five evaluation years. *Peabody Journal of Education, 85*, 333-347.

Berger, A., Turk-Bicaki, L., Garet, M., Knudson, J., & Hoshen, G. (2014). *Early college, continued success: Early college high school initiative impact study*. Retrieved from http://www.air.org/resource/early-college-continued-success-early-college-high-school-initiative-impact-study-2014

Berger, A., Turk-Bicakci, L., Garet, M., Song, M., Knudson, J., Haxton, C., . . . Cassidy, L. (2013). *Early college, early success: Early college high school initiative impact study*. Retrieved from http://www.air.org/sites/default/files/downloads/report/ECHSI_Impact_Study_Report_Final1_0.pdf

Berry, B. (2004). *Taking action to improve teacher quality: Addressing shortcomings in the teaching commission report*. Retrieved from http://files.eric.ed.gov/fulltext/ED499077.pdf

Berry, B. (2007). *The national board for professional teaching standards and the future of a profession.* Retrieved from http://www.teachingquality.org/sites/default/files/BerryNBPTS.pdf

Betts, J. R., Zau, A. C., & Rice, L. A. (2003). *Determinants of student achievement: New evidence from San Diego.* San Francisco: Public Policy Institute of California. Retrieved from http://www.ppic.org/content/pubs/report/r_803jbr.pdf

Bireda, S. & Chait, R. (2011). *Increasing teacher diversity: Strategies to improve the teacher workforce*. Retrieved from https://www.americanprogress.org/wp-content/uploads/issues/2011/11/pdf/chait_diversity.pdf

Blatchford, P., Russell, A., & Brown, P. (2009). Teaching in large and small classes, In LJ Saha and AG Dworkin (eds), *International Handbook of Research on Teachers and Teaching*.

Boe, E. E., Bobbitt, S. A., Cook, L. H., Whitener, S. D., & Weber, A. L. (1997). Why didst thou go? Predictors of retention, transfer, and attrition of special and general education teachers from a national perspective. *The Journal of Special Education, 30*(4), 390-411.

Bogdan, R. C. & Biklen, S. K. (2006). *Qualitative research for education: An introductory to theory and methods.* Needham Heights, MA: Allyn and Bacon.

Bond, L. Jaeger, R., Smith, T., & Hattie, J. (2000). *The certification system of the National Board for Professional Teaching Standards: A construct and consequential validity study.* Retrieved from http://educationnext.org/defrocking-the-national-board/

Borman, G. D. (2002). Experiments for educational evaluation and improvement. *Peabody Journal of Education, 77*(4), 7-27.

Boslaugh, S. (2007). *Secondary data sources for public health: A practical guide (Practical guides to biostatistics and epidemiology)*. Cambridge: Cambridge University Press.

Bowles, S., & Levin, H. (1968). The determinants of scholastic achievement: An appraisal of some recent evidence. *Journal of Human Resources, 3*(1), 3-24.

Boyd, D., Grossman, P. Lankford, H. Loeb, S., & Wyckoff, J. (2006). How changes in entry requirements alter the teacher workforce and affect student achievement. *Education Finance and Policy*, *1*(2), 176-216.

Boyd, D., Grossman, P. Lankford, H. Loeb, S., & Wyckoff, J. (2009). Teacher preparation and student achievement. *Educational Evaluation and Policy Analysis*, *31*(4), 416-440.

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2013). Analyzing the determinants of the matching of public school teachers to jobs: Disentangling the preferences of teachers and employers. *Journal of Labor Economics*, *31*(1), 83-117.

Burkhardt, H., & Schoenfeld, A. H. (2003) Improving educational research: Toward a more useful, more influential and better-funded enterprise. *Educational Researcher*, *32*(9), 3-14.

Burning Glass Technologies. (2014). *How demand for a bachelor's degree is reshaping the workforce*. Retrieved from http://www.burning-glass.com/research/credentials-gap/

Cabarrus County Schools. (2015). *Apply to the early college*. Retrieved from http://www.cabarrus.k12.nc.us/domain/2330

Cain, G., & Watts, H. (1970). Problems in making policy inferences from the Coleman Report. *American Sociological Review*, *35*(2), 228-242.

California Department of Education. (2007). *Evaluating progress toward equitable distribution of effective educators*. Retrieved from http://www.scribd.com/doc/234546585/Evaluating-Progress-Toward-Equitable-Distribution-of-Effective-Educators-California-Department-of-Education-July-2007#scribd

Capraro, M. M., & Joffrion, H. (2006). Algebraic equations: Can middle-school students meaningfully translate from words to mathematical symbols? *Reading Psychology, 27*(2-3), 147-164.

Carnevale, A., Jayasundera, T., Repnikov, D., & Gulish, A. (2015). *State online college job market: Ranking the states. Executive summary*. Retrieved from https://cew.georgetown.edu/wp-content/uploads/OCLMStates_ES_3.pdf

Carnevale, A. P., & Smith, N. (2012). *A decade behind: Breaking out of the low-skill trap in the southern economy.* Retrieved from https://cew.georgetown.edu/report/a-decade-behind/

Carnevale, A. P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of jobs and education requirements through 2018*. Retrieved from http://cew.georgetown.edu/jobs2018/

Carnevale, A. P., Strohl, J., & Gulish, A. (2015). *College is just the beginning: employers' role in the $1.1 trillion postsecondary education and training system*. Retrieved from https://cew.georgetown.edu/report/trilliontrainingsystem/

Castellano, W. G. (2013). *Practices for engaging the 21st century workforce: challenges of talent management in a changing workplace*. Upper Saddle River, NJ: Pearson FT Press. Catawba County Schools. (2014). *Challenger high school*. Retrieved from http://www.catawbaschools.net/schools/Challenger/default.aspx

Cavalluzzo, L. C. (2004). *Is national board certification an effective signal of teacher quality?* Retrieved from http://www.nbpts.org/sites/default/files/documents/research/Cavalluzzo_IsNBCAnEffectiveSignalofTeachingQuality.pdf

Center for Child and Family Policy. (2012). *North Carolina education research data center (NCERDC)*. Retrieved from http://www.childandfamilypolicy.duke.edu/project_detail.php?id=35

Chen, X. (2005). *First generation students in postsecondary education: A look at their college transcripts.* Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2005171

Chetty, R., Friedman, J. N., Hilger, N., Saez, E., Schanzenback, D.W., & Yagan, D. (2010). *How does your kindergarten class affect your earnings?* Retrieved from http://www.nber.org/papers/w16381

Chingos, M. M. (2010). The *impact of a universal class-size reduction policy: Evidence from Florida's statewide mandate*. Retrieved from http://www.hks.harvard.edu/pepg/PDF/Papers/PEPG10-03_Chingos.pdf

Chingos, M. M., & Dynarski, S. M. (2015). *How can we track trends in educational attainment by parental income? Hint: not with the Current Population Survey*. Retrieved from http://www.brookings.edu/research/papers/2015/03/12-chalkboard-income-education-attainment-chingos

Chingos, M. M., & Peterson, P. E. (2011). It's easier to pick a good teacher than to train one: Familiar and new results on the correlates of teacher effectiveness. *Economics of Education Review, 30*(3), 449-465.

Chingos, M. M., & Whitehurst, G. J. (2011). *Class size: What research says and what it means for state policy*. Retrieved from http://www.brookings.edu/research/papers/2011/05/11-class-size-Whitehurst-chingos#_ftn10

Clewell, B. C., Puma, M. J., & McKay, S. A. (2005). *Does it matter if my teacher looks like me? The impact of teacher race and ethnicity on student academic achievement*. Retrieved from https://www.aeaweb.org/assa/2005/0109_1015_0602.pdf

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. *Journal of Human Resources*, *41*(4), 778-820.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school: A cross-subject analysis with student fixed effects. *Journal of Human Resources*, *45*(3), 655-681.

Clotfelter C. T., Ladd H. F., Vigdor, J. L. (2012). *The aftermath of accelerating algebra: Evidence from a district policy initiative*. Retrieved from https://www.newyorkfed.org/medialibrary/media/research/education_seminar_series/algebrapaper-011212.pdf

Cochran-Smith, M., & Zeichner, K. M. (2005). *Studying teacher education: The report of the AERA panel on research and teacher education*. Retrieved from http://eric.ed.gov/?id=ED493809

Colby, S. L., & Ortman, J. M. (2014). *The baby boom cohort in the United States: 2012 to 2060.* Retrieved from http://www.census.gov/prod/2014pubs/p25-1141.pdf

Coleman, J. (1966). *Equality of educational opportunity,* Washington, D.C.: Government Printing Office.

Dagenhart, D. B. (2002). *Comparing the wants and needs of National Board certified with non-National Board certified middle school teachers for personal job success and satisfaction* (Unpublished doctoral dissertation). University of North Carolina, Chapel Hill.

Dale, A., Arber, S., & Procter, M. (1988). Doing secondary analysis. *Contemporary Social Research Series, 17,* Sydney, Australia: Allen & Unwin.

Darling-Hammond, L. (1998). Standards for assessing teacher effectiveness are key: A response to Schlalock and Myton. *Phi Delta Kappan, 79*(6), 471-472.

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Educational Evaluation and Policy Analysis, 8*(1), 1-44.

Darling-Hammond, L. (2006). *Powerful teacher education: Lessons from exemplary programs*. San Francisco: John Wiley and Sons, Inc.

Darling-Hammond, L., Berry, B., & Thoreson, A. (2001). Does teacher certification matter? Evaluating the evidence. *Educational Evaluation and Policy Analysis, 23*(1), 57-77.

Darling-Hammond, L., & Bransford, J. (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*. San Francisco: Jossey Bass, Inc

Darling-Hammond, L., Holtzman, D. J., Gatlin, S. J., & Heilig, J. V. (2005). *Does teacher preparation matter? Evidence about teacher certification, Teach for America, and teacher effectiveness.* Retrieved from http://files.eric.ed.gov/fulltext/EJ846746.pdf

Decker, P. T., Mayer, D. P., & Glazerman, S. (2004). *The effects of Teach for America on students: Findings from a national evaluation.* Retrieved from http://www.mathematica-mpr.com/~/media/publications/PDFs/teach.pdf

Dee, T. S. (2004). Teachers, race and student achievement in a randomized experiment. *Review of Economics and Statistics, 86*(1), 195-210.

Dee, T. S. (2005, April). *A teacher like me: Does race, ethnicity or gender matter?* Paper presented at an Invited Presidential Session of the Annual Meeting of the American Educational Research Association, Montreal, Canada.

Dee, T. S., & West, M. R. (2008). *The non-cognitive returns to class size*. Retrieved from http://www.nber.org/papers/w13994.pdf

Delacruz, G. C., Chung, G. K. W. K., Heritage, M., Vendlinski, T., Bailey, A., & Kim, J.-O. (July 2007). *Validating knowledge elicitation techniques: Examining the relation between measures of content knowledge and knowledge of teaching algebra.* Paper presented at the Annual Meeting of the National Council on Measurement in Education, Chicago, IL.

Desilver, D. (2014). *College enrollment among low-income students still trails richer groups*. Retrieved from http://www.pewresearch.org/fact-tank/2014/01/15/college-enrollment-among-low-income-students-still-trails-richer-groups/

Dixson, A. D., & Dingus, J. E. (2008). In search of our mother's gardens: Black women teachers and professional socialization. *Teachers College Record, 110*(4), 805–837.

Donaldson, M., & Johnson, S. M. (2010). The price of misassignment: The role of teaching assignments in Teach for America teachers' exit from low-income schools and the teaching profession. *Educational Evaluation and Policy Analysis, 32*(2), 299-323.

Duffy, H., Cassidy, L., Keating, K., & Berger, A. (2009). *Instruction across the high school-college divide.* Washington, DC: American Institutes for Research

Duffy, M. E. (1986). Methodological triangulation a vehicle for merging quantitative and qualitative methods. *The Journal of Nursing Scholarship*, *19* 3), 130-133.

Duke University. (2015). *North Carolina education research data center (NCERDC).* Retrieved from http://childandfamilypolicy.duke.edu/research/nc-education-data-center/

Dunbar, A., Hossler, D., Shapiro, D., Chen, J., Martin, S., Torres, V., . . . Ziskin, M. (2011). *National postsecondary enrollment trends: Before, during, and after the Great Recession*. Retrieved from http://eric.ed.gov/?id=ED536112

Durham Public Schools. (2015). J. *D. Clement early college high school*. Retrieved from http://echs.dpsnc.net/pages/Early_College

Edmunds, J. (2010). *A better 9th grade: Early results from an experimental study of the early college high school model*. Retrieved from http://www.serve.org/FileLibraryDetails.aspx?id=179

Edmunds, J. A., Arshavsky, N., Unlu, F., Luck, R., & Bozzi, L. (2010). They try their best to keep you: Lessons learned from a study of early college high school leavers. Retrieved from http://www.earlycolleges.org/Downloads/Theytrytheirbestheretokepyou.pdf

Edmunds, J. A., Bernstein, L., Glennie, E., Willse, J., Arshavsky, N., Unlu, F., . . . Dallas, A. (2010). Preparing students for college: The implementation and impact of the early college high school model, *Peabody Journal of Education, 85*(3), 348-364.

Edmunds, J. A., Bernstein, L., Unlu, F., Glennie, E., & Arshavsky, N. (2011). *The impact of the early college high school model on core 9th and 10th grade student outcomes*. Retrieved from http://files.eric.ed.gov/fulltext/ED518187.pdf

Edmunds, J.A., Bernstein, L., Unlu, F., Glennie, E., Willse, J., Smith, A., . . . Arshavsky, N. (2012). Expanding the start of the college pipeline: Ninth grade findings from an experimental study of the impact of the early college high school model. *Journal of Research on Educational Effectiveness, 5*(2), 136-159.

Edmunds, J., Unlu, F., Glennie, E., Bernstein, L., & Smith, A. (2013). *The impact of the Early College High School model on post-secondary enrollment*. Retrieved from http://ies.ed.gov/funding/grantsearch/details.asp?ID=1506

Educational Testing Service. (2012). *Praxis II overview*. Retrieved from http://www.ets.org/praxis/about/praxisii

Egalite, A. J., Kisida, B., & Winters, M. A. (2015). Representation in the classroom: The effect of own-race teachers on student achievement. *Economics of Education Review, 45*, 44-52.

Ehrenberg, R. G., & Brewer, D. J. (1994). Do school and teacher characteristics matter? Evidence from high school and beyond. *Economics of Education Review, 13*(1), 1-17.

Ehrenberg, R. G., & Brewer, D. J. (1995). Did teachers' verbal ability and race matter in the 1960s? Coleman revisited. *Economics of Education Review, 14*(1), 1–21.

Ehrenberg, R. G., Goldhaber, D. D., & Brewer, D. J. (1995). Do teachers' race, gender, and ethnicity matter? Evidence from the National Educational Longitudinal Study of 1988. *Industrial and Labor Relations, 48*(3), 547-561.

Eisenhart, M., & Towne, L. (2003) Contestation and change in national policy on 'scientifically based' education research. *Educational Researcher, 32*(7), 31-38.

England, R. E., & Meier, K. J. (1986). From desegregation to integration: Second generation school discrimination as an institutional impediment. *American Politics Quarterly, 13*(2), 227–247.

Evans, M. (1992). An estimate of race and gender role-model effects in teaching high school. *Journal of Economic Education, 23*(3), 209–217.

Farkas, G., Grobe, R. P., Sheehan, D., & Shuan, Y. (1990). Cultural resources and school success. Gender, ethnicity, and poverty groups within an urban school district. *American -Sociological Review, 55*(1), 127–142.

Farley, R. (2015). *Declining labor participation rates.* Retrieved from http://www.factcheck.org/2015/03/declining-labor-participation-rates/

Feistritzer, E. C. (2011). *Profile of teachers in the U.S. 2011*. Washington DC: National Center for Education Information.

Fetler, M. (1999). High school staff characteristics and mathematics test results. *Education Policy Analysis Archives, 7*(9), 1-44.

Ferguson, R. F. (1991). Paying for public education: New evidence on how and why money matters. *Harvard Journal on Legislation, 28*(2), 465-498.

Figlio, D. N. (2005). *Names, expectations and* the *Black-White test score gap.* Retrieved from http://www.nber.org/papers/w11195.pdf

Foster, M. (1989). ‘‘Its cookin’ now’’: A performance analysis of speech event of a Black teacher in an urban community college. *Language in Society, 18*(1), 1–29.

Fraga, L. R., Meier, K. J., & England, R. E. (1986). Hispanic Americans and educational policy: Limits to equal access. *The Journal of Politics, 48*(4), 850–876.

Freeman, C. (2004). *Trends in educational equity of girls and women*. Retrieved from http://nces.ed.gov/pubs2005/2005016.pdf

Frome, P., Lasater, B., & Cooney, S. (2005). *Well-qualified teachers and high-quality teaching: Are they the same?* (Research Brief). Atlanta, GA: Southern Regional Education Board.

Frumkin, P. (2006). *Strategic giving: The art and science of philanthropy*. Chicago, IL: The University of Chicago Press.

Gaston County Schools. (2014). *Gaston early college high school*. Retrieved from http://gaston.k12.nc.us/gastonearlycollege

Gates Foundation. (2005). Bill Gates- National education summit on high schools. Retrieved from http://www.gatesfoundation.org/media-center/speeches/2005/02/bill-gates-2005-national-education-summit

Gay, L. R., & Airasian, P. W. (2000) *Educational research: Competencies for analysis and application* (6th ed.). Englewood Cliffs, N.J.: Prentice Hall.

Glaser, B. G. (1963) Retreading research materials: The use of secondary analysis by the independent researcher. *The American Behavioral Scientist*, *6*(10), 11-14.

Glazerman, S., & Max, J. (2011). *Do low-income students have equal access to the highest-performing teachers?* Retrieved from http://ies.ed.gov/ncee/pubs/20114016/pdf/20114016.pdf

Glesne, C. (2011). *Becoming qualitative researchers: An introduction.* Pearson Education Inc: Boston, MA.

Goe, L. (2007). *The link between teacher quality and student outcomes: A research synthesis*. Retrieved from http://www.niusileadscape.org/docs/FINAL_PRODUCTS/LearningCarousel/LinkBetweenTQandStudentOutcomes.pdf

Golafshani, N. (2003). Understanding validity and reliability in qualitative research. *The Qualitative Report*, *8*(4), 597-607.

Goldhaber, D. D., & Anthony, E. (2004). Can teacher quality be effectively assessed? National Board Certification as a signal of effective teaching. *Review of Economics and Statistics, 89*(1), 134-150.

Goldhaber, D. D., & Brewer, D. J. (1997). Evaluating the effect of teacher degree level on educational performance. In W. J. Fowler (Ed.), *Developments in School Finance*, (pp.197-210). Washington, DC: National Center for Education Statistics, U.S. Department of Education.

Goldhaber, D. D., & Brewer, D. J. (2000). Does teacher certification matter? High school teacher certification status and student achievement. *Educational Evaluation and Policy Analysis, 22*(2), 129-146.

Goldhaber, D. D., Destler, K., & Player, D. (2007). *Teacher labor markets and the perils of using hedonics to estimate compensating differentials in the public sector*. Retrieved from http://www.crpe.org/sites/default/files/wp_sfrp17_goldhaber_aug07_0.pdf

Goldhaber, D. D., & Hansen, M. (2007). *National Board certification & teachers' career paths. Does NBPTS certification influence how long teachers remain in the profession and where they teach?* Retrieved from http://www.cedr.us/papers/credentials/2009-National%20Board%20Cetrification%20and%20Teacher's%20Career%20Path.pdf

Goldhaber , D. D., Krieg, J., Theobald, R., & Brown, N. (2014). *Knocking on the door to the teaching profession? Modeling the entry of prospective teachers into the workforce*. Retrieved from http://www.cedr.us/papers/working/CEDR%20WP%202013-2%20%287.12.2013%29.pdf

Goldhaber, D. D., Lavery, L., & Theobald, R. (2014). *Uneven playing field? Assessing the inequity of teacher characteristics and measured performance across students*. CEDR Working Paper 2014-4. University of Washington, Seattle, WA.

Goldhaber, D. D., Liddle, S., & Theobald, R. (2013). The gateway to the profession: Assessing teacher preparation programs based on student achievement. *Economics of Education Review, 34*(3), 29-44.

Gollnick, D. M. (2008). Teacher capacity for diversity. In M. Cochran-Smith, S. Feiman-Nemser, & J. McIntyre (Eds.), *Handbook of research in teacher education: Enduring issues in changing contexts* (pp. 249–257). Mahwah, NJ: Lawrence Earlbaum.

Gorard, S., Taylor, C., Rushforth, K., & Smith, E. (2003). *What is the research capacity of the UK education research community? Reconsidering the shortage of quantitative skills phenomenon*. Occasional paper series. Cardiff: University School of Social Sciences.

Gordon, R. T., Kane, T. J., & Staiger, D. O. (2006) Identifying effective teachers using performance on the job. Retrieved from http://www.brookings.edu/views/Papers/200604hamilton_1.pdf

Green, R. L. (1998). Nurturing characteristics in schools related to discipline, attendance, and eighth grade proficiency test scores. *American Secondary Education, 26*(4), 7–14

Greenwald, R., Hedges, L.V., & Laine, R. D. (1996). The effect of school resources on student achievement. *Review of Educational Research, 66*(3), 361-396.

Grissmer, D., Flanagan, A., Kawata, J., & Williamson, S. (2000). *Improving student achievement: What state NAEP test scores tell us* (Report MR-924-EDU). Santa Monica, CA: RAND.

Guyton, E., Saxton, R., & Wesche, M. (1996). Experiences of diverse students in teacher education. *Teaching & Teacher Education, 12(*6), 643–652.

Hall, A. L. (2008). *Program implementation and student outcomes at four western North Carolina early college high schools*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses.

Hanford, E. (2011). *The value of a college degree*. Retrieved from http://americanradioworks.publicradio.org/features/tomorrows-college/dropouts/value-of-college-degree.html

Hanssen, C. (2006, October). *The Milwaukee mathematics partnership: A path model for evaluating teacher and student effects*. Paper presented at the MSP Evaluation Summit II, Minneapolis, MN.

Hanushek, E. A. (1992). The trade-off between child quantity and quality. *Journal of Political Economy, 100*(1), 84–117.

Hanushek, E. A., Kain, J. F., & Rivkin, S. G. (2001). Why public schools lose teachers. *Journal of Human Resources, 39*(2), 326-354.

Harris, D. N., & Sass, T. R. (2007). *The effects of NBPTS-certified teachers on student achievement.* Retrieved from http://www.caldercenter.org/sites/default/files/1001060_NBPTS_Certified.pdf

Hasselkorn, D., & Hammerness, K. (2008). *Encore performances: Tapping the potential of midcareer and second-career teachers*. Retrieved from http://files.eric.ed.gov/fulltext/ED536872.pdf

Heath, S. (1983). *Ways with words: Language, life, and work in communities and classrooms*. London: Cambridge.

Henry, G. T., Bastian, K. C., & Smith, A. A. (2012*). The North Carolina teaching fellows program (Policy brief)*. Retrieved from http://www.teachingfellows.org/userfiles/file/TeachingFellowsPolicyBrief-Final%203-28.pdf

Henry, G. T., Bastian, K. C., Fortner, C. K., Kershaw, D. C., Purtell, K. M., Thompson, C. L., & Zulli, R.A. (2014). Teacher preparation policies and their effects on student achievement. In press, *Education Finance and Policy*.

Henry, G. T., Purtell, K. M., Bastian, K. C., Fortner, C. K., Thompson, C. L., Campbell, S. L., & Patterson, K. M. (2014). The effects of teacher entry portals on student achievement. *Journal of Teacher Education, 65*(1), 7-23.

Hess, F. M. (2004). *Common sense school reform*. New York: Palgrave Macmillan.

Hess, F. M., & Leal, D. L. (1997). Minority teachers, minority students, and college matriculation. *Policy Studies Journal, 25*(2), 235–248.

Hewson, C. (2006). Secondary Analysis. In Jupp, Victor ed. *The Sage Dictionary of Social Research Methods.* p. 275-276. London: Sage.

Hill, H. C., Rowan, B., & Ball, D. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal, 42* (2), 371- 406.

Hill, H.C., Schilling, S.G., & Ball, D.L. (2004). Developing measures of teachers' mathematics knowledge for teaching. *The Elementary School Journal, 105* (1), 11-30.

Hoffman, N., Vargas, J., & Santos, J. (2009). New directions for dual enrollment: Creating stronger pathways from high school through college. *New Directions for Community Colleges*, *2009*(145), 43-58.

Hollins, E. (1982). The Marva Collins story revisited: Implications for regular classroom instruction. *Journal of Teacher Education*, *33*(1), 37–40.

Hoskin, T. (n.d.). *Parametric and non-parametric: Demystifying the terms.* Retrieved from http://www.mayo.edu/mayo-edu-docs/center-for-translational-science-activities-documents/berd-5-6.pdf

Hoxby, C. M. (2000). The effects of class size on student achievement: New evidence from population variation. *Quarterly Journal of Economics, 115*(4), 1239-1285.

Humphrey, D., Koppich, J., & Hough, H. (2005). Sharing the wealth: National board certified teachers and the schools that need them most. *Education Policy Analysis Archives, 13*(18), 1-50.

Institute for Education in Transformation. (1992). *Voices from the inside*. Claremont, CA: Claremont Graduate School.

Institute of Education Sciences. (2014). *Impact of early college high school (ECHS) model on postsecondary performance and completion.* Retrieved from http://ies.ed.gov/funding/grantsearch/details.asp?ID=211

Institute of Education Sciences. (2015). *Fast facts*. Retrieved from http://nces.ed.gov/fastfacts/display.asp?id=98

Irvine, J. J. (1990). *Black students and school failure*. Westport, CT: Praeger.

Jacobson, J. (2005). The early college experiment. *The Chronicle of Higher Education, 51*(27), A36.

Jary, J., & Jary, D. (2000). *Collins dictionary of sociology*. New York City, NY: HarperCollins Publishers.

Jepsen, C., & Rivkin, S. (2009). Class size reduction and student achievement: The potential trade-off between teacher quality and class size. *Journal of Human Resources, 44*(1), 223-250.

Jobs for the Future. (2006). *Smoothing the path. Changing state policies to support early college high schools: Case studies from Georgia, Ohio, Texas, and Utah*. Retrieved from http://www.jff.org/sites/default/files/publications/smoothingexsum.pdf

Jobs for the Future. (2011). *A portrait in numbers*. Retrieved from http://www.earlycolleges.org/Downloads/portrait%20in%20numbers9.pdf

Jobs for the Future. (2013). *Overview & FAQ*. Retrieved from http://www.earlycolleges.org/overview.html#who1

Jobs for the Future. (2014). *Early college expansion propelling students to postsecondary success, at a school near you: Executive summary*. Retrieved from http://www.jff.org/sites/default/files/publications/materials/Early-College-Expansion-ExSumm_031414.pdf

Jobs for the Future. (2015). *Overview*. Retrieved from http://www.jff.org/initiatives/early-college-designs

Johnson, B., & Christensen, L. (2010*). Educational research: Quantitative, qualitative, and mixed approaches.* SAGE Publications, Inc.

Johnson, L. S. (2007, April). *What it takes to be a real role model: Perspectives from new teachers of color and their students*. Paper presented at the Annual Meeting of the American Education Research Association, New York City, NY.

Jones, E. B., Young, R., & Rodriguez, J. L. (1999). Identity and career choice among Mexican American and Euro-American preservice bilingual teachers. *Hispanic Journal of Behavioral Sciences, 21*(4), 431–446.

Jones, S. M., & Dindia, K. (2004). A meta-analytic perspective on sex equity in the classroom. *Review of Educational Research, 74*(4), 443-471.

Julian, T. (2012). *Work-life earning by field of degree and occupation for people with a bachelor's degree: 2011. American Community survey briefs.* Retrieved from http://www.census.gov/prod/2012pubs/acsbr11-04.pdf

Kaestle, C. F. (1993). The awful reputation of education research. *Educational Researcher, 22*(1), 23-31.

Kalogrides, D., & Loeb, S. (2013). Different teachers, different peers: The magnitude effects of student sorting within schools. *Educational Researcher, 42*(6), 304-316.

Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2006). *What does certification tell us about teacher effectiveness? Evidence from New York City* (NBER Working Paper No. 12155). Cambridge, MA: National Bureau of Economic Research.

King, J. K. (2003). *Teacher quality: Understanding the effectiveness of teacher attributes.* Washington, DC: Economic Policy Institute.

Kleinfield, J. (1998). *The myth that schools shortchange girls: Social science in the service of deception*. Retrieved from http://files.eric.ed.gov/fulltext/ED423210.pdf

Klopfenstein, K. (2005). Beyond test scores: The impact of Black teacher role models on rigorous math taking. *Contemporary Economic Policy, 23*(3), 416–428.

Krauss, S., Neubrand, M., Blum, W., & Baumert, J. (2008, October). *The professional knowledge of German secondary mathematics teachers: Investigations in the context of the COACTIV Project*. Paper presented at the 11th International Congress on Mathematical Education, Monterrey, Mexico.

Krueger, A. B. (1999). Experimental estimates of education production functions. *Quarterly Journal of Economics*, *115*(2), 497–532.

Lankford, H., Loeb, S., & Wyckoff, J. (2002). Teacher sorting and the plight of urban schools: A descriptive analysis. *Educational Evaluation and Policy Analysis, 24*(1), 37–62.

Leonhardt, D. (2014). *Is college worth it? Clearly, new data says.* Retrieved from http://www.nytimes.com/2014/05/27/upshot/is-college-worth-it-clearly-new-data-say.html?_r=0&abt=0002&abg=1

Lumina Foundation. (2013). *Strategic plan: 2013 to 2016*. Retrieved from http://www.luminafoundation.org/files/file/2013-lumina-strategic-plan.pdf

Lumina Foundation. (2014). *A stronger nation through higher education. An annual report from Lumina Foundation.* Retrieved from http://www.luminafoundation.org/files/resources/a-stronger-nation-through-higher-education-2014.pdf

Lumina Foundation. (2015). *A stronger nation through higher education: Ten-year time horizon brings Goal 2025 into sharp focus.* Retrieved from http://www.luminafoundation.org/stronger_nation

Lynn, M. (2006). Education for the community: Exploring the culturally relevant practices of Black male teachers. *Teachers College Record, 108*(12), 2497–2522.

Ma, L. (1999). *Knowing and teaching elementary mathematics: Teacher's understanding of fundamental mathematics in China and the United States.* Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review, 62*(3), 279-299.

Meier, K. J. (1993). Latinos and representative bureaucracy: Testing the Thompson and Henderson hypotheses. *Journal of Public Administration Research and Theory, 3*(4), 393–414.

Meier, K. J., Stewart, J., & England, R. E. (1989). *Race, class, and education: The politics of second generation discrimination*. Madison, WI: University of Wisconsin Press.

Mohatt, G., & Erickson, F. (1981). Cultural differences in teaching styles in an Odawa school: A sociolinguistic approach. In H. Trueba, G. Guthrie, & K. Au (Eds.), *Culture and the bilingual classroom* (pp. 105–119). Rowley, MA: Newbury House.

Moir, E. (2011). *Phases of first-year teaching*. Retrieved from http://www.newteachercenter.org/blog/phases-first-year-teaching

Moll, L. C. (1986). Writing as communication: Creating strategic learning environments for students. *Theory into Practice, 25*(2), 103–108.

Monk, D. H. (1994). Subject matter preparation of secondary mathematics and science teachers and student achievement. *Economics of Education Review, 13* (2), 125-145.

Mullens, J. E., Murnane, R. J., & Willett, J. B. (1996). The contribution of training and subject matter knowledge to teaching effectiveness: A multilevel analysis of longitudinal evidence from Belize. *Comparative Education Review, 40*(2), 139–157.

Murnane, R. J., & Phillips, B. (1981). What do effective teachers of inner-city children have in common? *Social Science Research, 10*(1), 83-100.

Murray, N., & Klinger, C. M. (2013). *Aspirations, access, and attainment: International perspectives on widening participation and an agenda for change*. United Kingdom: Routledge.

National Board for Professional Teaching Standards. (2001). *Leading from the classroom. Highlights from the 2001 NBPTS National Board certified teacher leadership survey*. Retrieved from http://files.eric.ed.gov/fulltext/ED475767.pdf

National Board for Professional Teaching Standards. (2009). *National Board certification-A growing education reform movement.* Retrieved from http://www.mcps.org/NationalBoard_Files/Benefit%20to%20Principals%20of%20NBCT%20Staff.pdf

National Board for Professional Teaching Standards. (2012). *Hillsborough county public schools: New data prove the value of National Board Certification*. Retrieved from http://www.nbpts.org/sites/default/files/documents/research/NBPTS_Hillsborough.pdf

National Board for Professional Teaching Standards. (2014). *National Board Certification?* Retrieved from http://www.nbpts.org/national-board-certification

National Center for Education Evaluation and Regional Assistance. (2013). *The effectiveness of secondary math teachers from Teach for America and the Teaching Fellows Programs*. Retrieved from http://ies.ed.gov/ncee/pubs/20134015/pdf/20134015.pdf

National Center for Education Statistics. (2012). *The condition of education 2012*. Retrieved from http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2012045

National Center for Education Statistics. (2013). *Enrollment and percentage distribution of enrollment in public elementary and secondary schools, by race/ethnicity and region: Selected years, fall 1995 through fall 2023*. Retrieved from http://nces.ed.gov/programs/digest/d13/tables/dt13_203.50.asp

National Center for Education Statistics. (2015). *Integrated postsecondary education data system glossary*. Retrieved from http://nces.ed.gov/ipeds/glossary/

National Commission on Teaching & America's Future. (1996). *What matters most: Teaching for America's future*. Retrieved from http://www.namodemello.com.br/pdf/tendencias/whatmattersmost.pdf

National Commission on Teaching and America's Future. (2003). *No dream denied: A pledge to America's children*. Retrieved from http://nctaf.org/wp-content/uploads/no-dream-denied_summary_report.pdf

National Council for Accreditation of Teacher Education. (2006). *What makes a teacher effective? A summary of key research findings on teacher preparation*. Retrieved from http://eric.ed.gov/?id=ED49540

National Research Council. (2010). *Preparing teachers: Building evidence for sound policy*. Washington, DC: National Academies Press.

National Science Foundation. (2007). *A national action plan for addressing the critical needs of the U.S. science, technology, engineering, and mathematics education system*. Retrieved from http://www.nsf.gov/nsb/documents/2007/stem_action.pdf

New America Foundation. (2014). *Federal school nutrition programs.* Retrieved from http://febp.newamerica.net/background-analysis/federal-school-nutrition-programs

New York City Department of Education. (2015). *About us*. Retrieved from http://www.mchslic.com/aboutus.htm

Nieto, S. (1994). Lessons from students on creating a chance to dream. *Harvard Educational Review, 64*(4), 392–426.

Nixon, L. A., & Robinson, M. D. (1999). The educational attainment of young women: Role model effects of female high school faculty. *Demography, 36*(2), 185-194.

North Carolina Commission on Workforce Development. (2014). *2014 employer needs survey*. Retrieved from https://www.nccommerce.com/lead/research-publications/the-lead-feed/artmid/11056/articleid/45/2014-employer-needs-survey-reveals-hiring-difficulties

North Carolina Community College System. (2015). *State board of community colleges: Cooperative innovative high school applications*. Retrieved from http://www.nccommunitycolleges.edu/sites/default/files/state-board/program/prog_09_-_coop_innov_hs_2.pdf

North Carolina Department of Public Instruction. (2009). *Class size*. Retrieved from http://prim.ncwiseowl.org/policy___legislation/class_size/

North Carolina Department of Public Instruction. (2011a). *Lateral entry teachers*. Retrieved from http://www.ncpublicschools.org/licensure/lateral/

North Carolina Department of Public Instruction. (2011b). *NC Career and College Promise*. Retrieved from http://www.dpi.state.nc.us/ccpromise/

North Carolina Department of Public Instruction. (2011c). *North Carolina end-of-course tests*. Retrieved from http://www.ncpublicschools.org/accountability/testing/eoc/

North Carolina Department of Public Instruction. (2014a). *News release: 2013-14*. http://www.dpi.state.nc.us/accountability/reporting/

North Carolina Department of Public Instruction. (2014b). *News release: 2014-15*. Retrieved from http://www.ncpublicschools.org/newsroom/news/2014-15/20140904-01

North Carolina Department of Public Instruction. (2014c). *Professional educator's licensure*. Retrieved from http://www.ncpublicschools.org/licensure/

North Carolina General Assembly. (1985). *North Carolina general statutes: Chapter 115C: Elementary and secondary education*. Retrieved from http://www.ncga.state.nc.us/EnactedLegislation/Statutes/PDF/ByArticle/Chapter_115c/Article_20.pdf.

North Carolina New Schools. (2013). *Changing the future through early college high schools*. Retrieved from http://ncnewschools.org/wp-content/uploads/2014/08/Early-College-overview.pdf

North Carolina New Schools. (2014). *Innovative schools results show strength*. Retrieved from http://ncnewschools.org/innovative-schools-results-show-strength/

North Carolina School Report Cards. (2013). *Highly qualified teachers—Additional information*. Retrieved from http://www.ncschoolreportcard.org/src/schMoreInfo.jsp?iId=407

North Carolina State Board of Education. (2013). *Policies on general licensure requirements.* Retrieved from http://sbepolicy.dpi.state.nc.us/Policies/TCP-A-001.asp?Acr=TCP&Cat=A&Pol=001

North Carolina Teaching Fellows Program. (2014). *North Carolina teaching fellows program*. Retrieved from http://www.teachingfellows.org/

Nye, B., Konstantopoulos, S., & Hedges, L.V. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis, 26*(3), 237-257.

Oates, G. L. (2003). Teacher-student racial congruence, teacher perceptions, and test performance. *Social Science Quarterly, 84*(3), 508–525.

Ochoa, G. L. (2007). *Learning from Latino teachers*. San Francisco: Jossey-Bass.

O'Connor, K.A. (2003). *Retain teachers by listening to their wants and needs*. Retrieved from http://www.usca.edu/essays/vol122004/oconnor.pdf

Onwuegbuzie, A. J. (2000). *Expanding the framework of internal and external validity in quantitative research*. Retrieved from http://files.eric.ed.gov/fulltext/ED448205.pdf

Organization for Economic Cooperation and Development. (2014). *Education at a glance 2014: OECD indicators.* Retrieved from http://www.oecd.org/education/eag.htm

Page, S., & Rosenthal, R. (1990). Sex and expectations of teachers and sex and race of students as determinants of teaching behavior and student performance. *Journal of School Psychology, 28*, 119–131.

Palaich, R., Augenblick, J., Foster, S., Anderson, A. B., & Rose, D. (2006). R*eturn on investment in early college high schools*. Retrieved from http://www.jff.org/publications/return-investment-early-college-high-schools-0

Pell Institution. (2015). *Indicators of higher education equity in the United States: 45 year trend report.* Retrieved from http://www.pellinstitute.org/publications-Indicators_of_Higher_Education_Equity_in_the_United_States_45_Year_Report.shtml

Peterson, K. D. (2002). *Effective teacher hiring: A guide to getting the best*. Alexandria, VA: Association for Supervision and Curriculum Development.

Petty, T. M. (2002). *Identifying the wants and needs of North Carolina high school mathematics teachers for job success and satisfaction*. Retrieved from http://www.researchgate.net/publication/36214301_Identifying_the_wants_and_needs_of_North_Carolina_high_school_mathematics_teachers_for_job_success_and_satisfaction_microform_

Pitts, D. W. (2007). Representative bureaucracy, ethnicity, and public schools: Examining the link between representation and performance. *Administration & Society*, *39*(4), 497–526.

Press, S. J., & Wilson, S. (1978). Choosing between logistic regression and discriminant analysis. *Journal of the American Statistical Association, 73*(364), 699-705

Raymond, M., Fletcher, S. H., & Luque, J. (2001). *Teach for America; and evaluation of teacher differences and student outcomes in Houston, Texas.* CREDO Report retrieved from http://credo.stanford.edu/downloads/tfa.pdf

Reininger, M. (2012). Hometown disadvantage? It depends on where you're from: Teachers' location preferences and the implications for staffing schools. *Educational Evaluation and Policy Analysis, 34*(2), 124-145.

Rice, J. K. (1999). The impact of class size on instructional strategies and the use of time in high school mathematics and science courses, *Educational Evaluation and Policy Analysis, 21*(2), 215–229.

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417-458.

Roberts, M. A. (2007). *Student engagement in the early college high school.* (Doctoral dissertation, North Carolina State University, Raleigh, NC, 2007).

Rockingham County Schools. (2014). *Rockingham early college high school. 2014-2015 admissions application*. Retrieved from http://www.rock.k12.nc.us/cms/lib6/NC01000985/Centricity/Domain/2550/RECHS%20app.2014.2015.final.corrected.pdf

Rockoff, J. E., Jacob, B. A., Kane, T. J., & Staiger, D. O. (2008). *Can you recognize an effective teacher when you recruit one? (*NBER Working Paper No. 14485). Cambridge, MA: National Bureau of Economic Research.

Rowan, B., Chiang, F. S., & Miller, R. J. (1997). Using research on employees' performance to study the effects of teachers on students' achievement. *Sociology of Education, 70*(4), 256-284.

Rowan, B., Correnti, R., & Miller, R. J. (2002). What large-scale, survey research tells us about teacher effects on student achievement: Insights from the prospects study of elementary schools. *Teachers College Record, 104*(8), 1525–1567.

Rueda, R., Monzo, L. D., & Higareda, I. (2004). Appropriating the sociocultural resources of Latino paraeducators for effective instruction with Latino students: Promises and problems. *Urban Education, 39*(1), 52–90.

Sadker, M., & Sadker, D. (1994). *Failing at fairness: How our schools cheat girls*. New York: Touchstone.

Salvador, S. K., & Baxter, A. (2010). *National board certification report*. Retrieved from http://www.cms.k12.nc.us/cmsdepartments/accountability/REA/Documents/National%20Board%20Certification%20Report.pdf

Sanders, L. R., Borko, H., & Lockard, J. D. (1993). Secondary Science Teachers' Knowledge Base When Teaching Science Courses in and out of Their Area of Certification. *Journal of Research in Science Teaching, 30*(7), 723–736.

Sanders, W. L., Ashton, J. J., & Wright, S. P. (2005). *Comparison of the effects of NBPTS certified teachers with other teachers on the rate of student academic progress*. Retrieved from http://files.eric.ed.gov/fulltext/ED491846.pdf

Sanders, W. L., & Rivers, J. C. (1996). *Cumulative and residual effects of teachers on future student academic achievement.* Knoxville, TN: University of Tennessee Value-Added Research and Assessment Center.

Sass, T. R. (2011). *Certification requirements and teacher quality: A comparison of alternative routes into teaching*. Retrieved from http://www.abcte.org/files/alt.cert.study.2011.pdf

Sass, T. R., Hannaway, J., Xu, Z., Figlio, D. N., & Feng, L. (2010). Value-added of teachers in high poverty schools and lower poverty schools. *Journal of Urban Economics, 72*(2), 104-122.

Schutt, R. K. (2012). Quantitative methods. In G. Ritzer (Ed), *The Wiley-Blackwell companion to sociology* (pp.55-72). Oxford, England: Blackwell Publishing.

Shen, J. (2003, April). *New teachers' certification status and attrition pattern. A survival analysis using the Baccalaureate and Beyond Longitudinal Study 1993-97*. Paper presented at the AERA annual meeting, Chicago.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Slavin, R. E. (1989). The PET and the pendulum. *Phi Delta Kappan, 70*, 752-758.

Simmons, S. C., & Mebane, D. J. (2005). Viable alternative routes to teaching in North Carolina. *Action in Teacher Education, 27*(1), p. 45-52.

Smith, E. (2008). Pitfalls and promises: The use of secondary data analysis in educational research. *British Journal of Educational Studies, 56*(3), 323-339.

Smith, T., Gordon, B., Colby, S., & Wang, J. (2005). *An examination of the relationship between depth of student learning and National Board Certification Status*. Retrieved from http://www.nbpts.org/sites/default/files/documents/research/SmithGordonColbyWang_RelationshipofDepthofStudentLearningandNBCStatus.pdf

Sobal, J. (1981). Teaching with Secondary Data. *Teaching Sociology, 8*(2), 149-170.

Spicer, J. (2004). Logistic regression and discriminant analysis. In *Making sense of multivariate data analysis* (123-151). USA: Sage Publications, Inc.

Statistic Solutions. (2015). *Assumptions of logistic regression*. Retrieved from http://www.statisticssolutions.com/assumptions-of-logistic-regression/

Stein, M. K., Kaufman, J. H., Sherman, M., & Hillen, A. F. (2011). Algebra: A challenge at the crossroads of policy and practice. *Review of Educational Research, 81*(4), 453-492.

Southern Regional Education Board. (2007). *The changing role of statewide high school exams: A focus report in the challenge to lead series*. Retrieved from: http://publications.sreb.org/2007/07E03_Statewide_Exams.pdf

Snyder, T. D. (1993). *120 years of America education: A statistical portrait.* Washington, D.C: National Center for Educational Statistics.

Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology 35*(1), 4-28.

SRI International. (2011). *Evaluation of the Texas high school project: Third comprehensive annual report.* Retrieved from http://www.sri.com/work/publications/evaluation-texas-high-school-project-third-comprehensive-annual-report

Steckler, A., McLeroy, K. R., Goodman, R. M., Bird, S. T., & McCormick, L. (1992). Toward integrating qualitative and quantitative methods: An introduction. *Health Education Behavior*, *19*(1), 1-8.

Steele, C. M. (1997). A threat in the air - How stereotypes shape intellectual identity and performance. *American Psychologist*, *52* (6), 613-629.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test-performance of African Americans. *Journal of Personality and Social Psychology*, *69*(5), 797-811.

Stern, B. S., & Kysilka, M. L. (2008). *Contemporary readings in curriculum*. Thousand Oaks, California: SAGE Publishing, Inc

Stewart, J., Meier, K., & England, R. (1989). In quest of role models: Change in Black teacher representation in urban school districts, 1968–1986. *Journal of Negro Education, 58*, 140–152.

Strand, J. A., & Peacock, T. D. (2002). *Nurturing resilience and school success in American Indian and Alaska Native students [ERIC digest]*. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools. (ERIC Document Reproduction Service No. ED471488)

Strategic Data Project. (2012a). *SDP human capital diagnostic: Los Angeles Unified School District*. Retrieved from http://cepr.harvard.edu/cepr-resources/files/news-events/sdp-lausd-hc.pdf

Strategic Data Project. (2012b). *Learning about teacher effectiveness: SDP Human Capital Diagnostic. Gwinnett County Public Schools, GA.* Retrieved from http://cepr.harvard.edu/cepr-resources/files/news-events/sdp-gcps-hc.pdf

Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics*. NY: HarperCollins.

Taylor, M. C. (1979). Race, sex and the expression of self-fulfilling prophecies in a laboratory teaching situation. *Personality and Social Psychology, 37*(6)897-912.

Teach for America. (2012). *Teach for America*. Retrieved from http://www.teachforamerica.org/our-organization

Teitel, L. (2004). *How professional development schools make a difference: A review of research*. Washington, D.C., National Council for Accreditation of Teacher Education.

Tharp, R., & Gallimore, R. (1988). *Rousing minds to life: Teaching, learning, and schooling in social context*. Cambridge, England: Cambridge University Press.

The College Board. (2013). *AP Scores*. Retrieved from https://apstudent.collegeboard.org/apscores

The Council of State Governments. (2009). *Improving access to postsecondary education through early college high schools: A trends in America special report*. Retrieved from http://www.csg.org/knowledgecenter/docs/TIA_focus_earlycollege_screen.pdf

Tierney, W. G., Bailey, T., Constantine, J., Finkelstein, N., & Hurd, N. F. (2009). *Helping students navigate the path to college: What high schools can do: A practice guide* (NCEE #2009-4066). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ies.ed.gov/ncee/wwc/publications/practiceguides/

Trochim, W. (2006). *General linear model*. Retrieved from http://www.socialresearchmethods.net/kb/genlin.php

Uhlenberg, J., & Brown, K. (2002). Racial gap in teachers' perceptions of the achievement gap. *Education and Urban Society, 34*(4), 493–530.

University of North Carolina. (2014). *Program overview*. Retrieved from http://old.northcarolina.edu/nc_inspire/apply.htm

U.S. Bureau of Labor Statistics. (2013). *Occupational employment projections to 2022.* Retrieved from http://www.bls.gov/opub/mlr/2013/article/pdf/occupational-employment-projections-to-2022.pdf

U.S. Bureau of Labor Statistics. (2014). *Labor force participation.* Retrieved from http://www.bls.gov/bls/cps_fact_sheets/lfp_mock.htm

U.S. Bureau of Labor Statistics. (2015). *Earnings*. Retrieved from http://www.bls.gov/cps/earnings.htm

U.S. Census Bureau. (2013). *American community survey 2011-2013 ACS 3-year PUMS files.* Retrieved from http://www.census.gov/acs/www/data_documentation/pums_data/

U.S. Census Bureau. (2015). *Educational attainment.* Retrieved from http://www.census.gov/hhes/socdemo/education/

U.S. Department of Agriculture. (2014). *National school lunch program (NSLP).* Retrieved from http://www.fns.usda.gov/nslp/national-school-lunch-program-nslp

U.S. Department of Education. (2004). *No Child Left Behind: A toolkit for teachers*. Retrieved from http://www2.ed.gov/teachers/nclbguide/index2.html

U.S. Department of Education. (2006). *A guide to education and No Child Left Behind*. Retrieved from http://www2.ed.gov/nclb/overview/intro/guide/guide_pg12.html

U.S. Department of Education. (2010). *Fast Facts.* Retrieved from http://nces.ed.gov/fastfacts/display.asp?id=28

U.S. Department of Education. (2015). *Improving basic programs operated by local educational agencies: Title I, part a.* Retrieved from http://www2.ed.gov/programs/titleiparta/index.html

Vandevoort, L. G., Amrein- Beardsley, A., & Berliner, D. C. (2004). National board certified teachers and their students' achievement. *Education Policy Analysis Archives*, *12*(46), 1-117.

Villegas, A. M., & Lucas, T. (2002). *Educating culturally responsive teachers: A cohesive approach*. Albany, NY: SUNY Press.

Vygotsky, L. S. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.

Wake County Public School System. (2015). *Application*. Retrieved from http://stemec.wcpss.net/index.php/apply

Walsh, K. (2001). *Teacher certification reconsidered: Stumbling for quality*. Retrieved from http://www.abell.org/pubsitems/ed_cert_1101.pdf

Wainer, H., & Braun, H. I. (1988). *Test validity*. Hilldale, NJ: Lawrence Earlbaum Associates.

Wayne, A., Chang-Ross, C., Daniels, M., Knowles, K., Mitchell, K., & Price, T. (2004). *Exploring differences in minority and majority teachers' decisions about and preparation for NBPTS certificatio*n. Arlington, VA: SRI International.

Webb, M. (2004). *What is the cost of planning and implementing early college high school?* Retrieved from http://www.earlycolleges.org/Downloads/FinanceReport.pdf

Webb, M., & Gerwin, C. (2014). *Early college expansion: Propelling students to postsecondary success, at a school near you*. Retrieved from http://www.jff.org/sites/default/files/publications/materials/Early-College-Expansion_031414.pdf

Webb, M., & Mayka, L. (2011). *Unconventional wisdom. A profile of the graduates of early college high school.* Retrieved from http://www.jff.org/publications/unconventional-wisdom-profile-graduates-early-college-high-school

Wenglinsky, H. (2000). *How teaching matters: Bringing the classroom back into discussions of teacher quality*. Princeton, NJ: Educational Testing Service.

Whitehurst, G. J. (2002, March). *Scientifically based research on teacher quality: Research on teacher preparation and professional development*. Paper presented at the White House Conference on Preparing Teachers, Washington, D.C.

Williams, M. R., & Southers, T. (2010). Blurring the lines between high school and college: Early colleges and the effect on adult learners. *Adult Learning, 21* (1-2), 26-30.

Wilson, S. M., Floden, R. E., & Ferrini-Mundy, J. (2002). Teacher preparation research: An insider's view from the outside. *Journal of Teacher Education*, 53(3), 190-204.

Winston-Salem/Forsyth County Schools. (2014). *Early college of Forsyth*. Retrieved from https://www.forsythtech.edu/credit-programs/college-in-high-school/early-college-of-forsyth/

Winter, G. (2000). A comparative discussion of the notion of validity in qualitative and quantitative research. *The Qualitative Report*, *4,* 3-4. Retrieved from http://www.nova.edu/ssss/QR/QR4-3/winter.html

Wolk, R. A. (2005). *'It's kind of different': Student experiences in two early college high schools*. Boston: Jobs for the Future.

Xu, Z., Hannaway, J., & Taylor, C. (2007). *Making a difference? The effects of Teach for America in high school*. Retrieved from https://www.teachforamerica.org/sites/default/files/TFA_final_v-March-2009_0.pdf

Zyngier, D. (2014). *Class size and academic results, with a focus on children from culturally linguistically and economically disenfranchised communities*. Retrieved from https://journal.anzsog.edu.au/publications/9/EvidenceBase2014Issue1.pdf

Appendix A

NORTH CAROLINA EDUCATION RESEARCH DATA CENTER
CONFIDENTIALITY AGREEMENT FOR RESEARCH STAFF

Title of Research Project: Exploring the Characteristics of Teachers and Student Outcomes in early colleges + Selected high schools

Name and Title of Researcher: Lindsay Ruggles, Doctoral Student

Department and Institution: Educational Leadership, Appalachian State University

Email Address: ruggleslc@email.appstate.edu

Name and Title of PI/Supervisor: Sara Zimmerman, Curriculum & Instruction

IRB Protocol Number: 12-2013

Pledge of Confidentiality

Through my work on a NCERDC-approved project, I will have access to data derived from confidential files supplied to the North Carolina Education Research Data Center from the North Carolina Department of Public Instruction. I am aware of restrictions to use of such data specified by the Family Education Rights and Privacy Act (FERPA), enacted by the United States Congress and by North Carolina General Statute 115C.

I agree to fulfill my responsibilities on this project in accordance with the procedures and requirements established in the approved Data Use Agreement and Data Security Plan. These conditions include the following:

1. I will use data only for the research purposes set forth in the proposal.

2. I will not attempt to identify individuals, families, or households.

3. In the event of that the identity of an individual, family, or household is discovered inadvertently, I will:
   - make no use of this information,
   - inform the Data Center Director of this discovery,
   - safeguard or destroy this information as advised by the Data Center Director, and
   - not inform anyone else of this discovery.

4. I will never release data to anyone who has not been authorized by the Data Center to receive such data.

5. I will never report results in a way that could permit inadvertent disclosure of an individual. When tabulations are produced, any table with a cell with 1, 2, or 3 cases will be recategorized.

6. I will destroy the data at the end of this project.

Anyone failing to abide by the procedures established in the approved Data Use Agreement and Data Security Plan will lose access to data from the North Carolina Education Research Data Center.

Signature: [signature]

Date: 3/8/12

Appendix B

NORTH CAROLINA EDUCATION RESEARCH DATA CENTER
CONFIDENTIALITY AGREEMENT FOR INVESTIGATORS

Title of Research Project: Exploring the Characteristics of Teachers and Student Outcomes in Early Colleges and Selected High Schools
Name and Title of Principal Investigator: Lindsay Ruggles

Receiving Department and Institution: Educational Leadership, Appalachian State University

Date of IRB Approval: To be determined

IRB Protocol Number: 12-2013

Telephone Number: 828-262-2232

Email Address: rugglesle@email.appstate.edu

Pledge of Confidentiality

I have received approval of my research proposal to access data derived from confidential files supplied to the North Carolina Education Research Data Center from the North Carolina Department of Public Instruction. I am aware of restrictions to use of such data specified by the Family Education Rights and Privacy Act (FERPA), enacted by the United States Congress and by North Carolina General Statute 115C.

I agree to fulfill my responsibilities on this project in accordance with the procedures and requirements established in the approved Data Use Agreement and Data Security Plan. These conditions include the following:

- That the data will be used solely for statistical analyses and that no attempt will be made to identify specific individuals, families, households, schools, or institutions, nor will any listing of data at the individual, family, or school level be published or otherwise distributed.
- That, if the identity of any student should be discovered inadvertently, then (1) no use will be made of this information, nor will it be shared with anyone else; (2) the identifying information will be safeguarded or destroyed.
- To avoid inadvertent disclosure of student identities by taking the following precautions in the release of statistics derived from the data set:
    - In no table should a single cell contain all cases in any row or column.
    - In no case should the total figure for row or column of a cross-tabulation be fewer than three.

- In no case should a quantity figure be based upon fewer than three cases.
- In no case should a quantity figure be published if one case contributes more than fifty percent of the amount.
- In no case should data on an identifiable case, or any of the kinds of data listed above, be derivable through calculation from the combination of tables released.
- Data released should never permit disclosure when used in combination with other known data.

- That only the persons identified in the data agreement as investigator or research staff will have access to the contents of the data files, including derived data files.
- To comply fully with the NCERDC-approved Data Security Plan.
- To respond promptly and in writing to inquiries from the NCERDC regarding compliance with this agreement or the expected date of completion of the research.
- To destroy all electronic and paper files by this date, specified within the data use agreement: _____May 2013_____ .
- To provide manuscripts to the North Carolina Department of Public Instruction prior to publication.
- To provide annual reports to the NCERDC, which include:
  - A copy of the annual IRB approval for the project;
  - A listing of public presentations at professional meetings using results based on the data; and
  - Copies of papers accepted for publication using these data, with complete citations.

I agree that if I fail to abide by the procedures established in this agreement, the approved Data Use Agreement, and the approved Data Security Plan, I immediately will cease using and will destroy all data obtained or derived from the North Carolina Education Research Data Center.

Signature: Lindsay Biggs

Date: 3/8/12

Appendix C

Appalachian STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
Office of Research Protections
ASU Box 32068
Boone, NC 28608
828.262.2692
Web site: http://researchprotections.appstate.edu/
Email: irb@appstate.edu

To: Dr. Lindsay Ruggles
RCOE
EMAIL

From: Dr. Lisa Curtin, Institutional Review Board Chairperson
Date: November 9, 2015
RE: Notice of IRB Approval by Expedited Review (under 45 CFR 46.110)
Study #: 15-0128
Study Title: Exploring the Characteristics of Teachers and Student Outcomes in Early Colleges and Selected High Schools
Submission Type: renewal
Expedited Category: 5. Research Involving Pre-existing Data, or Materials To Be Collected Solely for Nonresearch Purposes

Approval Date: November 9, 2015
Expiration Date of Approval: November 8, 2016

The Institutional Review Board (IRB) approved this study for the period indicated above. The IRB found that the research procedures meet the expedited category cited above. IRB approval is limited to the activities described in the IRB approved materials, and extends to the performance of the described activities in the sites identified in the IRB application. In accordance with this approval, IRB findings and approval conditions for the conduct of this research are listed below.

Approval Conditions:

Appalachian State University Policies: All individuals engaged in research with human participants are responsible for compliance with the University policies and procedures, and IRB determinations.

Principal Investigator Responsibilities: The PI should review the IRB's list of PI responsibilities. The Principal Investigator (PI), or Faculty Advisor if the PI is a student, is ultimately responsible for ensuring the protection of research participants; conducting sound ethical research that complies with federal regulations, University policy and procedures; and maintaining study records.

Modifications and Addendums: IRB approval must be sought and obtained for any proposed modification or addendum (e.g., a change in procedure, personnel, study location, study instruments) to the IRB approved protocol, and informed consent form before changes may be implemented, unless changes are necessary to eliminate apparent immediate hazards to participants. Changes to eliminate apparent immediate hazards must be reported promptly to the IRB.

Approval Expiration and Continuing Review: The PI is responsible for requesting continuing review in a timely manner and receiving continuing approval for the duration of the research with human participants. Lapses in approval should be avoided to protect the welfare of enrolled participants. If approval expires, all research activities with human participants must cease.

Prompt Reporting of Events: Unanticipated Problems involving risks to participants or others; serious or continuing noncompliance with IRB requirements and determinations; and suspension or termination of IRB approval by an external entity, must be promptly reported to the IRB.

Appalachian
STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD
Office of Research Protections
ASU Box 32068
Boone, NC 28608
828.262.2692
Web site: http://researchprotections.appstate.edu/
Email: irb@appstate.edu

Closing a study: When research procedures with human subjects are completed, please complete the Request for Closure of IRB review form and send it to irb@appstate.edu.

Websites:

1. PI responsibilities:http://researchprotections.appstate.edu/sites/researchprotections.appstate.edu/files/PI%20Responsibilities.pdf

2. IRB forms: http://researchprotections.appstate.edu/human-subjects/irb-forms

CC

Dr. Sara Zimmerman
Dr. Les Bolt
Dr. Tracy Goodson-Espy

Vita

Lindsay Ruggles was born in Catawba, North Carolina in 1988. She attended elementary, middle, and high school in Catawba, NC and graduated from Bandy's High School in June of 2006. While in high school, she enrolled in community college classes through the Huskin's Program. After graduating high school, she entered the University of North Carolina at Charlotte in the fall of 2006. In December of 2008 she was awarded the Bachelor of Arts degree in elementary education with a concentration in mathematics. In the spring of 2009 she entered Appalachian State University to pursue a Master of Arts degree in elementary education. In the spring of 2010 she was awarded the Master of Arts degree in elementary education. She decided to continue her studies at Appalachian State University and enrolled in the doctoral program in June of 2010. She earned her Ed.D. in Educational Leadership in May of 2016. While in the doctoral program, she completed a two year assistantship under the supervision of Dr. Sara Olin Zimmerman. She is currently an engineering draftsman and a substitute teacher for Lincoln County Schools in North Carolina.