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Minimum High School Graduation Requirements and Teacher Compensation

Allison Johnson
University of Kentucky, allison.d.johnson@gmail.com
Author ORCID Identifier:
https://orcid.org/0009-0004-1363-3808
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Allison Johnson, Student

Dr. Kelly Bradley, Major Professor

Dr. Jane Jensen, Director of Graduate Studies

MINIMUM HIGH SCHOOL GRADUATION REQUIREMENTS AND TEACHER COMPENSATION

DISSERTATION

A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Education in the
College of Education
at the University of Kentucky

By
Allison Johnson
Lexington, Kentucky
Director: Dr. Kelly Bradley, Professor of Education Policy, Measurement and Evaluation
Lexington, Kentucky
2023

https://orcid.org/0009-0004-1363-3808

ABSTRACT OF DISSERTATION

MINIMUM HIGH SCHOOL GRADUATION REQUIREMENTS AND TEACHER COMPENSATION

In the last forty years of educational reform, significant changes have been made to the number and type of high school credits students are required to complete for graduation. As these requirements have changed, the demand for higher-level academic courses has increased while teacher shortages, particularly in high-demand areas such as math and science, have continued to increase. This study uses data from the National Center for Education Statistics (NCES) Student and Staffing Survey to examine the relationship between minimum graduation credit requirements in core subject areas (English, math, science and social sciences) and teacher salaries, both holistically and in specific geographic contexts (cities, towns, suburbs and rural areas). Through the use of multiple regression models, this study examined the impact of graduation requirements and other district-level variables (including total student population, the number of teacher contract days and the percent of district students qualified for the National School Lunch Program) on both the lowest and highest fulltime teacher salaries.

The results suggest minimum graduation requirements, specifically science and social science courses, do impact teacher salaries, though the effect size is quite small.

KEYWORDS: teacher compensation, high school graduation requirements

Allison Johnson

(Name of Student)

04/027/2023

Date

MINIMUM HIGH SCHOOL GRADUATION REQUIREMENTS AND TEACHER COMPENSATION

By
Allison Johnson

Kelly Bradley
Director of Dissertation

Jane Jensen
Director of Graduate Studies

04/27/2023
Date

DEDICATION

To all who have gone before.

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Table Of Contents

LIST OF TABLES

CHAPTER 1. Introduction

For decades, one of the prevailing narratives of education in the United States has been the need for improvement. The 1958 National Defense Education Act, prompted in part by the launch of Sputnik by the Soviet Union, funneled funds to reform education with a focus on improving scientific capabilities nationwide (Goodman, 2019). In 1983, the publication of *A Nation At Risk* by the National Commission on Excellence in Education (Gardner et al., 1983) solidified the idea within the collective understanding of education in America. The commission was called to address the perception of the declining quality of education, and the final report highlighted the perceived deficiencies for the American public. Similarly, the No Child Left Behind Act of 2001 and the 2015 reauthorization of the Every Student Succeeds Act centered on improving education through a renewed focus on school accountability.

Despite the national calls for change and oversight by the U.S. Department of Education, states are generally able to create their own requirements for academic standards and minimum coursework requirements. One result of the call for improved education was increased requirements for the number of years of academic (math, science, social sciences, English language arts) coursework in a number of states. (Bishop & Mane, 2005; Clune & White, 1992; Goodman, 2019; Plunk et al., 2014; Teitelbaum, 2003). Though some states dictated specific course requirements (i.e., mathematics through algebra 2 or its equivalent), many states merely required a set number of courses, with the hope that students would take more rigorous and challenging coursework, rather

than similar-level elective courses within the academic discipline (Daun-Barnett & St. John, 2012; Koon & Davis, 2019; Raphael et al., 2012).

The demand for academic courses, specifically math and science, increased as student enrollment in those courses increased (Bishop & Mane, 2005; Nord et al, 2011) following the institution of these policies. Today, it is well documented that many districts struggle to fill teaching positions - particularly in those math and science courses (Abell et al., 2006; Hill & Stearns, 2015; Ingersoll, 2003; Morse & Mujtaba, 2008; Polizzi et al., 2015; Rushton et al., 2014).

Indeed, teacher shortages are an ongoing narrative within the public discourse on public education. The existence of a shortage is not generally debated; the difference in opinion comes with the extent and causes of the shortage and how to address the problem. Is the shortage with all teachers, rural teachers, STEM teachers, or some combination? Is the issue new teacher training, continuing professional support, attracting new teachers or retaining current ones? Should there be more regulation surrounding teacher certifications, or less? Should teacher compensation be increased, or tied to performance, or unchanged? There is more disagreement on the scope of teacher shortages than there is consensus.

One explanation may lie in the uneven population expansion across the United States. The Projections of Education Statistics to 2048 report by the National Center for Education Statistics (NCES) outlines statistics of enrollment, graduates, teachers, and expenditures in both public and private schools across the United States and then outlines projections of those same measures through the year 2048. Nationwide, NCES projects a 2% increase in total preK-12 public and private school student enrollment from 2016 to

2048 (Hussar & Bailey, 2020). Examining the same projections on a state-by-state basis, however, paints a different picture.

Within the national projections, 22 states are projected to have lower total preK-12 enrollment, and nine of those states projected more than 5% less enrollment, while 28 states and the District of Columbia are projected to have increases (with 15 states and the District of Columbia projected greater than 5% increases). Regionally, the Northeast and Midwest are projected to have decreases in enrollment (4% and 2 %, respectively), while the South and West are projected to have increases (5% and 2%) (Hussar & Bailey, 2020). In other words, though overall enrollment is projected to increase significantly, this is not a uniform change: some states will see a significant increase in student enrollment, while others will decrease.

Of course, if student-to-teacher ratios remain relatively stable, then it is expected that an increase in student enrollment would require a corresponding increase in teacher numbers. The projected scenario then makes an excellent case for a shift in the need of teachers - schools and districts in Northeastern and Midwestern states will need fewer teachers over time, and states in Western and Southern states will need additional teaching staff. Unless the teaching labor force is following the shift in needs geographically, it seems evident that the understanding of the existence of a teacher shortage may rely heavily on the geographical region which is being considered.

Notably, these projections account only for total student enrollment and teaching staff. The researchers did account for the continuing trend toward smaller student-teacher ratios, but no considerations were made for changing state and board policies surrounding

preK offerings and enrollments. Expansion of these programs will also increase enrollment.

Policy makers have grappled, then, with the problem of improving teacher recruitment and retention to maintain a sufficiently large, qualified teaching workforce to keep pace with the changes in demand for specific coursework and the increasing population of students. The national discourse has explored reforms to a variety of teacher compensation, including salaries, pensions, and scholarships, all with the aim of recruiting and retaining qualified teachers at sufficient rates. There is a body of literature exploring the impact of selected reforms on teacher behaviors, though the availability of information varies: salaries and other forms of merit pay have been examined much more extensively than pensions or other forms of compensation, for example. It is unclear that research has been conducted to explore the relationship between teacher compensation and graduation requirements, however, despite the evident connection between increased graduation requirements and increased demand for academic teachers as well as the connection between the resulting shortage of qualified teachers and teacher compensation measures.

1.1 Statement of Problem

In parts of the country, there are insufficient qualified teachers to fill all open positions. These teacher shortages are disproportionately found in secondary schools, often in upper-level math and science courses. There are multiple contributing factors to these teacher shortages, but it is understood in the literature and public opinion that the

teacher shortages (particularly in math and science) are at least partly attributable to teacher compensation (Ingersoll, 2003; Ingersoll & May, 2012; Schuster, 2013).

Due to these teacher shortages, there are students who are either unable to take upper-level courses or are taught by un- or under-qualified teachers (substitutes, out-of-area certifications, etc.) (Hill & Stearns, 2015; Ingersoll, 2003a; Polizzi et al., 2015; Rushton et al., 2014.) Despite this problem, states have set minimum credit requirements for graduation and, in some locations, local school boards or districts have policies which increase these minimum requirements.

This author is aware of at least one school district which altered the graduation course requirements due to difficulty in hiring and retaining qualified science teachers. Despite this, there appears to be a gap in the literature connecting teacher shortages with graduation requirements. Given the impact teacher compensation measures have on teacher shortages, this study aims to identify what relationship exists between teacher salaries and student graduation requirements.

1.2 Study Purpose and Significance

The purpose of this study is to contribute to the understanding of how teacher-level factors influence student experiences. Specifically, this study examines what relationship, if any, exists between teacher salaries and student graduation requirements. The study accomplishes this by comparing existing data on graduation requirements (across core subject areas and foreign languages) with information on teacher salaries from the Schools and Staffing Survey, 2011-2012 by the National Center for Education Statistics.

The literature suggests that graduation credit requirements have increased in both quantity and specificity over the last several decades, leading to more students enrolling in more advanced courses. At the same time, teacher shortages in certain certification areas (particularly science and mathematics) and geographic locations persist, leaving a growing number of students enrolled in courses taught by under-qualified or out-of-area teachers. Though there is a body of literature examining the impact of teacher compensation measures on both recruiting and retention of teachers, the current body of literature does not appear to contain any studies directly investigating how teacher compensation measures are related to student graduation requirements. Addressing this question provides additional insight to the body of literature concerning teacher compensation measures and may inform future studies.

1.3 Research Questions and Methodology Overview

The overarching questions for this study are "Is there a relationship between the number of core content (math, science, social studies, and English/Language Arts) credits required for high school graduation and the lowest paid full time teacher salary?" and "Is there a relationship between the number of core content (math, science, social studies, and English/Language Arts) credits required for high school graduation and the highest paid full time teacher salary?" This study examines the differential impacts of district location by asking "Is there a difference in the relationship between teacher salaries and the number of core content credits required for high school graduation for districts in different settings (urban, suburban, rural, town)?" District size (measured by total student enrollment), the percentage of district students qualified for free and reduced lunch, and

the number of teacher contract days in a year are variables controlled for within the data analysis.

An existing data set from the National Center for Education Statistics (NCES), the Schools and Staffing Survey, 2011-2012 (SASS), is utilized for quantitative analysis. The SASS survey consisted of teachers and principals at 9,000 schools in 4,500 school districts. Stratified sampling of schools occurred based upon the population of public schools in the 2009-2010 Common Core of Data and a compiled list of schools from private school organization lists and state private school lists. Teachers were sampled from lists provided by districts or schools in the larger SASS sample (NCES, 2011).

CHAPTER 2. Literature Review

This literature review will provide a framework for the discussion of trends in graduation credit requirements for high school students, teacher shortages, and teacher compensation in the United States. Beginning with an exploration of the changing landscape of graduation credit requirements, the impacts of these changed requirements will also be explored. A relatively robust literature on the causes of teacher shortages will be addressed, as well as an examination of some of the research discussing teacher recruitment and retention. The literature on teacher compensation measures is mixed in availability; the body of literature exploring teacher salaries and reform is fairly robust, whereas the body of literature exploring other measures of teacher compensation such as pension is significantly slimmer. Both will be explored within this review.

2.1 Graduation Credit Requirements

A discussion of student graduation credit requirements would be incomplete if the impacts of a high school diploma are not considered. Hickox's analysis of the impact of a high school diploma on the labor market (2015) provides some insight. Specifically, Hickox found an increase in employer's preference for hiring people possessing high school diplomas, as evidenced by a marked decrease in employment for workers without high school credentials, across market sectors (2015). In addition to actual employment opportunities, there is a difference in wages for workers with and without a high school diploma: over a lifetime, Rouse found that a worker without a diploma may earn $260,000-$569,000 less than a worker with a diploma (as cited in Hickox, 2015). Possessing a high school diploma does appear, then, to confer some societal benefits in

the form of increased lifetime earnings. The coursework required to earn such a credential has varied over time and across locales, however.

In 1983, the National Commission on Excellence in Education (NCEE) recommended all high schools students complete a minimum of 13 full-year courses: four in English, and three each in mathematics, science, and social studies, despite only 14% of 1982 high school graduates completing a similar series (Bishop & Mane, 2005). Some states did adopt these requirements into local policy, and by the year 2000 the number of academic courses taken by typical high school graduates increased to 16.9, from 12.9 credits in 1982 (Bishop & Mane, 2005). Similarly, Nord et. al (2011) found that both male and female high school graduates, as well as White, Black, Hispanic, and Asian/Pacific Islander graduates earned more credits in 2009 than in 1990.

Though these course recommendations were fairly widely adopted by states (Bishop & Mane, 2005; Clune & White, 1992; Goodman, 2019; Plunk et al., 2014; Teitelbaum, 2003), these recommendations did not immediately address the rigor or content of the required courses. States have approached the required content in a variety of ways. Earlier adoptions of the requirements tended to closely mirror the recommendations put forth by the NECC by mandating only a certain number of years in a subject, while more recent graduation requirements have specified both the numbers of years and the content required (Daun-Barnett & St. John, 2012; Koon & Davis, 2019; Raphael et al., 2012). The average number of credits in core academic areas required for graduation increased by more than 1.6 years from 1980 to 1993 (Stevenson & Schiller, 1999). The overwhelming majority of this change occurred specifically in math and science courses (Schiller & Muller, 2003).

Educational policy in the United States continues to center mathematics education as a critical need owing, at least in part, to a perceived gap between US students' mathematical skills and those of other nation's students (Daun-Barnett & St. John, 2012; Gonzales et al., 2009). Some researchers have noted a narrowing of that gap (Gonzales et al., 2009), but the gap continues. As of 2011, 20 states and the District of Columbia required high school students to complete math coursework through a minimum of algebra II or its equivalent in order to earn a high school diploma (Achieve, 2011). Mississippi adopted new academic content standards in 2014 and included a specific requirement for a total of four math credits, one of which must be Algebra 1 (Koon & Davis, 2019). Oregon required students in the class of 2014 and later to take three years of math, which must include Algebra 1 and Geometry (Raphael et al., 2012).

2.1.1 *Impact of Minimum Requirement Policies*

Much of the research on the impact of minimum graduation requirements is focused on mathematics, as that is the subject area most likely to have specific required courses (as opposed to years of study). Following the release of A Nation at Risk, support for increasing graduation requirements was mixed; though studies found positive associations between math and science credits earned and student achievement, there were fears that increased credit requirements would increase high school dropout rates (Teitelbaum, 2003). Despite this fear, Clune and White (1992) found no association between dropout rates and increased graduation requirements.

There is some additional evidence that minimum graduation requirements in general have positive impacts for students. Clune and White (1992) found that instituting

minimum graduation requirement policies did in fact translate to positive outcomes: students completed more courses than previously and completed more rigorous courses. Daun-Barnett & St. John (2012) found reason to support policies increasing graduation requirements, whether via minimum graduation credit requirements or end-of-course exit exams. Specifically, more students who graduate high school under these kinds of policies are then successful in college. However, exit exam policies have a negative effect on high school graduation. Daun-Barnett and St. John (2012) did not find a similar negative impact on minimum graduation credit requirements.

Similarly, Goodman (2019) found that some students' educational experiences can be meaningfully impacted by state-level minimum course requirements. Specifically, Goodman found that increased graduation requirements did not have a significant impact on most students' earnings or productivity following high school. For Black students, however, Goodman found that math coursework specifically accounted for about half of the economic return of an entire year of high school.

Not all the findings are positive, however, as there is some dissension on the impact of requiring courses. Teitelbaum (2003) found that taking additional math or science courses did not necessarily improve student achievement and suggested that a lack of teacher preparation may explain the difference. Schiller and Muller (2000) found the number of advanced mathematics courses taken by students appears to be increased when school accountability is increased, but these increases are not associated with a change in the rate of students obtaining a high school diploma.

In states which both required more math courses and adopted the NCTM math curriculum, St. John found a decline in high school graduation rates. (2006, as cited in

Daun-Barnett). However, several studies found a positive relationship between the number of math courses taken in high school and a student's likelihood of attending and succeeding in college (Pelavin & Kane, 1990; Berkner & Chavez, 1997; and Perna & Titus, 2004, as cited in Daun-Barnett).

Additionally, Schiller and Muller (2003) found state graduation requirement policies did have a statistically significant effect (albeit small) on the mathematics course taking of high school students. States with more graduation requirements had students who entered the high school mathematics curriculum at a higher level, but students placed in lower-level mathematics courses as freshmen were less likely to take advanced mathematics courses later in high school. (Schiller and Muller, 2003).

2.2 Teacher Shortages

Given the increased requirements (particularly in math and science courses), it is reasonable to consider the composition of the teacher workforce. Are there sufficient certified and qualified teachers to fill the required number of positions to serve all students? In short, no. Numerous studies have identified a gap between the number of currently certified and qualified teachers and the number required to meet the course load demand, particularly in science, technology, and mathematics (STEM) (Abell et al., 2006; Hill & Stearns, 2015; Ingersoll, 2003; Morse & Mujtaba, 2008; Polizzi et al., 2015; Rushton et al., 2014). Indeed, in some locations, this discrepancy is stark: more than 50% of all districts claim difficulty in recruiting or retaining highly qualified teachers for STEM subject areas, but in high-minority districts, that percentage climbs to more than 90% (Goldhaber et al., 2016).

This shortage of qualified and certified teachers, math and science teachers particularly, is worsening over time. Hill (2011, as cited in Rushton et al., 2014) found that in the 2007-2008 school year, 83% of public high school students were taught science by teachers who held a science degree, which is comparable to other core academic subjects. When science is split into sub-disciplines, however, the picture is less rosy: only 45% of chemistry students and 21% of earth science students were taught by teachers with degrees within those fields (Hill, 2011, as cited in Rushton et al., 2014).

It is notable, however, that these numbers continue to decline. Hill & Stearns (2015) found that only 78.8% of public high school students were taught science by teachers with a science degree in the 2011-2012 school year. Though there was an increase of 10% in the number of earth science students taught by teachers with degrees in that field (31.2% total), the percentage of chemistry students taught by teachers with degrees in that field dropped to 40.7% (Hill & Stearns, 2015).

Similarly, Polizzi et al. (2015) found that by 2007, students were 65% likely to have a biology teacher who held a biology degree. This was a 14% increase from 1990. Between 1987 and 2007, Polizzi et al. (2015) found the proportion of biology teachers holding provisional certifications was higher than biology teachers holding no certifications. Polizzi et al. (2015) additionally found that the proportion of non-STEM teachers teaching biology declined during that same time period, though the proportion of STEM teachers (not biology) teaching biology increased. This would seem to indicate that, when a biology-certified teacher is not available to teach biology, the course is increasingly taught by another science-certified teacher, rather than a teacher certified in another discipline entirely. The researchers are careful to note, however, that despite the

relatively large proportion of biology classes taught by teachers with a degree or credential in biology, somewhere between one and two million students took a biology class in 2007 taught by a teacher without a biology degree or certification (Polizzi et al., 2015).

Goldhaber et al. (2016) examined Washington state specifically and noted a discrepancy in supply and demand for STEM and special education (SPED) endorsed teachers when compared to other certification fields. The state produced fewer new SPED and STEM teachers than the number of teachers leaving positions in those fields for more than five (SPED) or ten (STEM) years. Conversely, the state produced significantly more elementary education teachers than the number of elementary education teachers who left (Goldhaber et al., 2016). This would indicate a teacher shortage constrained, as previously discussed, by certification subject area, rather than an overall teacher supply problem.

Schools and districts face an ever-growing problem, then, of how to staff their science and mathematics classes. One common solution is out-of-area teaching, or having teachers who are not certified in a particular subject teach (usually under some sort of provisional certification or waiver). Perhaps unsurprisingly, out-of-area teaching is more common in physical sciences than in other core academic areas (Ingersoll, 2003a; Polizzi et al., 2015; Rushton et al., 2014). This out-of-area teaching impacts schools disproportionately; schools with significant populations of students in poverty are more likely to have mathematics and special education vacancies and thus have a greater need for teachers to teach out-of-area (Ingersoll, 1999 & Strizek et al, 2006, as cited in Berry & Eckert, 2012). Out-of-area teaching is a short-term solution, but it does not completely

address the underlying issue. Of note, no literature was found researching whether districts or states have changed minimum graduation credit requirements due to a lack of sufficient certified or qualified teachers in particular subject areas.

2.2.1 *Teacher Recruitment and Retention*

The issue of teacher shortages, particularly in high-need or hard-to-fill areas, encompasses both recruitment (attracting new teachers) and retention (keeping existing teachers in the education field). One program, The National Science Foundation's (NSF) Robert Noyce Teacher Scholarship program (Noyce Program) was established to provide scholarships, stipends and fellowships to "address the critical need for recruiting and preparing highly effective elementary and secondary science and mathematics teachers in high-need local educational agencies" (National Science Foundation, 2017). Despite the relative popularity of the Noyce Program, Bull et al. (1994, as cited in Liou et al., 2010) found scholarship programs did not increase the supply of science teachers; specifically, programs designed to attract individuals to become science teachers attracted people who were already committed to teaching, though the study did not address the second component of the Noyce Program, working in high-needs schools.

However, Liou et al. (2010) examined the perceptions of 555 Noyce Program scholarship recipients specifically related to how the scholarship impacted their commitments to teaching in high needs schools. The researchers found the Noyce Program scholarship recipients perceived the scholarship as relating to finishing a certification program but not necessarily to the initial decision to become a

teacher. Similarly, the initial decision to teach in a high needs setting was perceived as more related to the scholarship than remaining in the same setting (Liou et al., 2010).

Retaining qualified teachers is also a challenge. Teaching is a profession with notably high turnover; Ingersoll (2003) found that between 40-50% of teachers leave the profession within their first few years of teaching. Teachers who leave the profession cite low salaries, lack of support from administrators, discipline issues, and a lack of decision-making power as reasons for their departure, with science teachers most often citing salary concerns (Ingersoll, 2003; Ingersoll & May, 2012). Schuster (2013) suggests this may, in part, be due to STEM professionals' capacity to earn more money in fields other than teaching.

2.3 Teacher Compensation

Given the literature indicating salary and compensation are real concerns for the recruitment and retention of teachers (Ingersoll, 2003; Ingersoll & May, 2012; Schuster, 2013), it is important that teacher compensation structures are well understood. Usually, public school teachers are compensated with a salary based only on years of experience and educational attainment (including certifications and degrees) (Booker & Glazerman, 2009). Teachers generally also receive a deferred compensation in the form of a retirement plan (Backes et al., 2016; Costrell & Podgursky, 2009; Costrell & Podgursky, 2010; Hansen, 2010). Despite the large percentage of education expenditures devoted to teacher compensation (Cornmen et al., 2015; Podgursky & Springer, 2011), there is little publicly available data on teacher compensation which is comparable across districts or states (Glander et al., 2018).

The problem is complex. National data is obtained primarily through periodic surveys, but more comprehensive data at the school or district level are often maintained in databases which either cannot be compared across states or which contain personally identifying information, making them unsuitable for public availability (Glander et al., 2018). The National Center for Education Statistics (NCES) instituted the Teacher Compensation Survey (TCS) in 2007 to explore development of a large-scale database of teacher demographic and compensation information nationally, but it was discontinued in 2011 due to budget (Glander et al., 2018). The SASS collected information on district-level teacher salary ranges and other compensation offered to teachers, and teacher-level (self-reported) base salary and additional compensation earnings (NCES, 2011a; NCES, 2011b). Limitations in how the data can be shared publicly create difficulty in observing some comparisons, however, like comparing salaries or compensation geographically or comparing salaries across certification fields. The National Teacher and Principal Survey succeeded the SASS. The teacher questionnaire collects similar compensation data as the SASS (still self-reported) (NCES, 2017), and the comparison difficulties remain similar as well.

As discussed, robust national data on teacher compensation is scarce. Despite this, teacher compensation has undergone many attempts at reform in recent years. This is not without reason: Podgursky and Springer (2011) found that the majority of districts in the United States spend at least 55% of their budget on teacher compensation alone, and Cornman et al. (2010) found more funds are diverted to teacher salaries than any other single expense. Despite this large expenditure, one of the most-cited reasons teachers give for leaving the field is salary concerns (Ingersoll, 2003). This disconnect, coupled

with the increasing teacher shortages in hard-to-fill specialties and areas (as previously noted), and the push for increased teacher effectiveness and student achievement, has spurred a raft of compensation reforms, though most have not been sustained for very long (Booker & Glazerman, 2009).

2.3.1 *Salary*

As noted by Brodsky et al. (2010), the traditional salary schedule (which recognizes years of experience and education only) does not differentiate among levels of effective teaching, and therefore is not sufficient motivation for individual teachers to improve their performance. A common compensation reform is some form of merit-based pay, where teachers are compensated for demonstrated teaching skills or student achievement, either individually or as a group. Several states, including (though not exclusively) Florida, Louisiana, Minnesota, Missouri, New Mexico, and Tennessee (Booker & Glazerman, 2009; Brodsky et al., 2010; Colson et al., 2018; Eren, 2019) have implemented some version of merit-based pay, though the approaches varied across states. Some of these programs are supported by grants from The Teacher Incentive Fund (TIF) program, established by Congress in 2006. The TIF attempts to increase teacher effectiveness by connecting teacher compensation with teacher performance (Chiang et al., 2017; Eren, 2019), specifically targeting high-need schools.

Florida attempted a performance-based pay system, called the Merit Award Program (MAP), beginning in 2007. Performance pay is awarded as a bonus, based upon a mix of student performance and principal evaluations of teachers (Florida Department of Education, 2007, as cited in Brodsky et al., 2010) Educators and teachers' unions

largely did not support the measure, and Brodsky et al. (2010) posits this lack of support "weakened the state's overall movement toward alternative teacher compensation" (p. 215).

Minnesota initially piloted a merit-based pay structure, the Quality Compensation for Teachers (Q Comp) in 2004, and in 2005 districts and schools across the state were able to participate (Minnesota Department of Education, n.d.). Though Florida's model focused on individual classroom student achievement and principal evaluations of teachers, the Minnesota program emphasized whole-school performance and peer-evaluation of teachers (Brodsky et al., 2010). Funding is provided to participant schools and districts as long as they follow a school- or district-designed plan which meets the four required components of the law: career ladder/advancement options, job-embedded professional development, teacher evaluation, and performance pay and alternative salary schedule. As of the 2017-2018 school year, 155 school districts and 77 charter schools are participating in the Q Comp program (Minnesota Department of Education, n.d.).

New Mexico approached merit pay slightly differently from both Florida and Minnesota. In 2003, the New Mexico legislature codified a three-tier licensure system for teachers. Advancing through the tiers requires a mix of experience, additional education and professional development, and demonstrated knowledge of the content and curriculum areas taught as well as skill in student assessment techniques (New Mexico Public Education Department, n.d.). This system is still utilized today.

Missouri's Career Ladder Program, established in 1985, is funded jointly by the state and participating districts. Unlike the other programs described previously, student achievement is not a factor considered for a teacher's performance or eligibility for the

program. Rather, teacher performance is evaluated by a district-level review committee based on observation, lesson plans, and the district's Performance-Based Teacher Evaluation. Teachers who are found eligible for the program may earn extra pay for supplemental work which contributes to students' academic outcomes. The availability of the supplemental work and the rate of pay are dependent upon the teacher's level within the career ladder (National Center on Performance Incentives, 2008).

Louisiana's program, TAP: The System for Teacher and Student Advancement (TAP), consists of four primary components: additional career paths with education (career, mentor and master teachers), ongoing applied professional growth, instruction-focused accountability, and performance-based compensation (Louisiana Department of Education, n.d.). The performance-based compensation portion is a hybrid program; it utilizes both individual and school-wide measures to determine eligibility for incentives. Similarly, though it incorporates student achievement measures (teacher outcomes) to determine teacher eligibility, it also relies upon teacher performance measures, so that no one measure determines teacher eligibility (Eren, 2019).

2.3.2 *Merit Based Pay Efficacy*

Evidence about the effectiveness of merit-based pay is mixed. Some researchers (Figlio & Kenny, 2007; Booker & Glazerman, 2009), found a positive association between merit-based pay and some categories of student achievement. Others, (Chiang et al., 2015; Chiang et al., 2017; Booker & Glazerman, 2009) found no such association. The U.S. Department of Education's Institute of Education Sciences conducted a four-year evaluation of the Teacher TIF program (Chiang et al., 2017). The TIF supported

performance-based compensation in high need schools via grants. Of the more than 130 districts which received grants in 2010, ten districts agreed to a random assignment study centered on the pay-for-performance portion of the TIF program. Chiang et al. (2017) found that "pay-for-performance led to slightly higher student achievement in reading and math" (p. ES-1) within two years.

Similarly, Missouri's Career Ladder Program combines teacher performance, tenure, and extra responsibilities for teachers to earn salary supplements. The Career Ladder Program is associated with a statistically significant increase in math achievement scores in three grade levels, though the effect size is very small. There is no significant effect on reading achievement scores at any grade level (Booker & Glazerman, 2009).

Colson et al. (2018) studied a single rural district's performance-based pay system between 2011-2015 under the Tennessee Value Added Assessment System (TVAAS). Of the district's teachers, 69% voluntarily participated in the performance-based-pay system. The researchers found that teachers who did participate in the program performed better by 1.83 points under the TVAAS evaluation system index (Colson et al., 2018).

Utilizing a survey on compensation policies as well as data from the National Education Longitudinal Study of 1988 and the 1993 U.S. Department of Education Schools and Staffing survey, Figlio and Kenny (2007) found that merit-based pay is associated with an increase in student achievement, as long as the merit pay is individual (as opposed to group- or school-based) and relatively small numbers of teachers are eligible to receive the merit pay.

Eren (2019) analyzed Louisiana's Teacher Advancement Program (TAP). While many merit-based pay systems focus on either individual teacher awards or group- or school-based awards, TAP utilizes a hybrid model and includes both forms of awards. Eren found a small but statistically significant impact from TAP on student achievement scores in math which increased over the three years observed. Though similar in size, gains in social studies were not statistically significant, while no changes were noted in science or English language arts scores (Eren, 2019).

Merit-based pay systems are not without issues, however. Past attempts have had mixed results (Chait & Miller, 2009; Harris, 2007, as cited in Brodsky et al., 2010). Such systems assume a variety of levels of teaching efficacy across teachers and assume that difference in student-level characteristics (such as socio-economic background or previous preparation levels) can be adequately addressed (Brodsky et al., 2010).

Elpus (2011) outlines several issues with broad reforms to teacher compensation methods, particularly for teachers of non-core academic subjects. Elpus highlights the focus in merit-based pay systems on student achievement as measured by standardized test scores, but points out that in subjects such as music, standardized and nationally-normed tests do not exist (2011). This focus effectively removes the ability to earn the maximum compensation from teachers of those subjects, unless exceptions are created or adequately addressed within policy. Elpus does not suggest abandoning merit pay altogether but does urge policymakers to consider the ramifications and ensure equity in access to merit pay for all teachers (2011).

The literature does provide some possibilities for future reforms that may positively impact the K-12 labor market. Morse & Mujtaba (2008) suggest school

districts should widen their view beyond recruitment and also focus on retaining existing teachers, given the findings that the teacher shortage is not entirely a supply problem but also an issue with turnover. Podgursky & Springer (2011) suggest looking to higher education for potential reforms, as faculty pay structures tend to be more flexible than K-12 salary schedules and, in higher education, collective bargaining agreements often allow for differential pay based upon the field. Colson et al. (2018) suggest that certain school districts, particularly small districts in rural areas, may benefit from differentiated compensation to "attract and retain more qualified teachers" (p. 2), particularly in high need certification areas (special education, mathematics, science).

Similarly, Goldhaber et al. (2016) suggests that an obvious solution may be to offer differentiated salaries based upon certification areas. The researchers do note, however, potential difficulties in altering collective bargaining agreements in order to achieve this end. Other potential solutions suggested by Goldhaber et al. (2016) include offering non-monetary compensation (such as extra prep time or extra days of leave). The researchers also noted a program recently started in Georgia whereby districts work within their existing single salary schedule and certified teachers in math and science are permitted to begin at a higher step than their teaching experience alone would typically indicate, though conclusions about the effectiveness of this solution were not delineated (Goldhaber et al., 2016).

Gunther (2019) found differences in the importance placed upon monetary compensation between less experienced and veteran teachers. Specifically, though both groups placed high value on salary, less experienced teachers also placed high value on other factors such as class size and administrative support. Gunther (2019) therefore

suggests that, while recruiting and retaining experienced teachers may indeed require salary increases or additional monetary compensation in some form, recruiting and retaining less experienced teachers may be achieved by improving working conditions.

2.3.3 *Pensions*

Though public sector jobs often have lower salaries than comparable work in the private sectors, conventional wisdom has the immediate compensation (salary) balanced by deferred compensation (pensions), resulting in a workforce with employment longevity. However, evidence is suggesting that pension plans are not lengthening public sector careers and may actually be shortening them due to the structure under which most of these pension plans operate (Costrell & Podgursky, 2009).

The majority of teacher pension plans in the United States are defined benefit plans. Unlike most other forms of retirement plans, payouts from defined benefit pension plans are calculated by a formula, rather than tied to an individual's monetary contribution (Backes et al., 2016; Costrell & Podgursky, 2009; Costrell & Podgursky, 2010; Hansen, 2010).

Under these plans, teachers and employers contribute a certain percentage each year of covered service (i.e., teaching under the plan) to a pension fund which pools all contributions across the plan. Once a teacher is vested in the system (typically between three and five years of service, though some states require ten), they are eligible to (upon retirement) withdraw a "defined benefit", or monetary amount in the form of an annuity. The amount of money withdrawn is calculated based on a formula which typically includes the employee's years of covered service, final salary (usually an average of the

salary from the final three to five years of employment) and some other factor. How the other factor is calculated varies from state to state but is most typically some percentage which is a function of years of service and age (Costrell & Podgursky, 2009; Costrell & Podgursky, 2010; Friedberg & Turner, 2010; Hansen, 2010).

Traditional teacher salary schedules typically provide pay increases relatively evenly, as a function of years of experience (often referred to as steps), with a teacher potentially experiencing a larger increase if they can move lanes on the schedule (usually by increasing teacher education level through an additional degree or credential) (Brodsky et al., 2010). It seems logical, therefore, that defined benefit teacher pension plans would provide similarly straightforward and level earnings, but they do not. The exact pattern of pension wealth accrual is dependent upon many factors such as the age of entry and the exact system which is being examined - state systems have very different rules governing when teachers can retire and what penalties (or bonuses) apply based upon the years of service and age of that event. However, Costrell & Podgursky (2009, 2010) found that all of the pension systems they examined created spikes of wealth accrual for teachers. In other words, teachers may have incentive to remain in the system long enough to accrue more wealth (usually to reach a certain age or years of service to minimize penalties) but then also have incentive to leave the system at a relatively early age to avoid the reduction of wealth accrual which happens (in most systems) when a teacher is eligible to draw their pension but instead continues to teach (Costrell & Podgursky, 2009, 2010).

Costrell & Podgursky (2009) are careful to note that retiring from teaching is not necessarily leaving teaching or employment, as many pension systems have provisions

allowing teachers to continue teaching within the system with some sort of offset for the pension penalty. Teachers who retire are generally also free to draw their pension and simultaneously seek employment in another career field entirely. The extent of the impact of these situations is unknown, as there does not seem to be nation-wide data maintained on this subject (Costrell & Podgursky, 2009).

In the literature concerning teacher pensions, career teachers are understood to be teachers who remain employed under a single pension system throughout their employment in education. They may move between positions, schools or districts, but remain under the purview of the same pension system for the duration of their career (typically defined as retirement). Mobile teachers, on the other hand, are teachers who move from one pension system to another at some point in their career (most typically, teaching in two different states) (Costrell & Podgursky, 2010).

Career teachers are disproportionately benefited by traditional (defined benefit) pension plans compared to mobile teachers. A teacher who works 30 years in two separate pension systems will earn far less retirement income; it may be as much as half the net worth of their pension when compared to a teacher who taught the same 30 years in a single pension system (Costrell & Podgursky, 2010; Goldhaber et al., 2015). The impact of this cannot be understated: it is estimated about one-sixth of teachers may move between pension systems at least once in a typical 30-year career (Costrell & Podgursky, 2010). Despite this, there has not yet been significant analysis of the teacher behavioral impacts of the shape of earnings under traditional defined benefit plans (Friedberg & Turner, 2010).

As previously noted, most teacher pension systems require between three and five years of covered service for a teacher to become vested in the plan, though some require as many as ten years. This contributes to a substantial loss of deferred compensation (in the form of pension annuities) for many early career teachers, given rate of turnover occurring in the first five years of teaching (Costrell & Podgursky, 2010). This also serves to disincentivize moving from one pension system to another (Hansen, 2015), even though Koedel et al. (2013) encourage policy makers to consider alternate compensation programs that may positively benefit the composition of the teacher workforce by increasing equity for short-term or mobile teachers. Such considerations may have a positive impact on shortage areas (particularly STEM) by encouraging career-changers (who may not teach long enough to receive the long-term benefits of a defined benefit pension plan). Increasing the incentive for teacher mobility (i.e., for teachers to follow the geographic changes in student population) may also mitigate the existing teacher shortages.

Goldhaber et al. (2015) examined rates of teacher mobility in Oregon and Washington state and found that the teachers moved employment within a state far more frequently than they moved across state lines. Though the authors found evidence of barriers for teachers moving across states in the differential rates of inter- and intra-state mobility, it is unclear what precisely those barriers are. Goldhaber et al. (2015) do note, however, that these barriers to mobility may include the high costs associated with an interstate move such as licensing costs. Whatever the cause, these mobility barriers may deter prospective teachers from entering the profession. Additionally, there is not yet data on how many teachers leave the profession following an interstate move because of

licensing transfer issues (Goldhaber et al., 2015), a lack of retirement plan portability (Friedberg & Turner, 2010), or other barriers; further research would perhaps clarify what role these structures have in the teacher labor market.

The literature on pensions discussed so far has focused on the retention of teachers; there does not appear to be literature directly exploring the impact of teacher pension plans on the recruitment of new teachers. However, Costrell & Podgursky (2009) suggest that the seemingly uncertain and distant deferred compensation (in the form of the pension payout following retirement), coupled with the significant negative impacts for teachers who leave the profession (or even just a specific pension system) early, may serve as a deterrent for young teachers. Instead, younger teachers may prefer a more evenly accrued benefit with more compensation up front (e.g., higher wages). Similarly, Backes et al. (2016) suggest that, if the financial resources used to adequately fund defined benefit plans were reallocated into teacher wages, there may be positive impacts on teacher recruiting and retention.

2.3.4 *Other Financial Incentives*

Teacher shortages, as noted previously, are endemic in specific certification areas and high-needs schools. One method policymakers have utilized to address this growing problem is financial incentives beyond merit-based pay and pensions. Goldhaber et al. (2016) posit a potential explanation for the discrepancies in teacher availability among various certification fields: single salary schedules. Even though STEM teachers likely have improved job prospects outside of education, and SPED teachers may experience more difficult conditions for work, these teachers are compensated under the same

schedule as the more proliferous elementary education teachers. As Colson et al. (2018) note, traditional single salary scales prevent differential payment for teacher certification in high-need areas because all teachers earn identical pay for credentials and years of experience, regardless of certification area. The researchers utilized the following example: “a second-grade teacher earns the same pay as a high school chemistry teacher with the same level of education and experience, even though the high [school] chemistry teacher is teaching in a high need area” (p. 2).

At least 30 states and more than 30% of the United States 50 largest school districts offer some sort of additional pay or financial incentive beyond the single salary schedule to teachers in hard-to-fill positions (Berry & Eckert, 2012). Denver instituted a bonus incentive to entice teachers to move to difficult-to-fill schools and positions, but there is no evidence the bonus incentive had achieved the desired result of decreasing turnover in these schools and positions (Berry & Eckert, 2012)

Though a teacher’s total financial compensation may also include paid health, dental or life insurance, subsidized housing or transportation in addition to base salary and retirement plans, there appears to be a gap in the literature, as no literature discussing these financial compensation measures could be found beyond that already explored in this and previous sections.

CHAPTER 3. Methodology

The purpose of this study is to contribute to the understanding of how teacher level factors influence student experiences, specifically teacher compensation measures and student graduation course requirements. Using the existing survey data set Schools and Staffing Survey, 2011-2012 (SASS), this study utilizes a correlational quantitative research design to discover what is the relationship between the lowest and highest teacher salaries and student graduation credit requirements (including English language arts, social sciences, math, sciences), as well as examine the differential impact district location (urban, rural, town, suburban) and total enrollment has on any existing relationship.

This chapter provides an overview of the research methods utilized for this study. This includes a discussion of the research design and the data sources. Information on the data set being utilized will be covered, including the sampling methods, instrumentation, and data acquisition. A discussion of the proposed data analysis will conclude the chapter.

3.1 Research Design

This study utilizes descriptive statistics, correlation matrices, and regression analysis to address the questions: 1) Is there a relationship between the number of core content (math, science, social sciences, and English) credits required for high school graduation and the lowest paid full time teacher salary?; 2) Is there a relationship between the number of core content (math, science, social sciences, and English) credits required for high school graduation and the highest paid full time teacher salary?; and 3) Is there a

difference in the relationship between teacher salaries and the number of core content credits required for high school graduation for districts in different settings (urban, suburban, rural, town)?. An existing large-scale, national, publicly available dataset (Schools and Staffing Survey 2011-2012 [SASS]) will be utilized. The SASS utilized multi-level stratified sampling to define the school district and teacher samples.

3.2 Data Source

The National Center for Education Statistics (NCES) has conducted the Schools and Staffing Survey (SASS) seven times between 1987 and 2011. The SASS surveyed public and private school districts, schools, principals, and teachers to provide "descriptive data on the context of elementary and secondary education." (NCES, 2020, "Overview"). Originally comprised of four components (the School Questionnaire, the Teacher Questionnaire, the Principal Questionnaire, and the School District Questionnaire), the SASS was redesigned with a focus on K-12 staff and the labor market and renamed the National Teacher and Principal Survey (NTPS) following the 2011-12 school year administration (NCES, 2020). This study will utilize the 2011-2012 SASS dataset.

3.2.1 *Research Sample*

The 2011-2012 SASS used stratified sampling to ensure a robust representation of differing school demographics, including over-sampling those which are not always well-represented in data samples. This stratification also ensured a representative sample for differing school types (i.e., public vs. private) and age ranges (primary, middle, high,

combined). Once schools were included in the sample, stratified sampling of the teachers employed there also occurred to create the complete sample (NCES, 2020).

3.2.2 *Instrumentation and Data Collection*

The 2011-2012 SASS consisted of five questionnaires for targeted groups, with slight variations (based upon public or private schools): school districts, principals, schools, teachers, and school library media centers. After verifying school addresses, survey information and questionnaires were mailed. Schools returned a Teacher List Form, which was then used to create the teacher sampling frame. Once teachers were sampled, teacher questionnaires were mailed. Telephone and in-person field follow up visits were utilized to promote survey completion (NCES, 2020)

Though the SASS surveyed several role groups, for the purposes of this study, the data being examined was addressed via the District Questionnaire. This survey included items covering basic demographic information of the district such as what grades were offered, how many students were served, racial and ethnic student populations, rate of student participation in the National School Lunch Program, and staff and faculty composition. The District Questionnaire also contained items on the number of required years of study in English or language arts, math, social sciences, computer sciences, science, and foreign languages. Items also covered teacher and principal compensation in the form of salaries (broken down by education credentials) and what alternate compensation items were offered, if any. Examples of additional compensation included health insurance, life insurance, retirement plans, tuition reimbursement, housing or meal

subsidies, transportation subsidies, or free training for teaching certifications in current or anticipated shortage areas.

3.2.3 *Variables*

The variables used for this study are described in *Table 3.1*. The dependent variables, highest and lowest teacher paid teacher salary, include only the normal base salary of the highest and lowest paid full time teacher within the district. This does not include administrators or other non-teaching staff or any one-time bonus or additional pay. For the independent variables for years of required credits, all data was reported as the number of instructional years to the nearest tenth required in the named subject for a student to earn a standard high school diploma.

The total student enrollment of the district, grades K-12, is used as a control variable to account for district size. The number of students qualifying for the National School Lunch Program (NSLP, also known as free and reduced lunch) was initially used as a control variable, but due to issues of multicollinearity the percent of students qualifying for NSLP was used instead. This control variable is an approximation of the socio-economics of the district's population. The number of teacher contract days is used as a control variable. This variable includes any contracted days, including instructional days and professional development or teacher workdays.

3.3 Data Analysis

Prior to comparing teacher salaries to student credit graduation requirements, data analysis included descriptive statistics, measures of central tendency, and correlation

matrices to explore relationships within each individual measure. Due to the format of the publicly available SASS dataset, all analysis occurred within the NCES DataLab PowerStats program.

Though this data set is robust, NCES anonymizes the data available for use. As part of this anonymization, the number of cases is coarsened and some measures are not reported to preserve the anonymity. PowerStats does allow for linear regression analysis but does not permit the creation of interaction variables. Additionally, some measures are not reported. For example, though R^2 is reported, adjusted R^2 is not.

Once internal relationships and correlations were determined for each of the variables used, regression analysis was utilized to examine relationships between salaries and student graduation credit requirements. Initially the models were developed using just the credit hour independent variables. Following analysis of those models, fixed-effect variables were added as controls to the model. Finally, when a statistically significant relationship between one or more of the teacher salary variables and student credit variables was identified, that relationship was analyzed for a differential impact by adding the district location (city, suburb, town, rural) variable.

3.4 Limitations

This study utilizes a national, publicly available dataset. The sampling methodology created a very robust sample, which avoids a common limitation of small sample sizes. However, due to privacy concerns, the publicly available SASS data is anonymized data which must be analyzed within the DataLab PowerStats program, which provides its own limitations.

For example, student graduation credit requirement minimums are typically decided at the state level, so it is important to consider the differential impacts across states. Teacher salaries and high school graduation requirements both can look quite different within different state contexts. The district SASS data set does contain a variable which analyzes the data based on state. However, there are not sufficient datapoints within the individual states of this variable to run the regression within PowerStats when including that as a control variable. Therefore, though geographic location is an important confounding variable to consider in the context of both teacher salaries and graduation requirements, it cannot be included in this study.

Another limitation is the possibility of numerous additional confounding variables affecting both teacher salary and graduation credit requirements. As previously discussed, geography and local policies may be a major component in determining both teacher salary and graduation credit requirements. Even when using geographic location (urban, suburban, rural, town) to examine differential impacts, it is not possible to totally account for local policies, particularly since local policies are inextricably twined with state policies. The PowerLab program is not able to create interaction variables, however, so even if the state variable could be used within this regression, the interaction between locality and state cannot be measured here. Similarly, the economic realities such as cost-of-living in an area likely contribute to differences in the teacher salary measures. Though the percentage of district students eligible for free- or reduced-lunch is used to approximate the economics of the district as a control, this is not a perfect substitute.

As discussed in Chapter 2, most teacher salaries are determined through a straight-forward step and lane system, where the teacher's educational attainment

determines the salary lane and the years of service determine the specific salary step (Brodsky et al., 2010). Therefore, in most salary systems, the highest paid teacher salary is to a long-career teacher. As the district data set does not contain information on the longevity of teachers within the district tied to salary, it is impossible to control for the impact that may have on the highest paid teacher salary variable. If, for example, a district has a teacher who has been teaching in the district much longer than any other teachers, that teacher's salary is likely to be the highest paid teacher salary and reported in the SASS, due to how the lane and step salary schedules are structured. However, that teacher's salary may be an outlier and skewing the picture of how teachers are typically compensated within that district. Additionally, there may be statistically significant differences in teacher longevity across districts which could impact this data set. If a particular district retains teachers more effectively than a neighboring district, then the district with the retained teachers is more likely to have a higher average teacher salary (and potentially higher highest teacher salary) because teacher pay is, in large part, determined by the number of years of experience. However, there is not a variable at the district level in this data set that can be used to control for that difference, so potential impacts on this study are unknown.

On the other hand, as discussed earlier, some districts do provide incentives, including higher salaries or bonuses, to attract and retain teachers in hard-to-fill areas and certifications. Though this data set does include information on which districts offer incentive such as those, that information is not tied to the salary information, so it is impossible to discern what impact those incentives may have.

Additionally, this study utilizes data from the 2011-2012 school year. Though the literature suggests teacher salary and shortages have been an ongoing issue for far longer than that, it is worth noting that in the last several years there has been considerable public discourse surrounding teacher compensation. Following teacher protests in multiple states over teacher salaries and pensions, as well as the Covid-19 pandemic, some states and districts have taken steps to address teacher compensation concerns. Similarly, the face of public education changed dramatically following the Covid-19 pandemic with the rise of virtual instruction and other distance learning opportunities, as well as changes to how some schools and districts define or measure some traditional metrics of education, such as attendance. It is reasonable to believe that these changes may also be reflected in changed credit requirements for high school diplomas, though the specific impacts are currently unknown. Therefore, as with most studies utilizing larger datasets, the passage of time has likely altered the relationship between teacher compensation and student graduation credit requirements - potentially in a very significant manner.

Finally, this study is examining only relationships between teacher salaries and student graduation credit requirements and any differential impact geographic location might have on those relationships. The scope is limited to the correlational relationship, and this study is not attempting to outline a causal relationship. To that end, the study utilizes only quantitative data and does not address additional factors such as teacher attitudes or perceptions of teacher compensation, which may impact teacher shortages and therefore may impact student graduation credit requirements.

3.5 Summary

This study was conducted using an existing and public data set from NCES: *School and Staffing Survey, 2011-2012*, in order to examine the relationship between the required credits for high school graduation and teacher salaries. The study examined two main research questions:

1. Is there a relationship between the number of core content (math, science, social sciences, and English) credits required for high school graduation and the lowest paid full time teacher salary?
2. Is there a relationship between the number of core content (math, science, social sciences, and English) credits required for high school graduation and the highest paid full time teacher salary?

The study then examined the differential impact of district location (city, suburb, town, or rural) for each of the main research questions:

1. What impact does the district locale (city, suburb, town, rural) have on the relationship between the number of core content credits required for high school graduation and the lowest paid full time teacher salary?
2. What impact does the district locale (city, suburb, town, rural) have on the relationship between the number of core content credits required for high school graduation and the highest paid full time teacher salary?

Multiple linear regression was used to analyze the research questions.

Table 3.1 Variables

Variable Name	Variable Description
LOWSALARY	Lowest fulltime teacher salary
HIGHSALARY	Highest fulltime teacher salary
ENGLISH	Number of English credit years required for high school graduation
MATH	Number of math credit years required for high school graduation
SOCSCI	Number of social science credit years required for high school graduation
SCIENCE	Number of science credit years required for high school graduation
FRL	Number of K-12 students qualified for free and reduced lunch
TOTALSTUDENT	Total student enrollment grades K-12
CONTRACT	Number of days in teacher contracts
NSLP	Percentage of students in district approved for the National School Lunch Program
URBAND12	District locale: urban, suburban, rural, town

CHAPTER 4. Data Analysis and Results

This chapter provides an explanation of the data analysis and results of this study. The study uses a single data source, the publicly available 2011-2012 SASS. Though this data set contains information from teachers, principals, schools and districts, this study utilizes only the data from the School District Questionnaire portion of the SASS. Data within the district-level data set includes: teacher salaries (both salary step schedules and minimum/maximum salaries for certified teachers); district demographic data such as rates of free and reduced school lunch, geographic setting within a state (rural, urban, suburban or town) and student enrollment rates; and credits required for high school graduation in math, science, English and social sciences.

4.1 Description of the Data Sample

The SASS used stratified sampling to identify the schools included in the study. Only schools within the 50 U.S. states and the District of Columbia were included. Once the sample of schools was determined, the public and public charter schools in the set were associated with the school district or supervisory union which oversees the day-to-day operations. This set of districts was then utilized as the sample for the district portions of the data collection. Public charter schools which operate independently of another school district were included in both the school and district samples. A total of 5,714 public schools and public charter schools were included in the sample. The 2011-2012 SASS had a district unweighted response rate of 82.6%. In order to adhere to NCES standards, the PowerStats program modifies the true sample size to minimize risk of

disclosure by coarsening the number of cases. For this analysis, the coarsened number of cases is 4,100.

4.2 Regression Model Development

This study explored whether minimum credit requirements for high school graduation predicted teacher salaries. Multiple linear regression was used in order to show the relationship between multiple independent variables and a dependent variable. The SPSS data set is only available via the NCES website and requires using NCES PowerStats program for all analyses. Two separate regression models were developed to answer the research question in order to examine the impact of required credits on both the lowest teacher salaries and the highest teacher salaries. The dependent variable for Model 1 was the lowest paid fulltime teacher salary (LOWSALARY), while in Model 2 it was the highest paid fulltime teacher salary (HIGHSALARY). *Table 4.1* provides descriptive statistics for all the variables used. It is important to reiterate that the LOWSALARY and HIGHSALARY variables include only full time teachers. The minimum value for LOWSALARY is $10,000, which does seem quite low as an annual salary for a full time teacher. However, this represents an outlier within the LOWSALARY data; it is almost four full standard deviations below the mean. Additionally, only 1% of the salaries included in the variable are less than $25,000, which is a much more reasonable beginning teacher salary in 2011.

Independent variables initially included in the models are the number of English (ENGLISH), science (SCIENCE), math (MATH), and social science (SOCSCI) required for graduation. Other independent variables used in the regression analysis to control for

confounding variables included the percent of K-12 students qualified for free and reduced lunch (NSLP), the total student enrollment grades K-12 (TOTALSTUDENT), the number of days in teacher contracts (CONTRACT), and the geographic location (urban, suburban, rural or town; URBAND12). Initially, the variable of FRL or the number of students qualified for free and reduced lunch was used. However, the models developed using this variable had significant multicollinearity issues, so the NSLP variable was substituted instead.

Table 4.1 provides descriptive statistics for all variables. Table 4.2 provides the frequencies for the components of the URBAND12 variable, while Tables 4.3-4.13 provide the regression results for the various iterations of the models.

4.2.1 *Model 1: LOWSALARY*

The regression analysis for this model included the dependent variable lowest paid fulltime teach salary (LOWSALARY) and all independent variables. Each independent variable was added to the model individually, beginning with the credit hour variables. In this model, all four independent variables (ENGLISH, MATH, SOCSCI and SCIENCE) are significant at the $p<0.05$ level. MATH and SCIENCE are significant at the $p<0.01$ level while SOCSCI is significant at the $p<0.001$ level. Somewhat surprisingly, a one-year increase in English, math and science required credits are all associated with a decrease in the lowest teacher salary (-$729.738, -$525.048 and -$801.063, respectively). A one-year increase in required social science courses, however, is associated with an increase of $1679.831 in the lowest full time teacher salary. It is important to note that this model only accounts for about 2% of the variance in the lowest

teacher salary. Additionally, the largest change in salary in this model ($1679.831, associated with the social science variable) is only about 4% of the mean of the LOWSALARY variable. In other words, though it is surprising to see a decrease in salaries associated with increases in required credit hours, the actual effect is very small.

4.2.2 *Model 2: LOWSALARY and Controls*

Next, additional control variables were added to the model. These variables include ENROLLMENT (total student enrollment), to control for the size of the district; CONTRACT (teacher contract days), to control for differences in teacher salary due to differences in contract lengths (such as year-round schooling); and NSLP (percentage of students qualifying for the National School Lunch Program), used as an approximate control for the economics of the district. In this model, ENGLISH and MATH credit years are no longer statistically significant. CONTRACT is significant at the $p<0.05$ level: a one-day increase in teacher contract days is associated with a $111.188 increase in the lowest teacher salary. A one-student increase in total student enrollment is associated with a $0.049 increase in the lowest teacher salary, significant at the $p<0.001$ level. A one-year increase in social science required credits is again associated with an increase in the lowest teacher salary, this time of $1593.196, significant at the $p<0.001$ level. A one-year increase in science credit hours is associated with a $814.699 decrease in the lowest teacher salary, also at the $p<0.001$ level. Finally, a one-percent increase in the number of students qualified for the NSLP is associated with a $42.082 decrease in the lowest teacher salary ($p<0.001$). As before, it is important to note that this model only explains about 8.7% of the variance in the lowest full time teacher salary, and again the

largest change in salary associated with a statistically significant variable is only about 4.4% of the mean salary. In other words, though there are statistically significant differences in the lowest teacher salary associated with graduation credit requirements, the effect is very small.

4.2.3 *Model 3: Differential Impacts*

This model uses the previous model and adds the variable URBAND12 to examine differential effects based on the geographic context of the district. In this model, ENGLISH and CONTRACT are not statistically significant. MATH is statistically significant at the $p<0.05$ level; a one-year increase in math credit hours is associated with a $467.349 decrease in the lowest teacher salary. SOCSCI is still significant at the $p<0.001$ level; a one-year increase in social science credit hours is associated with a $1488.373 increase in lowest teacher salary. A one-year increase in science credit hours is again associated with a decrease in the lowest teacher salary, this time of $486.280 ($p<0.05$). A one-percent increase in the student participating in NSLP is associated with a $27.049 decrease in the lowest teacher salary ($p<0.001$), while a one-student increase in total enrollment is associated with a $0.010 increase in salary ($p<0.05$).

Perhaps most interestingly, when all previous variables are held constant, districts in towns and rural locations are associated with decreases in lowest teacher salaries compared to districts in urban locations (town = -$2988.641; rural = $4284.437; $p<0.001$). On the other hand, districts in suburban locales are associated with a $2402.380 increase in lowest teacher salary compared to urban districts, when all other variables are held constant ($p<0.001$). Again, this model explains only about 25.6% of the

variance in the lowest teacher salary. Though some of the associated changes in salary are larger in this model (-$4284.437 in rural districts compared to urban), this is still only about 11.9% of the mean lowest salary in the data set. So, though there are statistically significant differences in the lowest teacher salary based upon the graduation required credits when controlling for student enrollment, participation in NSLP, teacher contract days and district locale, the overall effect is still quite small.

4.2.4 *Model 4: HIGHSALARY*

This model uses the dependent variable of the highest fulltime teacher salary (HIGHSALARY). The development of Model 4 mirrors the development of Model 1, in that the same independent variables were introduced to the model individually in the same order. In this model, ENGLISH is not statistically significant, but MATH, SOCSCI and SCIENCE are statistically significant at the $p<0.001$ level. A one-year increase in social science required credits is associated with a $4437.345 increase in the highest teacher salary, while a one-year increase in math credit hours is associated with a $1724.580 decrease in teacher salary (both $p<0.001$). A one-year increase in science credit hours is also associated with a decrease in the highest teacher salary of $4312.451 ($p<0.001$). As with the LOWSALARY models, though the results are somewhat surprising, the effect size is quite small. This model accounts for only 3.4% of the variance in the highest teacher salary. The largest statistically significant change (associated with social science credits, $4437.345) is only about 7% of the mean highest teacher salary.

4.2.5 *Model 5: HIGHSALARY and Controls*

Again following the development of Model 2, additional control variables were added to the model. These variables include ENROLLMENT (total student enrollment), to control for the size of the district; CONTRACT (teacher contract days), to control for differences in teacher salary due to differences in contract lengths (such as year-round schooling); and NSLP (percentage of students qualifying for the National School Lunch Program), used as an approximate control for the economics of the district.

In this model, ENGLISH and MATH are not statistically significant. A one-year increase in the number of social science credits is again associated with an increase in the highest teacher salary, this time of \$3972.841 ($p<0.001$). A one-year increase in science credits, however, is associated with a \$4572.987 decrease in highest teacher salary ($p<0.001$). All three control variables are statistically significant: CONTRACT at the $p<0.05$ level and ENROLLMENT and NSLP at the $p<0.001$ level. A one-student increase in total enrollment is associated with a \$0.188 increase in the highest teacher salary. A one-day increase in teacher contract days is associated with a \$239.283 increase in the highest teacher salary, while a one-percent increase in students qualifying for the NSLP is associated with a \$207.947 decrease in the highest teacher salary. This model accounts for about 15.7% of the variance in highest teacher salary. While this is a larger portion of the variance in highest teacher salary than what the lowest teacher salary model explains, it is still quite small. Again, the largest statistically significant change (associated with social science credits, \$4572.987) is only about 7% of the mean highest teacher salary.

4.2.6 *Model 6: Differential Impacts*

This model uses the previous model and adds the variable URBAND12 to examine differential effects based on the geographic context of the district. In this model, ENGLISH, MATH and CONTRACT are not statistically significant. A one-year increase in social science credits is associated with a $3594.694 increase in highest teacher salary, significant at the $p<0.001$ level. A one-year increase in science credits is associated with a $3453.338 decrease in highest teacher salary, significant at the $p<0.001$ level. A one-student increase in total student enrollment is associated with a $0.090 increase in highest teacher salary, while a one-percent increase in students qualified for NSLP is associated with a $150.023 decrease in highest teacher salary, both significant at the $p<0.001$ level.

The largest difference found in any of the models is found here when looking at the URBAND12 variable. When all other variables are held constant, the highest teacher salary in suburban districts is associated with a $12500.470 increase compared to urban districts. In addition to being statistically significant at the $p<0.001$ level, this difference is equivalent to almost 20% of the mean highest teacher salary. Similarly, the highest teacher salary in town districts is $2796.027 less than in city districts, while rural districts are even lower at a difference of $8064.776 below city districts (all other variables held constant). In other words, district locale plays a fairly significant role in determining the highest teacher salaries, all other variables being equal. While this model has the most explanatory power of any of the models – explaining about 35.6% of the variation in highest teacher salaries – that is still only a relatively small effect.

4.3 Summary

When considering the entire data set, the number of English and math credit years are a poor predictor of teacher salaries, both lowest and highest. Social science credit years are associated with increases in both lowest and highest teacher salaries, while science credit years are associated with decreases in lowest and highest teacher salaries. As discuss previously, this is a surprising finding, given the focus on increasing the number of students taking higher-level math and science courses and the subsequent recruiting of math and science teachers, often using pay stipends as an incentive. However, though this association is the opposite of the expected impact, it is very important to note that the effect size is quite small. Yes, science credit hours were associated with decreases in lowest and highest teacher salaries, but the actual money amounts associated with these changes are very small relative to the mean salaries. Additionally, the explanatory power of these models is rather small, meaning there are many other factors contributing to the variance in teacher salaries that are not included in these models.

Finally, these models examined differential impacts based on the districts geographic locale. For both lowest and highest teacher salaries there were statistically significant differences based upon the geographic locale: the suburban district teacher salaries were both (highest and lowest) higher compared to urban district salaries, while districts in town and rural areas had lower salaries compared to urban district salaries. The range in the difference is larger in the highest teacher salary model, but the range of highest teacher salaries is also larger than the range of lowest teacher salaries, so this is not unexpected.

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Table 4.1Descriptive Statistics

Variable Name	Minimum	Maximum	Mean	SD
LOWSALARY	10,000	74,312	35,800.15	6,543.49
HIGHSALARY	26,671	147,790	62,691.34	17,630.71
ENGLISH	1	6	3.99	0.21
MATH	1	6	3.3	0.6
SOCSCI	0.5	6	3.29	0.58
SCIENCE	1	6	3.04	0.63
FRL	2	691,483	1,501.82	7,461.23
CONTRACT	140	365	188.21	21.52
TOTALSTUDENT	2	1,032,013	2,832.16	11,459.06
NSLP	0.14	100	51.94	25.1

Table 4.2 Frequencies for URBAND12

	Percentage
Urban (city)	14.95
Suburban	19.48
Town	16.7
Rural	48.86

Table 4.3 Multiple Regression Results for Model 1: LOWSALARY

	Estimate	SE	95% Confidence Interval		p-value
			LL	UL	
ENGLISH	-729.738	355.673	-1436.816	-22.659	0.043
MATH	-525.048	175.849	-874.636	-175.459	0.004
SOCSCI	1679.831	221.087	1240.311	2119.352	0.000
SCIENCE	-801.063	226.941	-1252.222	-349.903	0.001
INTERCEPT	36918.821	1177.094	34578.758	39258.884	0.00

NOTE: $R^2 = 0.021$; SE = standard error; LL = lower limit; UL = upper limit

Table 4.4 Multiple Regression Results for Model 2: LOWSALARY with controls

	Estimate	SE	95% Confidence Interval		p-value
			LL	UL	
ENGLISH	-592.921	348.289	-1285.320	99.478	0.092
MATH	-360.290	231.167	-819.850	99.269	0.123
SOCSCI	1593.196	220.778	1154.290	2032.102	0.000
SCIENCE	-814.699	209.154	-1230.496	-398.902	0.000
ENROLLMENT	0.049	0.006	0.037	0.060	0.000
CONTRACT	111.188	52.745	6.332	216.045	0.038
NSLP	-42.082	7.177	-56.350	-27.815	0.000
INTERCEPT	17406.928	10073.567	-2619.323	37433.180	0.087

NOTE: $R^2 = 0.087$; SE = standard error; LL = lower limit; UL = upper limit

Table 4.5 Multiple Regression Results for Model 3: LOWSALARY with URBAND12

	Estimate	SE	95% Confidence Interval		p-value
			LL	UL	
ENGLISH	-325.356	436.368	-1192.856	542.143	0.458
MATH	-467.349	223.445	-911.557	-23.141	0.039
SOCSCI	1488.373	201.810	1087.175	1889.571	0.000
SCIENCE	-486.280	201.532	-886.926	-85.634	0.018
ENROLLMENT	0.010	0.005	0.001	0.020	0.028
CONTRACT	72.624	47.498	-21.801	167.050	0.130
NSLP	-27.049	6.200	-39.374	-14.724	0.000
URBAND12					
SUBURB	2402.380	378.976	1648.975	3155.786	0.000
TOWN	-2988.641	460.105	-3903.329	-2073.952	0.000
RURAL	-4284.437	358.11	-4996.362	-3572.512	0.000
INTERCEPT	24968.083	9199.809	6678.863	43257.303	0.008

NOTE: $R^2 = 0.256$; SE = standard error; LL = lower limit; UL = upper limit;

URBAND12 uses URBAN as reference

Table 4.6 Multiple Regression Results Model 4: HIGHSALARY

	Estimate	SE	95% Confidence Interval		p-value
			LL	UL	
ENGLISH	236.199	883.403	-1520.006	1992.404	0.790
MATH	-1724.580	465.574	-2650.141	-799.019	0.000
SOCSCI	4437.345	611.080	3222.517	5652.172	0.000
SCIENCE	-4312.451	584.881	-5475.193	-3149.708	0.000
INTERCEPT	66698.454	2660.262	61409.853	61409.853	0.000

NOTE: $R^2 = 0.034$; SE = standard error; LL = lower limit; UL = upper limit

Table 4.7 Multiple Regression Results Model 5: HIGHSALARY with controls

	Estimate	SE	95% Confidence Interval		p-value
			LL	UL	
ENGLISH	-445.750	800.813	-2037.766	1146.265	0.579
MATH	-191.226	490.272	-1165.587	783.434	0.697
SOCSCI	3972.841	633.727	2712.992	5232.691	0.000
SCIENCE	-4572.987	519.734	-5606.218	-3539.756	0.000
ENROLLMENT	0.188	0.014	0.161	0.216	0.000
CONTRACT	239.283	90.905	58.564	420.001	0.010
NSLP	-207.947	12.247	-232.294	-183.600	0.000
INTERCEPT	32375.671	17941.667	-392.362	68043.705	0.075

NOTE: $R^2 = 0.157$; SE = standard error; LL = lower limit; UL = upper limit

Table 4.8 Multiple Regression Results Model 6: HIGHSALARY with URBAND12

	Estimate	SE	Confidence Interval		p-value
			LL	UL	
ENGLISH	54.243	969.451	-1873.025	1981.512	0.956
MATH	-579.694	488.899	-1551.624	392.237	0.239
SOCSCI	3594.116	558.238	2484.339	4703.894	0.000
SCIENCE	-3453.338	505.602	-4458.475	-2448.201	0.000
ENROLLMENT	0.090	0.008	0.074	0.105	0.000
CONTRACT	147.143	84.277	-20.399	314.685	0.084
NSLP	-150.023	11.128	-172.145	-127.902	0.000
URBAND12					
SUBURB	12500.470	728.334	11052.542	1348.399	0.000
TOWN	-2796.027	752.010	-4291.023	-1301.031	0.000
RURAL	-8064.776	756.647	-9568.990	-6560.562	0.000
INTERCEPT	46554.298	17479.706	11804.643	81303.953	0.009

NOTE: $R^2 = 0.356$; SE = standard error; LL = lower limit; UL = upper limit;

URBAND12 uses URBAN as reference

CHAPTER 5. Conclusions

5.1 Introduction

As discussed in Chapter 2, the literature suggests that high school graduation requirements have changed significantly through the last several major iterations of educational reform, beginning with the publication of *A Nation at Risk.* Simultaneously, there is an ongoing shortage of qualified teachers, though the extent of that shortage varies with geographic location and certification area. Though there is literature examining the relationship between teacher recruitment and retention and teacher compensation, and literature examining the impact of minimum graduation requirements on student success, there is a gap in the literature examining the relationship between these two groups – teacher salaries and minimum graduation requirements. The purpose of this study was to examine that relationship and then examine differential impacts based on geographic location of the district.

5.2 Discussion of the Results

The results of this study were rather surprising. As noted in the literature, there has been a significant push in the last several decades for students to take additional, advanced math and science courses. Within the same time frame, there has been an increased demand for – and resulting shortage of – qualified teachers, particularly in math and science courses. Given the increased demand and shortage of supply, and the widespread popular debate concerning teacher salary, it was reasonable to hypothesize that increased math and science credit requirements would lead to increased teacher

salaries. Therefore, it seems counter-intuitive that math credit years were not statistically significant in the models, and in all instances math and science years variables were associated with a decrease in teacher salary.

Social science credit years were also associated with increases in the lowest and highest teacher salaries. In fact, social science was associated with some of the largest differences in all of the models. In other words, social science credit years do help explain variability in both lowest and highest teacher salaries.

The association between the percent of students qualified for free and reduced lunch with the teacher salaries within the regression models was also surprising. Though it was a statistically significant relationship in almost every model analyzed, and always associated with a decrease in salary, the impact was never very large. For example, in Model 2 (lowest teacher salary with controls), the salary increase associated with a one-day increase in teacher contract days is almost three times the amount of salary decrease associated with a one-percent increase in student qualifying for NSLP. In that same model, a district would need to increase the percent of students qualifying for NSLP by almost 38 percent to offset the increase in salary associated with one-year increase in social science credit years.

Of course, all of the regression models in this study explain a fairly small portion of the variability in teacher salaries. Of all the models, the model for the highest teacher salary with controls and URBAND12 has the largest explanatory power, and it is still only explaining about 35.6% of the variability in the highest teacher salary there. Though it is clear that a relationship between minimum credit hours and teacher salaries exists, the nature of that relationship depends greatly upon which specific credit hours are being

examined and the geographic location of the school district. In all instances, the models explained more of the variability in the highest teacher salaries than the lowest teacher salaries using the same variables and controls.

5.3 Future Research

This study suggests several further areas for research. While the results of this study show there are relationships between credit requirements and teacher salaries, those relationships vary greatly depending upon the subject area of the credit requirements and the geographic location of the district. Many districts and states have graduation requirements beyond English, math, social science and science, such as foreign language or fine arts, and those requirements may also be associated with variability in teacher salaries. Some states and districts have additional graduation requirements which are not credits at all, such as community service hours or passing a specific standardized test. None of those requirements are accounted for within this study, but have the potential to alter teacher duty requirements (such as supervising community service hours) and therefore may also impact teacher salaries.

Additionally, this study only examined traditional public and public charter schools, without differentiating if there was an established focus for the school or district (or, in the case of some charter schools which are their own district, both). For example, some schools provide a general high school education, while others focus on a particular career track (e.g., health services, engineering, performing arts) or general subject area (e.g., STEM). Particularly where a school is its own district, as in the case of some charter schools, such a focus may impact the graduation requirements. Similarly, salary

scale structures and highest/lowest teacher salaries may be impacted by the age of the school or district or by having an unusually high number of teaching staff in a particularly high- or low-paid area. Further research with additional granular data like this may add clarity to this study's findings. Similarly, private schools can have substantially different credit requirements than public districts, such as when religious courses are required. Private schools may also have, in some instances, more flexibility to approach teacher compensation, which may impact the salary structure. Future research into that population may also illuminate how credit requirements and teacher compensation are associated.

It is clear that geographic location significantly changed the relationship between graduation requirements and teacher salary. Further research into this relationship, such as looking at differential impacts across states or regions of the country by including cities in different regions of the country or examining states as whole entities would further clarify how the geographic context impacts the relationship between graduation requirements and teacher salaries. This is particularly important as both graduation requirements and teacher compensation (both salary structure and rate, as well as incentives and other forms of compensation) can vary widely both within a state but also from state to state.

This study did not examine teacher experience or education levels, both of which can significantly impact teacher compensation. The current expectation for teachers is that teaching is a life-long career, and the salary schedules are structured to reflect that expectation (with all teachers earning salaries based on experience steps and education lanes, regardless of certifications or the needs of the district). Given the number of

programs and the push for second-career teachers and recruiting professionals from the industry field into teaching, exploring the impact of teacher experience on teacher compensation is important. Though this study was unable to do so due to the availability of data, future research should additionally examine the impact of teacher years of experience on compensation – both at the individual teacher and systemic district levels.

Similarly, there has been a shift in many states regarding teacher education and whether a master's degree is required to obtain or maintain teaching credentials. As teacher salary schedules typically involve different "lanes" based on education, a significant shift in the educational credentials of the teaching workforce may also significantly alter the teacher compensation conversation. Again, this study was unable to examine the impact of teacher education on teacher compensation due to the limitations of this data set, but future research should examine this impact at both the individual teacher level and the systemic district/state levels.

Finally, the best model explained only 35.6% of the variance in highest teacher salary. There are clearly a number of additional factors which are influencing teacher salary. Additional studies that account for other forms of teacher compensation, other district- or teacher-level demographics or other components of the geographic context may explain more of the variance seen in teacher salary.

5.4 Summary

This study investigated the relationship between minimum graduation requirements in English, math, social science and science and teacher salaries, and explored the differential impact of the geographic location of the district. The study found

that increased requirements in science credits are associated with decreased teacher salaries, at both the lowest and highest ends of the salary scales. Social science credit requirements, however, are associated with increased teacher salaries, while English and math credit requirements have no notable association with teacher salaries. The percent of students in a district qualifying for free and reduced lunch is associated with relatively small decreases in teacher salaries. The geographic context, however, is associated with somewhat larger changes in teacher salaries, all other variables (credit hours, NSLP, teacher contract days and total student enrollment) remaining constant. This study addresses a gap in the literature – the impact of increased graduation requirements on teacher salaries – but additional research is needed.

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Vita

Education
M.Ed., Students with Moderate Disabilities, Lesley University
BA, Psychology, Cambridge College

Professional Positions
Exceptional Children Consultant, Kentucky Department of Education
Exceptional Children Instructor, Elkhorn Crossing School, Scott County Schools
Special Education Math Teacher, The Carroll School
Special Education Teacher, Germaine Lawrence

Honors
Hope Street Group Teacher Fellow

Allison Johnson