2015

Preparing for Changes in Teacher Preparation Program Accountability: Evaluating the Factors that Influence Job Placement of Teacher Preparation Program Graduates

Amy F. Johnson PhD
University of Southern Maine, Muskie School of Public Service

PREPARING FOR CHANGES IN TEACHER PREPARATION PROGRAM ACCOUNTABILITY:

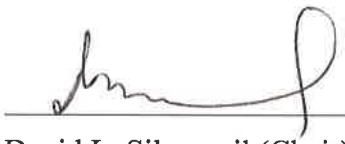
EVALUATING THE FACTORS THAT INFLUENCE JOB PLACEMENT OF TEACHER PREPARATION PROGRAM GRADUATES

By Amy F. Johnson

B.S. SUNY at Buffalo, 1994

M.S.Ed. Duquesne University, 1999

Approved By:



David L. Silvernail (Chair)

Charles S. Colgan, Member

Catherine Fallona, Member

PREPARING FOR CHANGES IN TEACHER PREPARATION PROGRAM ACCOUNTABILITY: EVALUATING THE FACTORS THAT INFLUENCE JOB PLACEMENT OF TEACHER PREPARATION PROGRAM GRADUATES

By Amy F. Johnson

B.S. SUNY at Buffalo, 1994

M.S.Ed. Duquesne University, 1999

A DISSERTATION

Submitted in partial fulfillment of the requirements for the Degree of

Doctor of Philosophy in Public Policy

The University of Southern Maine

December 4, 2015

Advisory Committee:
David L. Silvernail (Chair), Professor of Educational Leadership
Charles S. Colgan, Professor of Community Planning and Development
Catherine Fallona, Professor of Literacy

LIBRARY RIGHTS STATEMENT

In presenting this dissertation in partial fulfillment of the requirements for an advanced degree at the University of Southern Maine, I agree that the library shall make it freely available for inspection. I further agree that permission for "fair use" copying of this dissertation for scholarly purposes may be granted by the librarian. It is understood that any copying or publication of this thesis for financial gain shall not be allowed without my written permission.

Signature: 

Date: December 11, 2015

PREPARING FOR CHANGES IN TEACHER PREPARATION PROGRAM ACCOUNTABILITY: EVALUATING THE FACTORS THAT INFLUENCE JOB PLACEMENT OF TEACHER PREPARATION PROGRAM GRADUATES

By Amy F. Johnson

Dissertation Advisor: Dr. David L. Silvernail

An abstract of the dissertation presented in partial fulfillment
of the requirements for the degree of Doctor of Philosophy in Public Policy
University of Southern Maine

December 2015

Teacher preparation programs are facing increased pressure to report on the outcomes of their graduates, including their job placement rates. Prior research on job placement for teachers establishes that a variety of factors are related to whether or not individuals apply for and receive jobs. This research study explored these factors through quantitative analysis of three cohorts of teacher preparation program completers within the institutions of the University of Maine system, using logistic regression to identify the individual and contextual characteristics that are most predictive of job application and hiring.

Of the factors studied, the most influential factors in job placement in public schools in the state were (1) in-state residency status, (2) preparation in a teacher shortage area, (3) completion of a post-baccalaureate preparation pathway, (4) receipt of financial assistance that requires completion of future teaching service, (5) institution attended, (6) GPA relative to other graduates, (7) year of graduation, and (8) age at the time of

completing the program. However, these combined variables provide less than 20% of the potential predictability in job placement outcomes. This suggests that additional work is needed to identify the factors influencing beginning teacher placement. Job placement rates for preparation programs should be interpreted with caution, as at least some of the related factors are not within the control of preparation programs (e.g. year of graduation). Furthermore, the use of job placement rates to make high-stakes decisions may provide incentives to programs to implement policies that may not be ethical (such as preferential admission of younger applicants) or that may not be advisable for other reasons.

Acknowledgements

This study was funded in part by an American Association of Colleges of Teacher Education Research Fellowship in Educator Preparation grant. The study does not necessarily reflect AACTE policy, and the AACTE does not formally endorse, certify, guarantee, or warrant the study, or the results or products of the study.

I wish to thank all of the many people in my personal, professional, and student spheres who supported me in myriad ways throughout my doctoral studies. Dr. David Silvernail was first among equals of all my USM supporters as a tireless mentor, coach, and friend. Fellow Committee members Cathie Fallona and Charlie Colgan provided thoughtful insights and responsive feedback while letting me find my own answers. Other faculty members in my program (and beyond), and especially my colleagues in the doctoral program cohort, stretched my thinking and kept me motivated. And most of all, I thank my supportive husband and daughters who have borne a larger share of responsibilities, eaten more take-out food, and tolerated more late arrivals than they probably would have liked in order to provide me with the time and space to complete this work.

Table of Contents

Acknowledgements vi

List of Tables viii

Chapter 1: Rationale for the Study 1
- **Statement of the Problem** 1
- **Purpose of the Study** 6
- **Research Questions** 7
- **Significance of the Study** 7
- **Document Organization** 9

Chapter 2: Literature Review 10
- **Introduction** 10
- **Situating the Research Study** 11
- **Teacher Labor Markets** 13
- **Methodological Precedents** 16
- **Additional Studies of Job Application (Supply-side) Factors** 20
- **Additional Studies of Hiring Preference (Demand-side) Factors** 25
- **Summary** 30

Chapter 3: Research Methods 32
- **Research Questions** 32
- **Methodology Overview** 33
- **Rationale for Methodology** 33
- **Study Sample** 36
- **Survey Instrument Development & Data Collection** 36
- **Administrative Data Sources** 38
- **Operational Definitions** 39
- **Variables** 40
- **Data Analysis** 44
- **Research Hypotheses** 46

Chapter 4: Results and Findings 48
- **Process Findings: Challenges in Data Collection & Compilation** 48
  - Survey Response Rates 49
  - Administrative Data Availability and Data Matching Challenges 51
  - Process Findings Summary 52
- **Survey Results** 52
  - Job Application Process 53
  - Job Application Outcomes 55
  - Survey Results Summary 56
- **Logistic Regression Model Overview** 57
- **Preliminary Relationships of Individual Factors to Outcomes** 58
- **Survey Model Results** 61
- **Administrative Model Results** 63
  - 1-Admin (Certification Attainment) 63
  - 2-Admin (Hiring Factors) 65
  - 3-Admin (Job Placement) 66
  - Administrative Models Summary 67

Results for Individual Factors **69**
Demographic Variables 69
Student Characteristics 74
Institutional and Program Factors 77
Exploration of Geographic Variables **79**
Summary of Findings **80**
Limitations and Delimitations **81**

Chapter 5: Conclusions **86**
Discussion of Individual Factors **87**
Individual (Demographic) Characteristics 88
Student Characteristics 92
Institutional and Program Factors 96
Individual Factors Summary 101
Implications for Data Collection and Reporting **102**
Implications from Survey Results **105**
Implications from Data Models **106**
Recommendations and Next Steps **107**
Operationalizing Job Placement 108
Importance of Centralized Technical Support 109
Implications for Accreditors 110
Implications for State and Federal Policymakers 111
Further Research **111**
Summary **113**

References **115**

Appendix A: Survey Respondent Representation by Various Characteristics **118**

Appendix B: Preliminary Analysis of Relationships to Dependent Variables **119**

Appendix C: SPSS Output for Administrative Models **128**

Appendix D: Job Outcomes in Maine by Specific Certification Areas **132**

Biography of the Author **133**

List of Tables

Table 1a, Independent Variables and Definitions (Demographics)…….…... 41
Table 1b, Independent Variables and Definitions (Student Characteristics) 42
Table 1c, Independent Variables and Definitions (Program & Geographic Factors) 43
Table 1d, Binary Dependent (Outcome) Variable Definitions 44
Table 2, Job Application Process Characteristics (N=234) 54
Table 3, Job Application Supports 54
Table 4, Newly Hired Graduate Outcomes (N=184) 55
Table 5, Chi-Square / t-Test Significance values, $p < 0.100$ 60
Table 6, Survey Response Counts by Dependent Variable 61
Table 7, Model 1-Admin, Factors Related to Attainment of Maine Teacher Certification (U.S. Residents) 64

Table 8, Model 1-Admin Statistics 64
Table 9, Model 2-Admin – Factors Related to Hiring of Maine Certified Teachers 66
Table 10, Model 2-Admin results 66
Table 11, Model 3-Admin of All Graduates' Job Placement 67
Table 12, Model 3-Admin Results 67
Table 13, Summary of Significant Factors in Administrative Models 68
Table 14, Administrative Model Statistics 68
Table 15, Correlations Between Z-GPA and Praxis Scores 75
Table 16, Job Placement Outcomes Compared to Institution 1 78
Table 17, T-Test Significance values, $p < 0.100$ for Geographic Factors 80

Preparing for Changes in Teacher Preparation Program Accountability: Evaluating the Factors that Influence Job Placement Rates of Teacher Preparation Program Graduates

Chapter 1: Rationale for the Study

Statement of the Problem

In recent years, there has been a move to hold institutions of higher education more accountable for the success of their students. Given the large investment of public and private dollars, colleges and universities are being asked to show their worth in various ways. The U.S. Department of Education has released a College Scorecard website to allow prospective students to compare institutions based on indicators such as cost, graduation rate, loan default rate, and median salary of graduates. Accrediting bodies are also being asked to increase the level of rigor used when evaluating colleges and universities in periodic program reviews (Duncan, 2015).

Pressure is also mounting to raise standards for specific programs within colleges and universities, including programs that prepare future teachers. Criticisms of teacher preparation programs have been fueled by a proliferation of studies investigating the links between teacher quality and various educational outcomes (Cochran-Smith et al., 2012). Empirical research has confirmed the conventional wisdom that teachers are the largest in-school factor impacting student achievement (Clotfelter & Ladd, 2007; Hanushek & Rivkin, 2010) which has led to a heightened emphasis in policy conversations about how prospective teachers should be selected and prepared. Programs that prepare educators are subject to increased scrutiny, and pressure is mounting to hold programs accountable for the effectiveness of their graduates (Cochran-Smith et al., 2012).

As a result, teacher preparation programs are being asked to collect and report an increasing amount of data about their program completers. Under Title II of the Higher Education Opportunity Act (HEOA), most recently reauthorized in 2008 (P.L. 110-315, Sec. 205-208), all teacher preparation programs must comply with mandatory annual reporting on selected measures about their program and their students.

The newly-constituted Council for Accreditation of Educator Preparation (CAEP), which is the result of the merger of two accrediting bodies with a historic combined membership of approximately 900 colleges and universities, requires annual reporting on a variety of program outcome measures (CAEP standard 4, Program Impact). The National Center on Teacher Quality has developed a highly politicized annual report that ranks preparation programs using available program measures (Greenberg, McKee & Walsh, 2013). In short, teacher preparation programs are increasingly under the microscope.

One of the specific program outcome measures that is often included in these efforts is job placement rate. At the time of writing in fall 2015, the U.S. Department of Education has completed public comment and review and is preparing to release changes to its rules governing annual Title II reporting requirements, with an expected release in December 2015. Job placement rates were included in the draft proposed rules among the several program outcomes to be required in annual institutional reporting. If job placement rate is added as a mandatory element, it will affect every one of the approximately 2,100 educator preparation programs in the country (USDE, 2014). Job placement rate is also already currently included as a measure in the CAEP annual

reporting for its member institutions, though reporting is currently voluntary as programs build capacity for data collection.

Job placement occurs at the nexus of supply and demand. The proportion of an institution's graduates who ultimately secure teaching positions is influenced both by the number who decide to enter the labor market supply by applying for jobs, as well as their ability to secure a job offer by having qualifications that are desired by employers on the demand side. Because the measure is potentially impacted by the full gamut of both supply and demand side variables, any attempt to discern the factors with the largest influence on the overall placement rate must encompass both realms.

The distinctions between the supply side and demand side are also important for the policy conversation. Some of the ongoing narrative supporting the practice of reporting job placement rates appears to be is rooted in discussions about the responsibility of teacher preparation programs to supply high-quality teachers, particularly for the public schools that serve the vast majority of economically disadvantaged youth. These discussions often lament that preparation programs are not able to provide an adequate supply of well-prepared teachers for all subject areas and for all types of school settings. In its whitepaper laying out the rationale for new federal reporting requirements, the U.S. Department of Education states:

> Programs often do not respond to school district needs for teachers prepared to teach in high-need subjects […]. Over half of all districts report difficulty recruiting highly-qualified teachers in science and special education, and over 90% of high-minority districts report difficulty in attracting highly qualified math and science teachers. (Duncan, 2011, p. 5).

Job placement data, the logic goes, would identify the programs that are doing the best job at supplying candidates that match the needs of schools. This line of thinking suggests a closer look at the job application behaviors of graduates to see whether programs are supplying credentialed candidates for open positions.

A parallel conversation around job placement is grounded in the belief that strong placement rates are a hallmark of programs with well-prepared graduates. The logic postulates that hiring committees are adept at selecting the strongest candidates; and therefore, programs with higher hiring rates are graduating higher proportions of desirable candidates. In the same USDE whitepaper, reference is made that "outcome based data can inform better decision-making at all stages of teacher preparation. […] School districts and principals seeking reliable pools of effective teachers can make better decisions about which programs to partner with and from which to hire" (USDE, 2011, p.10). This suggests that comparing hiring rates for job applicants from different programs could serve to identify programs that are perceived by the field as being higher quality.

Prior research has been completed to analyze administrators' hiring practices on the demand side (Balter & Duncombe, 2007; Harris et al., 2010; Ingle, Rutledge, & Bishop, 2011), and the non-wage factors impacting individuals' interest in teaching on the supply side (Ballou, 1996; Boyd, Lankford, Loeb, and Wyckoff, 2005 and 2006; Reback, 2006). However, a critical gap remains in empirical research that considers both supply and demand factors simultaneously and thus identifies which carry the most weight in an institutional job placement rate.

Three particular empirical studies, by Ballou (1996), Boyd, Langford, Loeb, and

Wyckoff (2003), and Goldhaber, Krieg, and Theobald (2014), included both supply and demand-side factors and are strong foundations for this work. However, each provides only partial information.

Ballou's (1996) study was closely aligned in intent and design in his use of the Survey of Recent College Graduates national dataset to investigate both supply and demand-side factors influencing hiring. However, his data did not include a complete description of job application behavior or administrative measures of content knowledge (self-reported only). The study was aggregated nationally, included non-teacher education students in the model of job application behavior, and did not include any institutional measures other than a measure of college selectivity based on Barron's five-point rating system. This study considers only students who graduated from a preparation program and has an increased emphasis on individual and institutional attributes specific to teacher preparation, such as teacher certification area.

Boyd et al. (2003) investigated teachers' and employers' preferences in job searches. They used administrative data on teachers who were hired to investigate factors that affected teachers' choice of employment contexts. Their findings have implications for supply-side questions; however, because they only investigated successful applicants, they did not include two key parts of the denominator in the job placement ratio: graduates who do not pursue teaching, and those who apply but are not hired, two factors included in this research study.

In the most recent investigation of job placement, Goldhaber et al. (2014) modeled factors related to overall job placement of teacher preparation program graduates. The study included hired as well as non-hired candidates and thus provides

useful insight into factors influencing the probability that an individual will enter the teaching workforce. It included an emphasis on attributes of the schools where the student completed clinical preparation experiences and had access to placement data in private as well as public schools. This study differs in that it separately models job application and hiring of applicants. In addition, this study includes several additional independent factors, such as whether program completers were undergraduates or post-baccalaureate students, income level, and whether they received financial support with an attendant teaching service commitment (e.g. an Educators for Maine forgivable loan).

As described in more detail in Chapter 2, some of the factors identified in either supply-side studies or demand-side studies are directly related to the practice and policies of the programs, such as graduates' content knowledge. Other factors that may influence job placement, such as candidates' geographic preferences and the amount of competition from experienced teachers in the applicant pool, are unrelated to teacher preparation program practices. At present, not enough is known about the complex interplay of factors that impact candidates' hiring to be able to interpret what any given institution's overall job placement rate says about it. Additional information about the measure is needed in order to discern whether it is an appropriate data point to use in high-stakes program accountability systems. This study included data to explore both the supply and demand aspects of job placement for all program graduates in order to develop a deeper understanding of the measure.

Purpose of the Study

The purpose of this exploratory research study was to identify the individual and institutional factors that are most influential in determining job placement rates for

graduates of traditional teacher preparation programs. Logistic regression models, including an array of individual and institutional variables, were developed and refined to determine the characteristics that were most predictive of whether recent program graduates enter the teacher supply (i.e. job seeking behavior) and whether they were in demand (i.e. the employment status of applicants). Those factors that drove overall job placement rates were also examined.

Research Questions

The research questions examined in this study were:

1) For traditional teacher preparation program completers, what student and institutional factors were most predictive of whether a candidate applies for teaching jobs?;
2) For program completers who apply for teaching jobs, what student and institutional factors are most predictive of whether they secure a teaching position?;
3) Of the factors identified in questions 1 and 2, which are most influential in determining overall job placement?; and
4) How well can job placement be predicted from these factors?

Significance of the Study

Based on the patterns identified in prior research, one may anticipate that any institution's overall job placement rates will be related to a mix of factors both within and outside of their sphere of influence. Given that these reporting requirements are in effect for CAEP institutions, and likely imminent for *all* programs as part of HEOA Title II reporting, a deeper understanding of the factors that drive placement rates will be of

immediate interest to stakeholders at the highest levels, including accrediting bodies and state education agencies who may be considering use of the measure to evaluate programs.

Creating a clearer understanding of the variables that influence hiring also has critical importance for the recruitment, selection, preparation, and career services practices of teacher preparation programs. Programs may wish to modify their practices in order to increase placement rates. Providing meaningful information to the public programs is another contribution of the study, as different factors will imply different strategies and policy levers for effecting program improvement.

Until now, institutional job placement rates have been difficult to determine. As is the case in many states, there have been no prior systematic efforts in Maine to collect and compare job placement rates for graduates of approved teacher preparation programs. Institutions wishing to know whether their graduates obtained teaching jobs were required to take on the rather onerous task of individual follow-up with each student. The resulting findings are thus subject to student response rates and quality concerns about self-reported data. In the cases where institutions have done this work, the data may or may not be publicly available. However, the centralized reporting on program graduates now in place due to Title II reporting, and the advent of the State Longitudinal Data System in Maine, should facilitate this data collection. It is technically within reach for the Maine Department of Education to calculate placement rates within the state, with considerable accuracy, on behalf of all Maine programs. In other words, the situation was ripe for this work. This exploratory study also provided actionable information

about the technical feasibility of collecting and reporting job placement data in the state, which may be of interest beyond Maine to states with similar data needs and questions.

Document Organization

In summary, the study described in this document addresses an issue with broad relevance, and potentially high stakes for institutions, where additional research is needed. Chapter 2 of this dissertation provides a summary of prior relevant literature through a review of research related to teacher preparation program accountability, as well as specific studies investigating teacher supply and demand. Chapter 3 gives details on the methodological approach used in this study, including study parameters and limitations. The results of the data analyses are provided in Chapter 4 in several categories. Some of the challenges in conducting the research are provided, since the process itself mirrors the steps teacher preparation programs will face in complying with future reporting requirements. The bulk of Chapter 4 focuses on the more traditional content of findings from the research analyses, including regression model results and findings for each independent variable. Chapter 5 provides conclusions to be drawn from the research about the factors that are related to job placement of teacher preparation program graduates, reflects upon the research conclusions and their attendant policy implications, and arrives at recommendations for policymakers and preparation programs.

Chapter 2: Literature Review

Introduction

Job placement is an intuitive measure by which to assess outcomes for teacher preparation program graduates, as it is readily understood by multiple stakeholders and carries practical significance for teacher candidates. However, perhaps in part because of its familiarity, it has been largely overlooked in existing research. Limited empirical investigations exist to study the determinants of job placement, how closely the measure is linked to other hallmarks of program quality, and whether it is appropriate for use in accountability decisions.

The purpose of this research was to identify the individual and institutional factors that are most influential in determining job placement rates for graduates of traditional teacher preparation programs. Existing research demonstrates that there are multiple factors unrelated to preparation program quality that influence whether individual candidates find teaching jobs. It is important to understand the complex interplay of factors that impact hiring so that institutions' placement rates can be interpreted. Institutions themselves also benefit from deeper understanding of the characteristics that impact their graduates' likelihood of securing teaching employment, as different factors may imply different strategies and policy levers for effecting program improvement.

Job placement rates are affected by both supply and demand, and the labor market context for public school teachers is idiosyncratic. The study considered a wide breadth of prior research. The relevant literature for this work is organized into the following categories: program accountability, teacher labor markets, supply-side hiring factors, and demand-side hiring factors.

Situating the Research Study

A recent review by Cochran-Smith, Cannady, Pesola, McEachern, Mitchell, Piazza, Power, and Ryan (2012) summarized research in teacher preparation, and provided a framework with six distinct categories of research: (1) teacher certification and its correlates, (2) teachers' educational backgrounds and the teacher workforce, (3) entry pathways into teaching and their consequences, (4) teacher preparation programs and their graduates, (5) teacher preparation and learning to teach in the early career years, and (6) teachers' life experiences, beliefs and practices. This dissertation work fits best in genre 4, teacher preparation programs and their graduates, because of its policy context. According to Cochran-Smith et al. (2012):

> Some of the studies in this genre can be understood as a response by the teacher education community to shifting notions of accountability from primarily inputs to primarily outcomes, which were reflected in the reporting requirements that followed the 1998 reauthorization of Title II of the Higher Education Act. Shifting ideas about accountability for outcomes were also reflected in the new standards of teacher education's national and regional accreditors, which required preparation programs to produce credible evidence of the knowledge and demonstrated skills of the teachers they prepared. (p. 19)

However, this research study was grounded in work in other genres. It relied heavily on prior studies investigating teacher labor markets and hiring practices (genre 2, teachers' educational backgrounds and the teacher workforce).

As described in the introductory chapter, teacher preparation programs are facing

increasing demands to improve the quality of their graduates. The push for greater accountability has been fueled by a proliferation of empirical research studies that investigated links between teachers' education and student learning outcomes.

High-profile research in this genre sought to understand the relationship between teacher quality and student achievement. These studies investigated the validity of using student test scores to evaluate teachers, and have served to underpin sweeping changes in state-level teacher evaluation policies (driven in part by federal mandates attached to states seeking flexibility waivers from No Child Left Behind requirements). Some of these studies (e.g. Clotfelter & Ladd, 2007; Hanushek, 2005; Rivkin, 2005) have supported the technical feasibility and validity of using student tests to evaluate teachers. Others have challenged the validity of the practice and call for ending the use of student test scores in teacher evaluations, particularly for high-stakes decisions (Darling-Hammond et al., 2012).

Additional studies that were more directly related to this dissertation work take this concept one level higher and examine the validity of using teacher evaluation ratings based on student test scores to evaluate their educator preparation programs. Gansle, Noell, and Burns (2012) attempted to determine whether it was possible to discern aggregate differences in student achievement for graduates of different preparation program pathways in Louisiana. Their research found that statistically significant differences could be found among preparation programs, demonstrating that it is technically possible to measure aggregate differences between student test score gains for teachers from varying preparation programs after accounting for students' prior knowledge, demographics, and school effects. Goldhaber (2011) demonstrated the same

technical feasibility using Washington state institutions, and found that the variance among graduates within a program was far larger than that between programs. Others (e.g. Henry, Kershaw, Zulli, & Smith, 2012; Plecki, Elfers, & Nakamura, 2012) have similarly made contributions to the ongoing body of work.

As with the concept of using student achievement for teacher evaluation, the idea of tying the evaluation data to teacher preparation program quality also has its critics. Floden (2012) described limitations for use of value-added modeling techniques to evaluate teacher preparation programs, including the assertion that the degree to which programs influence the quality of their graduates has not been empirically established.

Another category of studies describes (or laments) the demographics and qualifications of our teaching force (e.g., Ingersoll, 1999; Zumwalt and Craig, 2005; Monk, 2007). These studies document the uneven distribution of teachers across schools of varying types and establish the concerning finding that our nations' neediest schools also struggle the most to attract and retain well-qualified and highly effective teachers.

This broad body of research has been driven by, and contributes to, an ongoing policy dialog about the importance of teacher preparation program accountability. It is within this context that the current research into teacher hiring was situated.

Teacher Labor Markets

Economists have been studying the teacher labor market for several decades. Haggstrom, Darling-Hammond, and Grissmer (1988) produced a lengthy review for RAND 25 years ago in an attempt to develop recommendations for national data collection. At that time, there was limited available data and large-scale analyses of teacher labor markets had not been attempted. But even then, Haggstrom et al. were able

to establish some of the idiosyncrasies of teacher supply and demand, noting that "they depend on a multitude of local factors that affect the employment decisions of prospective and current teachers" (p. vi). They further noted that the collective bargaining structures that are endemic to teaching, and the complex array of state and district mandated qualifications for various teaching subjects and grade levels, insulate the teacher labor market from the traditional forces of supply and demand.

Boyd, Lankford, Loeb and Wyckoff (2003) also attempted to develop and evaluate a model for estimating the complex wage forces at work in teacher labor markets. Noting that "markets for public school teachers […] differ in fundamental ways from those in the private sector" (p. 1), they applied game theory and the method of "simulated moments" to estimate the weight of various factors in the hiring equation. Prior attempts to model the teacher market were problematic because the assumptions required for hedonic wage regression models do not hold. Salaries in the public sector schools are "unlikely to clear their respective markets" (p. 11) because salaries in unionized teacher labor markets do not flexibly adjust to equilibrium levels based on the available supply and demand. In other words, because teacher wages do not vary much based on the supply quantity or quality due to collective bargaining contracts, regression models attempting to relate various characteristics to demand (as judged by salary) are not robust. They produce results that are contrary to conventional wisdom, such as finding that teachers prefer high-poverty under-resourced schools because those schools pay lower salaries. Though their work was preliminary, it confirmed that their modeling methodology was promising as an improvement over prior efforts, as their model results were more intuitive. More germane to the topic at hand, their model did find quantifiable

effects on hiring for three factors. First, teachers prefer some job settings more than others ("non-pecuniary" factors) and are willing to sacrifice some amount of wage in exchange for certain school and student characteristics. Specifically, teachers prefer schools with lower percentages of poor and minority students, though these measures may be proxies for other factors such as neighborhood or adequacy of school resources. Second, teachers are influenced by geography, and strongly prefer jobs closer to home. Third, there are measurable effects of employer hiring preferences for candidates with higher credentials (as estimated through certification test scores, selectivity of undergraduate institution, and post-bachelor's degree attainment), and for minority applicants.

In his work to develop procedures for estimating appropriate levels of teacher compensation for the purposes of school funding decisions, Chambers (1995) also implicitly described some of the forces at work in the teaching job market. His empirical analysis also showed that teachers are influenced by many factors other than wages (e.g. community amenities and characteristics of the job assignment) and that hiring administrators discriminate between candidates based on various attributes. Salaries also vary based on the cost of living and level of competition in the labor market in the area.

These labor market studies did not directly address the question of job placement, but they demonstrated that there are a variety of factors that may come into play when establishing a salary for a given match between a job opening and an applicant. Given the intrinsic relationship between this work and the simpler construct of job placement, it is reasonable to assume that many of the same factors will also play a role in influencing institutional placement rates.

Methodological Precedents

Three particular empirical studies by Ballou (1996), Goldhaber, Krieg, and Theobald (2014), and Boyd, Langford, Loeb, & Wyckoff (2003) are strong foundations for this study of job placement rates. As described in Chapter 1, these studies helped inform the work, but each provides only partial information for this research purpose.

Ballou's inquiry into whether schools select the most qualified job applicants used self-reported survey data from the national Survey of Recent College Graduates (SRCG) from 1976 to 1991 to separately identify the determinants of teacher job application behavior and hiring outcome. In that study, Ballou found that the largest determinants of college graduates applying for teaching jobs were higher relative salary for teachers (compared to those hired in other professions), the proportion of applicants who failed to obtain teaching jobs, higher undergraduate GPA, graduation from a less selective institution, and individual demographic characteristics (where being female, non-white, married, and young each increased likelihood of application). The largest determinants of hiring were obtaining certification before graduation, higher undergraduate GPA, graduation from a less selective institution, having an education degree, and individual demographic characteristics (where being female, non-white, married, and young each increased likelihood of being hired).

The biggest distinction between the present study and Ballou's work is the restriction of the sample to individuals who completed a teacher preparation program. Individuals who complete a program potentially have markedly different reasons for not applying for teaching jobs as compared to the population of all college graduates. The current study is interested in the factors at play among the pool of graduates for which

institutions will be held accountable in reporting—their preparation program graduates. Moreover, the current policy context, in which there are federal mandates for public schools to hire "highly qualified" teachers (which includes obtainment of state certification), is vastly different from the more lenient policies that were in place in the 1970s and 1980s when the SRCG was conducted. Non-prepared teachers are discouraged from applying for jobs, unless through alternative certification programs such as Teach for America.

In addition, Ballou did not have information on applicants who received but declined job offers, the geographic areas where students lived, individual administrative data on the graduates such as GPA and certification test scores, or whether the individuals were certified in a shortage subject area, all of which were included in the present study.

More recently, Goldhaber, Krieg, and Theobald (2014) investigated teacher entry into the workforce after completion of a preparation program. The study has significant similarities to this dissertation work but had not yet been published when the current study began. Goldhaber and his colleagues developed split population models to investigate the effect of various individual and program-related attributes on whether and when candidates are hired as teachers. The split population duration model technique investigates probability of entry into the teacher workforce over time, allowing for the possibility that the entry never happens (i.e. the individual is not hired in any type of school setting). The study was conducted with seventeen years of longitudinal data to look at the time to hiring for program graduates. The researchers had access to administrative data capturing teaching employment in public schools, non-teaching

employment in public schools, and employment in private schools. This provided their outcome (dependent variable) measure for incidence of entry into the workforce. In addition, they had administrative data from the preparing institutions including detailed data about the schools and mentor teachers where candidates participated in student teaching, as well as demographic (gender, race and ethnicity data) on most cases. Grade Point Average (GPA) or certification test scores data were each available for approximately one-half of the cases. While the duration model itself has important implications, the most relevant findings pertain to the parameter coefficients for the incidence model—i.e. the estimates for whether or not a hiring outcome of interest is ever achieved.

Goldhaber et al. found that few graduates were employed exclusively in private schools or in non-teaching roles in public schools. Subsequently, their final models compared those hired in public schools to those who were never found employed in public or private schools (i.e. the private school and non-teachers were omitted). Thus their analysis of split estimates of hiring probability are analogous to the current study's model of overall job placement, with the exception that the current study captured employment outcomes after only two years and Goldhaber et al. allowed up to twelve years to observe employment. A second substantial distinction from the current study is that Goldhaber et al. controlled for the institution attended and the year the internship was completed. In their words, "This is important because we observe large disparities in placement rates between participating institutions and internship years" (p. 117). The current study took the opposite approach and instead limited the time interval for observing hiring status, and also investigated the effects of institution attended and year

of graduation.

In their full sample of 8,080 graduates, 5,218 graduates were hired in a public school, 271 were hired as private school teachers, 185 were hired in non-teaching roles in public schools, and 2,406 were not observed in state employment records. Figures provided in the report indicate that about 3,700 of those hired in teaching jobs were employed within one year of completing their internship and approximately an additional 1,100 were employed in their second year after graduating. The remaining 700 or so hires, or roughly 10% to 15% of those hired, took three years or more to find teaching employment.

In the relevant model results, the researchers found that the following factors had a significant positive impact on the probability of being hired as a public school teacher: being of a younger age; being white and non-Hispanic (particularly in the more urban part of the state); holding certification in science, math, special education, or English Language Learning; completing student teaching in a school with higher teacher turnover (as measured by a "stay ratio" calculated for each school); and completing student teaching in a suburban school. Variables that did not impact probability of hiring were gender, certification exam scores, and undergraduate GPA.

The study by Boyd, Langford, Loeb, and Wyckoff (2003) to improve upon models for teacher labor markets is described in the prior section. The study's purpose was to estimate the value of non-monetary workplace factors (e.g. school demographics) that teachers value in their job searches in an effort to inform labor market modeling methodology. Though less similar to the current study in goals or analytic methods, it still provided some useful guidance for this dissertation work. As with the current study,

the study had detailed records for both the teachers and the schools where they worked and it examined both teacher and employer preferences. In addition, the treatment of geographic variables in the Boyd et al (2003) study informed the current research, which included data to attempt to explore regional differences in both the supply and demand aspects of job placement for all program graduates. However, their study included only teachers who had been hired, as non-teachers were not pertinent to their particular study goals. Job placement rates are negatively impacted by the proportion of graduates who choose *not* to teach as well as by those who are unsuccessful in seeking employment; thus, a bigger scope and different methodology is needed to investigate job placement likelihood.

Additional Studies of Job Application (Supply-side) Factors

In prior studies, researchers have identified various non-wage factors on the applicant side that affect job application behaviors, and by extension, the job placement process. This section describes additional quantitative and qualitative research on four factors that have been identified on the teacher supply side. The quantitative studies addressed above in the labor market models and methodological precedents also support the importance of these factors.

Proximity

Boyd, Lankford, Loeb, and Wyckoff (2005) found that teachers have a strong geographic preference for jobs located close to their hometowns. Using statewide New York staffing data, they determined that 61% of public school teachers took their first teaching job within 15 miles of their hometown and 85% within 40 miles from home (Boyd, Lankford, Loeb, & Wyckoff, 2005). This increased for densely populated areas—

90% of New York City teachers were near home compared to 65% from Rochester, which they suggested may be influenced by increased demand for teachers in those markets. Their data also suggested a relationship between the urbanicity of one's hometown and first job, so that individuals from urban, suburban, and rural areas showed a strong preference for job locations that were similar to their hometown in population density—whether or not they are nearby. From this, the authors speculate that teachers seek out teaching environments that are familiar to what they experienced growing up.

This finding was confirmed and further explored by Fowles, Butler, Cowen, Streams and Toma (2013) in their research into initial job placements in rural Kentucky. They found that individuals who completed teacher preparation in Appalachia tended to find their first job in the region, and those trained out of the area were unlikely to be employed in Appalachia. They also found that the academic credentials for new rural teachers were lower than those for their non-rural counterparts and that Appalachian teachers, once hired, were unlikely to leave the region. Thus, it may be that candidates' likelihood of job placement is related to the teaching job markets where they live.

Community Amenities

An additional influence on teacher preferences, and thus on their behavior in the job market, is the number and type of services and amenities that are available in the area where a teaching position is located. Miller (2012) found that the ability of rural schools to retain teachers is impeded by their relative lack of resources. Communities with richer amenities, such as nearby shopping and socio-economic health, had significantly better teacher retention (5% to 8% better) compared to those with fewer amenities. The value of community amenities was also quantified in Chambers' (1995) labor market model.

It is possible that this phenomenon is related to the geographic patterns noted above in the Proximity section. In other words, prospective teachers may seek to live in communities that have the types of amenities and quality of life with which they are most familiar.

Hiring School and Position Attributes

Teachers also exhibit preferences for jobs based on specific attributes of the school or the specific teaching position. Two studies of intradistrict teacher transfer rates shed light on the types of settings that teachers choose when provided the opportunity. Hanushek and Rivkin (2007) looked at Texas school transfer data and found that teachers preferred suburban schools to urban schools and were willing to take a reduction in pay to do so. On average, they received slightly lower salaries (a 0.7% decrease) after their transfer. They also moved toward schools with higher academic achievement levels and lower levels of poor and minority students. Boyd, Langford, Loeb, Ronfeldt, and Wyckoff (2011) also looked at teacher transfer requests using New York City administrative records. They found that when other factors were held equal, teachers of lower achieving students were more likely to request job transfers to other schools.

Ingersoll's (2004) analysis of survey results from teachers who had left positions in high-poverty school settings triangulate these results. Those leaving their jobs due to dissatisfaction reported that they were influenced by low salaries, student behavior problems, lack of administrative support, lack of autonomy, and to a lesser extent, large class sizes. While his investigation was focused on retention of existing teachers and not initial hiring, it is likely that the factors that drive teachers to leave schools would also serve as disincentives to apply or accept job offers, to the extent that they are visible to

prospective applicants.

Lastly, Engel, Jacob, and Curran (2013) investigated job application preferences using sign-in sheet data from schools seeking to recruit teachers at job fairs in Chicago. They found that schools in certain geographic locations received substantially more applications than others—ranging from zero to over 450 applications per school. Schools with higher proportions of students in poverty and minority students received fewer applications. Interestingly, the preferences also varied based on applicant characteristics, for example Hispanic applicants were more likely to apply for jobs in schools with higher numbers of English language learners.

These studies suggest that teacher preferences contribute to the non-random distribution patterns seen across schools, whereby higher achieving teachers (as measured by test scores and other selectivity measures) are placed in higher-achieving, lower poverty schools; these staffing patterns have been well documented (Boyd, 2005; Zumwalt & Craig, 2005; Ingersoll, 1999). In Chambers' (1995) work to build hedonic wage model of teacher salaries, he identified the need to provide differential wages to compensate for larger class sizes, more reported incidents of student misconduct, and lower academic achievement. This is another corroboration that teacher preferences for certain schools and positions may influence job placement.

Entry Requirements

Another supply-side factor that is important to the conversation is the threshold level of education required to enter the teaching profession in public schools. State standards and federal mandates demand that public school teachers obtain certification. While certification criteria are set by each state and thus vary, it takes time, energy, and

money (in the form of foregone wages as well as tuition) to earn the prerequisite teaching credentials. Teacher preparation programs have different institutional resources and pressures for recruiting students into teaching. In public institutions, which prepare the lion's share of certified teachers nationally and in Maine, undergraduate preparation programs often serve large numbers of students. Reback (2006) found that this is less true of selective institutions. More selective institutions were less likely to offer undergraduate teacher certification programs, and their graduates were approximately one-half as likely to eventually gain teacher certification compared to institutions that offer a preparation program. In other words, top-tier students were less likely to become teachers if they were unable to pursue the necessary requirements during the course of their undergraduate career.

To increase teacher supply, many states have attempted to reduce the barriers to entering teaching by offering alternate pathways to becoming a teacher. Boyd et al. (2006) found that such approaches did increase teacher supply. New York City employed over 6000 Teaching Fellows in its schools in 2004-05, who are alternatively certified individuals serving as the classroom teacher of record (as opposed to being a student teacher) while pursuing initial teacher certification requirements. While not the primary finding of their study, Boyd et al.'s work also documented that once such fellowship programs were established, the qualifications of the individuals in alternate route programs were stronger than those for individuals enrolled in traditional university-based programs, as measured by exam scores. This supports the conventional wisdom that the teacher supply is impacted by the costs and time needed to obtain teacher certification.

Summary

In summary, existing research to date establishes that there are several factors that affect whether prospective teachers apply for jobs in a given school: proximity to where they live, other location factors such as community amenities and neighborhoods, school attributes including student demographics and academic achievement, and certification requirements. Since applicant preferences are part of the matching process that leads to job placement, these factors may be determinants in overall job placement models.

Additional Studies of Hiring Preference (Demand-side) Factors

Researchers have found that administrators responsible for hiring decisions evaluate a mix of personal and professional attributes in weighing job applicants. As was the case for supply-side factors, many of these factors emerged in labor market models, and others (especially those that are less measurable) were identified in qualitative studies involving direct interaction with hiring administrators.

Teaching Skill & Content Knowledge

In interviews and ranking exercises of administrators, Harris, Rutledge, Ingle, and Thompson (2010) found that the two top-ranked hiring criteria were teaching skill and subject matter knowledge. Roden's survey of school administrators (1996) also identified content knowledge and having an "understanding of learning theory and pedagogy" in the top three most important selection criteria. In addition, Boyd, Langford, Loeb, Ronfeldt, and Wyckoff's (2011) study of New York City teacher transfers, teachers with higher scores on the New York content knowledge assessment (the LAST certification exam) were significantly more likely to be hired into the transfer school.

Neither of the survey studies asked the respondents to describe their methods for assessing these attributes. Presumably, the academic preparation of a teacher candidate would be related to their GPA in content courses, as well as to their performance on standardized tests of content knowledge that are required for teacher certification. Performance in education courses (related to the theory and clinical practice of teaching) may provide a measure of a candidate's pedagogical knowledge; but there are limited examples of valid standardized assessments to gauge teaching knowledge and skill, and none are required in Maine. If the hiring administrators use the available measures as a means for assessing applicants' content and teaching knowledge, they may be influential in the data models.

Dispositions & Personal Attributes

In the Harris et al. (2010) study, the most important hiring criteria, after teaching skill and subject matter knowledge, were the dispositional characteristics of being caring, enthusiastic, and motivated. Interpersonal communication skills and the ability to work well with others also ranked high. Roden (1996) also found that the "ability to present one's self professionally in an interview" was tied with content and pedagogical knowledge for the top three most important qualities in a prospective teacher. Notably, Roden's study did not include a choice that would be analogous to the dispositions probed by Harris et al. The fact that these studies found similar results for the most important hiring criteria provides confidence that they are important.

Experience

In the Harris study, teaching experience was a mixed factor – some preferred prior teaching but others preferred to hire beginning teachers since they have lower pay scales

(Harris et al., 2010). Roden's (1996) survey did not directly probe for number of years of prior teaching experience; but two related items, the length of student teaching experience and whether the candidate had prior experience (i.e. substitute teaching) in the district, were not considered very important by administrators.

However, Boyd, Langford, Loeb, Ronfeldt, and Wyckoff (2011) found that when evaluating prospective New York City school transfers, administrators did place a statistically significant value on prior experience. Each additional year of prior teaching experience resulted in a 10% increase in the likelihood of being hired into the transfer school. This finding is only partially applicable to the topic at hand, as their study only included in-service teachers who had applied for transfers. The findings do not shed light on the extent to which novice teachers may have fared in competition with those who were requesting transfers. However, it is plausible that this preference would extend to create a disadvantage for recently graduated job applicants when in competition with veteran teachers.

Diversity and "Fit"

Harris and his colleagues (2010) also described administrators' processes for determining individual applicants' institutional and organizational "fit," whereby they seek to hire specific traits or skills that they believe will benefit the overall organization. This included a preference for candidates from underrepresented racial or ethnic backgrounds to try to increase the diversity of the faculty, as well as achieving balance in age, experience, and gender. It could also include hiring for unique skills or traits that fit an unmet institutional need, such as ability to staff co-curricular or extra-curricular programs.

Selectivity of Preparing Institution

Notably, Harris et al. also found that graduates from more selective institutions have no advantage in securing jobs, and possibly even a disadvantage, over their peers from less selective institutions. Principals interviewed expressed a belief that graduates from top-tier institutions were not likely to stay at their schools. In the words of one interviewee, "I'm not looking to hire somebody from Harvard. The couple of people that I have hired from Harvard didn't stay with me; they had other aspirations" (Harris, 2010, p. 238).

These findings confirmed Ballou's (1996) research, which separately modeled application and hiring factors as was done in the present study. His study demonstrated a negative selection effect for graduates from top-tier institutions. Ballou also confirmed prior findings that teacher preparation graduates from institutions with above average selectivity were less likely to apply for teaching jobs than their peers at less selective institutions, even when considering only the individuals who followed through to obtain initial state certification. College selectivity was operationalized using Barron's Profiles of American Colleges rankings at the time of the study. Those top-tier graduates who did apply for jobs were slightly less likely to be hired than their peers with similar GPAs at less prestigious institutions. In other words, more selective institutions had a greater proportion of education program graduates who choose not to further pursue a career in teaching and comparable to worse hiring outcomes for those who do apply for jobs. By systematically ruling out several alternate explanations, Ballou presents persuasive analysis that the effect is from employer preferences, not by factors on the applicant side. This finding was significant in the context of this study, as selective programs may see

negative impacts on their job placement rates as a result of these practices. Ballou's (1996) study looked at undergraduate institution reputation as a whole, and did not address the more nuanced question of perceived teacher preparation program quality within the larger institution. It is possible that teacher preparation program reputations may diverge from institutional stature, with mediocre institutions having well-regarded programs within K-12 education circles or vice versa.

Recruitment

Balter and Duncombe (2007) collected survey data on the practices used by public school districts to promote their available job openings. Comparing the recruitment activities to available administrative data on teacher qualifications, they found that schools with more aggressive recruitment practices were able to hire more qualified applicants. Given the aforementioned importance of both geography and school working conditions in prospective applicant's interest in jobs, it is important that the supply side is aware of the available demand. Perhaps because of the geographic factors, most districts do not aggressively recruit for their openings; over 70% of districts limited advertising to local areas (within 50 miles). This reinforces the pattern of teachers seeking jobs nearby. It also may disadvantage recent program graduates, who compete with experienced teachers seeking to relocate within the local job market, and may have less opportunity to be aware of available openings. The implications for these findings are that institutions in different geographic areas, with varying levels of tuition support, may have different recruitment capabilities and ability to attract top candidates. These aspects of supply would likely impact the subsequent job placement rates of graduates, but are not directly

related to the actual teaching and learning that happens within the program courses and experiences.

Summary

On the demand (hiring) side of the job placement equation, research suggests that several factors affect whether applicants are selected for teaching positions. Prospective employers value teaching skill and disciplinary knowledge and seek to find candidates that they perceive to be strong in these areas. They also look for certain personal dispositions and for individuals who they believe will be a good fit for their school environment. Schools with strong recruitment programs are more likely to hire well-qualified candidates. Experience level was an indeterminate factor, with mixed results from different studies. Available empirical studies suggest that graduates from highly selective institutions are less likely to be hired. This mix of factors depicts a selection process that is highly dependent on subjective evaluations of individual candidates' suitability for a specific school context. It also raises questions about whether these factors can or should be associated with perceptions of quality of the preparing institution.

Summary

In total, the existing research establishes that institutional job placement rates are likely to be impacted by many factors, some of which are unrelated to the quality of experiences provided to their students. For example, candidates' demographic characteristics, choices in applying for jobs in certain communities, and preparation at *less* selective institutions may drive placement in ways that do not relate, or relate negatively, to evidence-based program practices. In addition, changes in the teacher job

market over time impede the ability to compare placement rates from year to year. It was a fundamental premise of this exploratory research study that it is imperative to further study these factors, so that policymakers can weigh the interrelationship between these factors and the usefulness of job placement rate as an accountability measure.

Chapter 3: Research Methods

The purpose of the research study was to identify the individual and institutional factors that are most influential in determining job placement for graduates of traditional teacher preparation programs. Existing research demonstrated that there are multiple factors that influence whether individual candidates find teaching jobs, and some of these factors are unrelated to preparation program practices. It is important to understand the relative importance of all of the factors that impact hiring, so that individuals who are interpreting the meaning of a particular institution's overall placement rate may properly understand the contextual issues that may have wrought an impact.

This chapter describes the methodology of the study, beginning with the research questions that guided the study, a brief overview of the selected methodology, and the rationale for its selection. These are followed by descriptions of the sample, survey instrument development, data collection methods, administrative data sources, and operational definitions of the included variables. Then the research hypotheses and analytic methods are provided. Limitations and delimitations of the study are combined and addressed at the conclusion of Chapter 4.

Research Questions

The questions that guided the design and implementation of the research study were:

1. For traditional teacher preparation program completers, what student and institutional factors are most predictive of whether a candidate applies for teaching jobs?
2. For program completers who apply for teaching jobs, what student and

institutional factors are most predictive of whether they secure a teaching position?

3. Of the factors identified in questions 1 and 2, which are most influential in determining overall job placement?
4. How well can job placement be predicted from these factors?

Methodology Overview

This quantitative research study employed logistic regression to separately model the factors that predict whether program completers apply for teaching jobs and are hired as teachers. Additional models investigated the combined effects of application and hiring that result in overall job placement. Using data on three recent years of Maine teacher preparation program graduates from public institutions, models were established to calculate the coefficients of independent factors and thus identify those that have the largest relationship to the job application outcome of interest. Each question was explored through two routes with one model based on data obtained from surveying recent program graduates and a second one built with data solely available from administrative sources. Thus a total of six logistic regression models were attempted, using 16 different independent factors.

Another set of analyses were conducted to explore various methods of measuring the strength of the teacher job market in different areas of the state (by town and labor market area (LMA)). Because these administrative data were only available for in-state residents, these analyses were performed on more limited sets of data.

Rationale for Methodology

The study purpose demanded a quantitative treatment. Because the goal was to

measure the relative importance of variables, empirical study with measurable variables was required. Qualitative research could be valuable for initial identification of the types of variables that come into play in hiring situations, or for providing deeper understanding of the complex social factors on both the applicant and employer sides. However, only quantitative methods can determine how the various job placement factors stack up against each other in the overall process, as when looking at institutional and statewide rates.

The study employed an ex post facto quantitative research design in which logistic regression was used to calculate the degree to which each independent factor is related to whether traditional teacher preparation program completers (a) apply for teaching jobs and (b) are hired as teachers. Binary logistic regression is the preferred method of analysis as both models involved a binary dependent variable. Multiple regression was not appropriate as the binary dependent variable did not meet the requirement of normality, and had a non-linear (S-shaped) relationship to the independent variables (Pampel, 2000). According to Hair et al. (2005), the other technique commonly used with categorical dependent variables, discriminant analysis, is less preferred. Logistic regression has more flexible requirements for its independent variables, and better accommodates dummy independent variables than discriminant analysis (Hair et al., 2005). Furthermore, logistic regression captures the overall predictive power of a given set of factors, which was of key interest in this study.

The ex post facto design was appropriate for several reasons. True experimental design was not possible, as randomization of subjects and creation of treatment and control groups was not feasible in this situation. Moreover, even if it were theoretically

possible, experimental designs must first have a strong empirical basis for the factors being manipulated. There is not enough of a research basis yet to determine which factors should be varied or held constant in such a study. The nature of this study goes beyond correlational analyses, which could have been used if the goal were only to assess the strength of each factor's relationship to job application or placement rates. Because the intent was to establish each independent factor's relative influence on the outcomes, a multivariate technique was necessary.

The rationale for using two versions of each model (i.e. one with the dependent variable determined through self-report survey data and one relying on administrative data) was two-fold. First, the two methods align to the policy choice that states must make in determining whether they will base their definition of "job placement" on data that may be readily obtained from state sources, or whether they will require (or allow) institutions to survey their graduates to determine who obtained job offers. Survey data is necessary to capture several critical data points that are typically missing from administrative data records, such as whether an individual ever applied for jobs, obtained a job offer out-of-state, was hired in a private setting that is not captured in state administrative records, or declined a job offer. Thus, an administrative definition of "hired" is narrower than what is possible with survey data. However, survey data are limited by the proportion of responses that are received and, thus, may present challenges of their own. The use of both methods in the modeling allowed contrast that may inform state policy decisions about how best to define hiring for their preparation programs. Secondly, this ability to compare and contrast two different ways of defining the dependent variables was intended to provide a check for robustness of the significance of

the independent factors.

Study Sample

The analysis was conducted on the most recent three cohorts of University of Maine System (UMS) traditional teacher preparation program completers for which two years of employment data were available at the outset of the study (i.e. those graduating in 2010-11, 2011-12, or 2012-13). In this time frame, 1,444 completers were reported from the six UMS institutions. The use of three cohorts allowed smaller programs to have a larger number of students included in the study to assist in adequate representation of each.

All students were included in the initial descriptive data analysis. The logistic regression models dependent on survey data were performed on the subset of 286 completers who responded. The administrative data models included 1,300 U.S. residents who met the criteria specified for each model, as described below in the operational definitions.

Survey Instrument Development & Data Collection

A survey of the program completers provided details that were critical for understanding the overall job placement picture. Because administrative employment data are only available for individuals employed in Maine public schools, the survey was needed to determine whether the unemployed completers were in fact teaching in another state or in a Maine private school. In addition, the survey ascertained whether completers applied for teaching jobs at all, the number of job offers received, whether they had institutional support for job placement, and the radius of their search region. The survey instrument is included as Appendix E.

The survey was coded so that individual responses could be linked to the student-level variables obtained from administrative sources. This allowed for a shorter, more efficient survey, as it was possible to omit several variables (e.g. gender, GPA, certification area, etc.) from the instrument. It also reduced reliance on potentially inaccurate self-reported data. Because the survey was electronic, the instrument also incorporated branching logic to move participants efficiently through only the applicable questions.

A draft instrument was administered to ten recent teacher preparation program graduates in summer 2014 (a non-included cohort) to gather feedback on the item construction, and identify potential problems with language or clarity. The instrument captured only descriptive information and not attitudes, beliefs or opinions. Therefore, additional measures to assess internal validity (such as factor analysis) were neither necessary nor appropriate. Based on those results, final edits were made to the instrument.

All program completers in the administrative sample were individually solicited for participation in the web-based survey in December 2014 using e-mail addresses provided from the University of Maine System database. Each individual was sent an email to their UMS-provided account, as well as to any additional or alternate forwarding email addresses on file. In the initial request, participants were requested to respond within three weeks. Reminders were sent to non-respondents after two weeks and on the second to last day. Respondents who wished to be entered into a drawing for a $25 gift card chose to do so by submitting their e-mail address in a separate (and unlinked) form provided at the end of the survey. E-mail addresses of respondents were tracked in order

to streamline the reminder process and ensure respondents only competed one survey, but the e-mails were not linked to actual survey responses to maximize confidentiality. Two hundred thirty-seven (237) individuals (16.5% of those invited) responded within the first time interval.

An invitation letter containing a short URL to link to the survey was then mailed in January to the 1207 completers who did not complete the web survey within the three-week window. Respondents to the letter were asked to include their individualized project ID (provided in the letter) so that their responses could be linked to administrative records. An additional 48 completers participated by this route, for a response rate of 4.0% to the mailed invitations. The total of 285 individuals resulted in an overall response rate of 19.7%.

Administrative Data Sources

Quantitative data was compiled from four existing administrative sources: (1) Maine Department of Education Title II data (DoE-T2), (2) Maine Department of Education Staffing data (DoE-Staff), (3) University of Maine System student records (UMS), and (4) the public Maine Department of Education Data Warehouse (DoE-DW). Data from the survey of recent program completers (Survey) was added to the administrative dataset when complete.

Records from DoE-T2 are the authoritative source of data on traditional program completers, as they are derived directly from annual required teacher preparation program reporting. These sources were used to identify the 1,444 individuals to be included in the analysis. A list of individuals in the DoE-T2 records (with a random project ID number, name and either social security number or date of birth) was provided to staff in the

University of Maine System information department and returned securely to the researcher as a matching key file with only project ID and social security number. Separate files were also provided with the requested UMS variables identified only by the random project ID and UMS ID. The key file containing social security numbers of all completers was then transferred securely to Maine Department of Education (DoE) staff to be matched to a Maine DoE identification number. The updated key file was used to merge data from the DoE-Staff file, including type of employment. A final file obtained from research staff in the Maine Education Policy Research Institute was used to map all Maine residents into one of 35 Labor Market Areas (LMAs) used in Maine's school funding formula, based on their town of residence at the time they first applied to a UMS institution. Once all files were obtained and merged, identifiers were removed and cases were identified only by the random Project ID number.

Operational Definitions

The general terms that require delineation are described in this section. A complete list of independent variables and accompanying definitions is included below in Table 1 in the Data Analysis section. Key operational definitions are as follows:

Program Completer

An individual who has completed all requirements of a traditional preparation program and was recommended for initial Maine certification. It is possible to be a program completer without earning a degree, passing all required Praxis exams, and/or passing a background check, if not required by institutional policies and procedures. There are many cases of post-baccalaureate students who completed programs without earning a second degree and completers who had not taken or passed Praxis II specialty

exams within the data collection window.

Teaching Job

For the purposes of the study, an individual was considered to be hired as a teacher if he or she obtained full or part-time employment as a classroom teacher. This did not include long-term substitute teacher or paraprofessional positions, such as Educational Technicians, that sometime serve as a stepping stone to teaching jobs. For the models based on survey data, teaching jobs in other states or countries, or in private schools, were treated the same as public teaching jobs in state. For the administrative data models, only teaching positions in public schools in Maine were captured.

Traditional Preparation Program

A program housed at a college or university that is approved by the State of Maine Board of Education for providing the courses and clinical experiences for initial teacher certification and that is authorized to recommend students for certification when the individual has met all program requirements. This study included only the six programs housed at public institutions in the University of Maine System, as administrative student data were not available from private institutions.

Variables

Tables 1a to 1d contain a complete list of the variables that were included in the analyses. Several of the variables were derived or composed from other source data points. Data was compiled from four sources: Maine Department of Education certification data, Maine Department of Education staff data, University of Maine System student records (UMS), and program completer surveys. Geographic variables used in separate analyses were obtained from the Maine Department of Education Data

Warehouse, using a list of Maine towns in each teacher labor market area (LMA) provided by the Maine Education Policy Research Institute.

Table 1a, Independent Variables and Definitions (Demographics)

Independent Variable	Source	Type	Definition & Notes
Demographic			
Gender	UMS	Binary	Female or male
Underrepresented Race / Ethnicity	UMS	Binary	Binary variable with white, non-Hispanic students coded as "0"; all other students coded as "1"
Residency	UMS	Categorical	In-state vs. Out-of-state residency, as defined by the University of Maine System for tuition purposes
Mean FAFSA EFC score	UMS	Scale	The Expected Family Contribution (EFC) rating from the Free Application for Federal Student Aid (FAFSA) process; average of all years for which EFC scores are available; the minimum EFC is zero, indicating the highest level of student financial need.
Minimum FAFSA EFC score	UMS	Scale	The minimum EFC score result from any year for which an EFC is reported
Age at Completion	UMS	Scale	Year of birth subtracted from the year of program completion

Table 1b, Independent Variables and Definitions (Student Characteristics)

Individuals' Student Characteristics			
Service Obligation	UMS	Binary	Flag ("1") to identify students who received a Educators for Maine or a NSF Noyce scholarship, each of which requires repayment if the recipient does not teach; all other students coded as "0"
High-need Certification Area	MDoE	Binary	Flag of "1" to identify students prepared in special education, English as a second language, physical science, mathematics, or foreign language; all others coded as "0"
Post-baccalaureate Student	UMS	Binary	Flag of "1" to identify students prepared in post-baccalaureate preparation programs; undergraduate program completers coded as "0"
Program GPA	UMS	Scale	Overall Grade Point Average upon completion of the preparation program, on a scale of 0.0 to 4.0
Praxis I Reading	MDoE	Scale	Highest score on the Praxis I Reading exam by the end of the year of graduation; score range is 150-190; a cut score of 176 is considered passing in Maine
Praxis I Writing	MDoE	Scale	Highest score on the Praxis I Writing exam by the end of the year of graduation; score range is 150-190; a cut score of 175 is considered passing in Maine
Praxis I Math	MDoE	Scale	Highest score on the Praxis I Mathematics exam by the end of the year of graduation; score range is 150-190; a cut score of 175 is considered passing in Maine
Praxis II Score Quartile	MDoE	Scale	1-4 scale indicating the quartile in which the score on the appropriate Praxis II exam fell in the year the test was taken, with 1 being the lowest quartile (0 to 25%); the quartile cut scores differ among subject exams and from year to year

Table 1c, Independent Variables and Definitions (Program & Geographic Factors)

Program Level Factors			
Year Graduated	UMS	Scale	Academic year in which the candidate completed the preparation program: 2011, 2012, or 2013
Institution	UMS	Categorical	Random letter assigned to each of the six UMS institutions to designate which preparation program was attended (A, B, C, D, E, or F)
Institution Group	UMS	Categorical	Similar to Institution with the three smallest institutions (A, E, and F) combined into one group; the four groups were randomly assigned labels 1 through 4 to ensure de-identification in the discussion of model results.
Geographic Variables:		Each of the following variables was calculated for two points in time: 2006 and 2014 for student enrollments, and 2008 and 2014 for FTE teachers. In addition to the counts in each year, the change in counts and percent change in counts was also calculated for the time interval. Thus, there were four variables for each.	
Number of Students in Hometown	MDoE	Scale	Resident pupil enrollments in the town where the student lived at the time of application to the preparation program
Number of Students in Hometown LMA	MDoE	Scale	Resident pupil enrollments in the Labor Market Area (LMA) where the student lived at the time of application to the preparation program. There are 31 LMAs in Maine; for scale, Maine has 16 counties, thus LMA is a smaller geographic area than counties but encompasses multiple school districts
FTE Teachers in LMA	MDoE	Scale	Number of Full-time Equivalent classroom teachers in the LMA

Table 1d, Binary Dependent (Outcome) Variable Definitions

Dependent Variable	Source	Model	Definition & Notes
Applied for Job	Survey	1	Applied for a teaching job in any location or school setting, including provate schools and out-of-state; self-reported
Certified	MDoE	1	Obtained Maine provisional teacher certification in any endorsement area; requires meeting all eligibility requirements and application for the credential, including all paperwork, passing exam scores, program recommendation, a background check, and application fee
Hired	Survey	2	Received at least one educational job offer, as reported by the survey respondent; does not require that the candidate accepted the job offer
Hired in Maine Public School	MDoE	2	Candidate was certified in Maine and matched to state employment records for schools receiving state funding and was further identified as holding a teaching position within two years of program completion
Placed	Survey	3	Candidates who applied for jobs, received a job offer, and accepted a position in any setting or location
Placed in Maine Public School	MDoE	3	Similar to hired in Maine public school, but for all candidates (with non-certified individuals counted as not placed)

Data Analysis

The data set was assembled from the quantitative data sources and program completer survey using identifier variables. When matching was complete, any individual information used for data linking (name, social security number, etc.) was deleted from the dataset. Descriptive statistics for all variables were analyzed to evaluate distributions and identify the presence of potential outlier cases that may have influenced results.

Because logistic regression is based on the generalized linear model, it can robustly handle non-parametric variables that would require transformation for use in

strictly linear techniques such as multiple regression. This was an advantage for the logistic regression method, since the distribution of the variables in the three cohorts of program graduates was not known and may not have met assumptions of normality.

Next, the survey respondent pool was analyzed to determine representation of the six preparation providers, gender, race/ethnicity, age, and in-state vs. out-of-state residents. Correlations between all variables were next evaluated to identify potential overlap and interactions that may have affected the inclusion of variables in the logistic models (i.e. collinearity).

Prior to building the logistic regression models, each variable was analyzed to assess its relationship to each of the binary dependent (outcome) variables.
In the case of categorical variables, this was accomplished by Chi-square tests of significant differences in frequencies between the outcome groups (i.e. applied vs. not applied, hired vs. not hired, etc.). Two-tailed t-tests were performed for continuous variables, comparing the means of each group as independent samples.

The results of these tests were used to determine which factors to include in the logit models, using a $p=0.10$ significance level as the threshold for inclusion. A lower p-value threshold was employed (90% rather than 95% confidence level) because of the exploratory nature of the study. The regression analyses have the potential to identify effects that exist in interaction with other variables and may be obscured in single-variable tests of significance. A more inclusive standard was used in order to decrease the chances of false negative findings about factors with borderline significance.

Finally, the logistic regression models were created using all variables that appeared to have influence on the outcome variables based on the descriptive statistical

analysis. As expected, not all of the variables could be sustained in the models, either due to weak relationships or to overlap with other independent variables. The logistic models based on administrative data were run using the data available for all U.S. residents. The survey data models were attempted using the data points observed for the 284 survey respondents.

When the model results were complete, the results of the parallel models were compared to discern whether the same factors were identified as statistically significant, and with what magnitude. Results were then considered through the lens of research questions and hypotheses, as described in the following section.

Research Hypotheses

Model Set 1: Job Application. Based on the findings of the prior research described in Chapter 2, research hypotheses were proposed for variables that have been found to influence individual decisions to enter the teaching job market by applying for positions. It was predicted that the following variables would be significant in the model of job application behavior: (1) GPA, (2) gender, (3) ethnicity, and (4) age. In addition, it was hypothesized that individuals who received financial support with an attached teaching service obligation (e.g. an Educators for Maine loan) would be significantly more likely to apply for jobs. The null hypothesis was selected for all other variables in the model: low-income status, in-state residency status, type of undergraduate major, certification area and grade level, Praxis test scores, and institution attended. Statistical significance of individual predictor variables was determined using the Wald test of significance. Calculation of each predictor's impact on the odds ratio provided another way to gauge the relative weight of each factor in the model. In addition, it was

hypothesized that the overall model of job application behavior would be significant compared to the null model. This was assessed using the Chi-square test compared to the null model of no predictor variables. The percent of correctly classified cases also provided a measure of the overall model's explanatory power. While logistic regression does not have a direct measure of the amount of variance accounted for in the model, as the R^2 measure does for OLS regression techniques, Nagelkerke's R^2 value was a helpful "pseudo" measure. The Nagelkerke R^2 provided an indication of how much each fitted model improved upon its null model (with no independent variables) in successfully predicting the dependent outcome.

Model 2. The following variables were expected to have a significant role in predicting whether job applicants were hired, based on prior research: (1) GPA, (2) gender, (3) ethnicity, (4) age, and (5) whether they were prepared in a high-need certification field. All other variables in Table 1 were tested using the null hypothesis. The overall model of job hiring was hypothesized to be significant compared to the null model. As in the case of the first model, significance of individual predictor variables was determined by the Wald test, and the overall model was assessed using chi-square analysis and Nagelkerle R^2 pseudo measure of improved predictive power.

In summary, a survey was conducted on three cohorts of graduates from teacher preparation programs in the University of Maine System. Survey results were combined with administrative data, and logistic regression was used to model the factors that predict job application, hiring, and overall job placement. Details about the results of the analysis are discussed in the following chapter.

Chapter 4: Results and Findings

The purpose of this research study was to separately investigate the independent factors that are related to whether teacher preparation program completers apply for teaching jobs and are hired by schools and to identify which factors are most predictive of overall job placement for all completers. This study employed logistic regression to identify these factors in a causal comparative design using data on job outcomes for three recent cohorts of program graduates from Maine's public university system.

The results of the analysis are categorized in six sections. The first describes the process of conducting the study, and includes some challenges that impacted the analysis. The process challenges themselves have policy implications that are discussed in subsequent chapters. The second category provides the results of the program completer survey. Next, the initial analysis of each independent variable's relationship to the three outcome (dependent) variables is summarized. Category four contains the findings from the subsequent logistic regression modeling and focuses on overall model results. The fifth section discusses the results of each individual factor in order to synthesize preliminary significance tests, survey findings, and model results and compare relative importance. Analysis is also provided for selected variables that appear to interact with other factors. The sixth and final section describes the exploratory efforts to investigate the impacts of geographic differences using data from a subset of completers.

Process Findings: Challenges in Data Collection & Compilation

This report section addresses three types of general challenges that arose in the course of conducting the study: (1) survey response rates, (2) availability of administrative data, and (3) ability to match data from various sources. As will be

discussed in subsequent chapters, these findings are more than just research details, as the data collection process in this study closely resembles the types of activities institutions may need to undertake in preparing data about their job placement rates. Institutions and their state education agencies may encounter similar obstacles.

Survey Response Rates

The first and largest challenge in this study was a lackluster survey response rate. The study design relied on direct report information obtained by surveying program graduates to capture data that are not available in administrative records. In December 2014, a survey was conducted of all 1,444 University of Maine System teacher preparation program completers in 2010-11, 2011-12, and 2012-13. A total of 285 individuals initiated the online survey by responding to an email (237 respondents) or mailed invitation (48 respondents), for a total response rate of 19.7%. Of the 285 initial respondents, 26 discontinued the survey before responding to a question about the outcome of their job search, rendering their data unusable in analyses related to hiring outcomes. Thus the pool of usable data was even smaller (259 of 1,444 completers, or 17.9%). The standard error for this sample proportion was 2.38%.

The overall number of respondents (285) does not raise general concerns about the ability to conduct basic statistical analyses; the rule-of-thumb threshold of 25 to 30 cases for functions such as means and t-tests was well surpassed. However, it was of concern that two institutions (A and E) had fewer than 10 respondents each, and institution F had a borderline response of 27. This may compromise the ability to analyze differences across institutions using survey data. If institutional affiliation plays a substantial role in job application or hiring outcomes (as would be the case if, for

example, program reputation is a strong factor in hiring considerations), then the small numbers of cases from some institutions would make that relationship harder to detect with confidence. Using the G*Power software application, a sample size of 10 would require an effect size of .89 to correctly detect a significant t-test difference with p=.05 and a power level of 80%. An effect size of 0.89 is considered large (Cohen, 1988). Given the exploratory nature of this research, a greater sample size was desirable so that smaller effect sizes can be detected.

The pool of survey respondents was not significantly different from the overall group of program completers with respect to gender, residency status, race / ethnicity, and year of graduation. However, there were significant differences in the levels of institutional representation (comparison group E, "Institution Attended"). The response rate varied from a low of 13.2% at Institution B to a high of 29.5% at Institution D. Given the overall standard error of 2.38% for the overall proportion of 17.9% complete survey respondents, these discrepancies are quite large—2.0 standard errors below the overall rate for Institution B and 4.9 standard errors above for Institution D.

There was also a significantly higher response rate from individuals who were known from administrative records to be employed as a teacher in a Maine public school than from those who were not matched to Maine teaching jobs (comparison group F, "Employment Outcome in Maine"). Individuals hired in Maine were more likely to complete the survey (22.4%) than non-hired individuals (17.3%), raising additional concerns about the representativeness of the survey data. These response rates differ by 2.1 standard errors. Appendix B provides more details on the results of chi-square tests of significance for the differences in survey response rates by various student

characteristics.

Lastly, the results of subsequent analyses suggested that the survey respondents were not similar in age to the overall pool of completers. Further analysis revealed that the survey respondents were significantly older than the non-respondents, with an average age of 28.0 compared to 25.7 ($t(352.1)=-4.40$, $p<.000$).

Administrative Data Availability and Data Matching Challenges

There were several data points that are important for depicting job placement (and the related CAEP-required measures of job retention) that were not available from institutional or state administrative records. Institutions themselves do not track schools where graduates are hired within the central University of Maine System student information system. Anecdotal reports suggest that some programs may have internal records to track graduates, but these are not systematically collected in a way that institutional researchers, or system level representatives, could compile data. Moreover, these data are often provided when a recent graduate obtains a job offer and shares the news with faculty and may not reflect last-minute changes or moves over time. The data is often incomplete as it relies on self-reporting. Maine institutions do not currently have the ability to look up completers in state records to determine in-state placements, though this is a feature that is anticipated to be included in a new state certification records system.

In the reverse direction, the Maine Department of Education has information about newly-hired teachers but does not currently have accurate identification of the preparing institution within the *staff* records system. Staff records contain an "institution attended" field that typically lists the bachelor's degree institution, so individuals

prepared in post-baccalaureate pathways are misidentified. It is also difficult to distinguish experienced teachers who are new to a position from first-time teachers, as data files with position details do not contain the unique state ID associated in other staffing files. This is especially challenging for experienced teachers moving to Maine from another state. As a result, it would not be straightforward for the Maine Department of Education to compile job placement rates in the current system. It is unclear whether the new state certification records system and parallel changes in staff data collection will improve this capacity.

Lastly, no data collection system is in place in Maine to identify candidates who do not seek teaching employment. States that provide a central system for job applications for public school positions are one step closer to being able to compile such data. Implications for establishing operational definitions of job placement measures within these data limitations are discussed in the conclusions.

Process Findings Summary

The challenges encountered in this study included small numbers of students at some institutions, varying representativeness of survey respondents, the existence of data in usable formats, and the ability to match employment data to teacher preparation program completers. These challenges are likely not unique to Maine.

Survey Results

Setting aside the aforementioned concerns of survey representativeness, the results from the 285 respondents were, nonetheless, informative. The first item on the survey asked respondents whether or not they applied for teaching jobs within two years of completing their program. Twenty-eight respondents (9.8%) did not apply for

teaching jobs of any kind. Connected to the study context, this means that institutional job placement rates would be expected to be about 90% at a maximum, even if every applicant was hired. It is also plausible that the actual prevalence of non-applicants may be higher, since non-hired graduates were less likely to respond to the survey.

Job Application Process

Most of the non-applicants (24 of 28) provided at least one reason for not pursuing teaching jobs in an open-ended item. The responses were grouped into themes which are provided below, along with the number of non-applicants mentioning each reason (respondents could choose more than one reason):

- Lack of jobs that fit their criteria: 46%
- Wanted to try something else or pursued another opportunity: 38%
- Changed mind / no longer wished to teach: 29%
- Relocated out of Maine and did not apply in new location: 17%
- Did not feel prepared/ready for teaching: 13%
- Misc: Had a bad student teaching experience (8%), Low pay (8%), Competing family needs (spouse's job, childcare) (4%), not confident in job application skills (4%), Unable to pass certification exam (4%).

While the number of non-applicant respondents was low, these results highlight the importance of candidates' individualized needs and concerns in their decision not to enter the job market. Program completers had a variety of reasons for not pursuing teaching jobs, and many of these reasons (though not all) are beyond the power of institutions to influence positively.

Next, the survey asked job applicants to provide more detail about their

application process. Only 234 of the 257 job applicants continued the survey at this point. A summary of the quantitative factors related to job applications queried in the survey is provided in Table 2.

Table 2, Job Application Process Characteristics (N=234)

	Mean (Std.Dev.)	Median	Min.	Max.
Number of positions applied for	16.7 (24.4)	7	1	150
Radius of job search (in miles, one way; excluding international)	159.9 (455)	40	2	3000
Travel to accepted teaching position (in miles, one way; excludes international)	109.1 (599.5)	20	1	360

As expected from prior research, geography played a role in the graduates' job application process. Less than half of those who applied for education positions (101 of 234 respondents, or 43%) applied for a position that would require relocating.

The applicants also provided information about the types of supports they received from various sources with their pre-service experience. Table 3 reports the percentage of respondents that indicated they received support from each source listed. The most frequent source of each type of support is indicated in boldface.

Table 3, Job Application Supports

Type of Support	Faculty Member	Mentor teacher	Education Program Staff	Career services office	Other person
Provided letter(s) of recommendation	70%	**89%**	44%	1%	24%
Told me about expected job opening(s) I could apply for	20%	**35%**	15%	6%	29%
Gave me advice on my resume or other application materials	35%	**42%**	27%	16%	28%
Helped me gather transcripts and other required application materials	17%	12%	17%	9%	**23%**
Other Support*	15%	**17%**	10%	3%	13%

***** *Activities reported as "Other support" included interview preparation, advice on positions, superintendent panel discussion, general support and encouragement*

These responses indicated that candidates relied most often on their mentor teachers from their pre-service internship / student teaching experiences during their job application process.

Job Application Outcomes

The next series of survey items investigated the outcomes of the job application process, including characteristics of the positions that new graduates accepted. Of the 234 respondents who applied for a teaching job, 201 (86%) received an education-related job offer. Only three individuals (1.5%) declined a job offer and, as a result, did not obtain employment. Table 4 summarizes the outcomes for those individuals who received a job offer.

Table 4, Newly Hired Graduate Outcomes (N=184)

Position Characteristic	*Percent*
• New hires who relocated for a job	24.5%
• Hired at a private school	13.7%
• Hired outside of Maine	14.8%
• Completed student teaching in the district where hired	28.8%
Types of Education Positions Accepted	*Percent*
• Full-time classroom teacher (Including pre-K)	59.1%
• Educational technician (paraprofessional)	17.2%
• Part-time classroom teacher	10.8%
• Teacher in specialist setting (ELL, Special Ed / Resource room, technology integrator, distance learning, physical education, culinary arts)	5.4%
• Substitute teacher	2.7%
• Other (after school program, family support coordinator, environmental educator, band director, international)	4.8%

This table shows several noteworthy data points. First, while 43% of respondents applied for a position that would require relocation, only 24% of those hired actually needed to relocate, suggesting a matching preference (on one side or the other) for local applicants.

In other words, schools may have been more likely to offer positions to local candidates, or applicants may have selected more local positions among multiple offers received. Secondly, a number of respondents obtained employment in contexts that would not appear in state administrative employment data—13.7% in private schools, and 14.8% outside of the state. Over one in four hired applicants (28.8%) had a connection to their employing school district because they completed their student teaching experience in one if its schools. Lastly, the individuals were hired into a wide variety of education positions.

During the course of the analysis, it became apparent that the attrition of 26 individuals between the survey questions relating to job application and job search outcomes (hired or not) were impactful. These 26 respondents represented 10% of the respondents that had applied for jobs. The average age of these respondents was 26 years as compared to 28.5 years for those who completed the survey, which was significantly different ($t(39.4)= 2.00$, $p=.05$). Given the aforementioned finding that the survey respondents as a group are already significantly older than non-respondents, this further raises concerns about the validity of survey data for items relating to hiring outcomes, particularly the impact of age.

Survey Results Summary

In summary, the survey results demonstrate that Maine program graduates, like their peers in prior studies, prefer teaching jobs in schools near to where they live. Completers rely on their pre-service mentors in their job searches, and over one quarter of those hired were known to their hiring district as student teachers.

Additionally, a substantial portion of graduates hired in education-related jobs

were not full-time classroom teachers in public schools within the state. One in eight hired graduates joined a private school, and nearly one in six was hired outside of Maine. Only approximately two-thirds of hired graduates served in full-time teaching jobs; the rest worked part-time or in some other educational or support capacity. These results demonstrate the importance of establishing clear definitions for what it means to be "employed" in education upon completing a preparation program.

Logistic Regression Model Overview

The remainder of the data analysis focused on the exploration of the four research questions through logistic regression models. Each of the questions was investigated with two different models, using survey data for one analysis and administrative data for another.

Conceptually, the first pair of models investigated teacher supply in modeling the variables that relate to whether or not program graduates apply for teaching jobs. Model "**1-Survey**" used survey data to identify the factors that were related to completers' decisions to apply for teaching jobs in any location. Model "**1-Admin**" used administrative data to identify the factors that were related to completers' intent and eligibility to apply for Maine public school teaching jobs, as indicated by attainment of a Maine teaching credential.

The second pair of models can be seen as describing teacher demand and considered the factors that predict whether or not job applicants were hired. The **2-Survey** model identified the factors that were related to job applicants' successful receipt of a teaching job offer in any locale and setting, as reported by the survey respondents. The **2-Admin** model identified the factors that were related to a successful hiring match

in a Maine public school for completers who demonstrated intent and eligibility for such jobs through attainment of a Maine teaching credential. In these analyses, only data from job applicants (or certified individuals) were included. These are described in this study as the "Hiring" models.

The third set of models looked at the entire pool of completers to identify the factors that were related to overall job placement, encompassing both the supply and the demand sides. Model **3-Survey** was designed to identify the factors that were related to any completers' successful placement in a teaching position in any locale and setting using survey data. The **3-Admin** model identified the factors that were related to completers' successful placement in a Maine public school teaching position. This outcome variable required that a graduate both applied for and received and accepted a job offer. These were termed the "Placement" models.

The section that follows provides details of the initial exploration of each independent variable's relationship to the three outcomes of interest, which were used as the basis to determine which variables to include in the subsequent logit models. This is followed by the results for the survey models, and then the administrative models. As described in the methods section, additional models using only Maine residents were also explored to assess the influence of the size and strength of the job market in different geographic areas in Maine. These results are discussed in a separate section.

Preliminary Relationships of Individual Factors to Outcomes

In the initial analysis, the relationship of each independent variable to each of the three dependent variables was analyzed: (1) job application, (2) hiring of job applicants, and (3) hiring of all graduates. For categorical variables, Chi-square tests were

performed to evaluate whether different groups reflected different outcomes; t-tests were performed with continuous variables to assess whether means of each outcome group were significantly different. Tests were first run using data from the survey respondents, and then analyzed separately using administrative data.

Overriding Impact of Residency Status in Administrative Data

This initial chi-square analysis highlighted an important relationship in the administrative data between country of residence and the dependent variables. While 76.5% of the overall sample of graduates obtained certification in Maine (1104 of 1444 graduates), only 4.3% of Canadian students were certified (6 out of 140). It is not known whether this reflects true behaviors or is an artifact of the data matching process since Canadian students typically do not have social security numbers (the primary and most accurate basis for matching to state records). Because there are immigration policies that meaningfully affect the ability for international residents to obtain employment in Maine, and because the empirical data show that Canadians are very different from US residents in Maine hiring outcomes, international students were excluded from further analysis in the study. This reduced the administrative study sample from 1444 to 1304 graduates.

Preliminary Relationships for Other Individual Factors

Complete details for the Chi-square and t-test results, including mean values, are included in Appendix B. The summary of results below provides an at-a-glance depiction of the factors that appear to relate to each of the three outcomes at an exploratory 90% confidence level ("ns" indicates a lack of significance at p=.10 level). Administrative data include only U.S. Residents. Each of the three outcomes relates to its respectively numbered research question, and each outcome was explored with both survey data and administrative data available for all completers. By looking at each

independent variable's level of significance across all of the columns, one can readily identify which factors are influential in any model, and how the significance varies across each outcome. Bold font is used to distinguish significance levels below p=.05.

Table 5, Chi-Square / t-Test Significance values, p < 0.100

Independent Variable	**1. Application**		**2. Hiring**		**3. Overall**	
	Survey	Admin	Survey	Admin	Survey	Admin
Number of Cases (N)	*285*	*1304*	*231*	*1100*	*259*	*1304*
Residency (In-state)	*ns*	**.000**	*ns*	**.000**	*ns*	**.000**
Gender	*ns*	*ns*	*ns*	*.127*	*ns*	*ns*
Underrepresented Race/Ethnicity	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Graduation year	*ns*	**.004**	*ns*	**.027**	*ns*	**.001**
Institution Attended	.100	**.000**	*ns*	**.000**	*ns*	**.000**
Teaching Service Obligation	*ns*	**.000**	*ns*	**.023**	*ns*	**.000**
High-need Certification Area	*ns*	**.000**	*ns*	**.000**	*ns*	**.000**
Post-Baccalaureate Program	.086	**.000**	*ns*	**.000**	*ns*	**.000**
Program GPA	**.023**	**.000**	*ns*	**.000**	**.018**	**.000**
GPA Z-score		**.000**		**.000**		**.000**
Praxis I Reading	*ns*	**.002**	*ns*	**.001**	*ns*	**.000**
Praxis I Writing	**.030**	**.010**	*ns*	**.002**	*ns*	**.000**
Praxis I Math	*ns*	.084	*ns*	**.000**	*ns*	**.000**
Praxis II Score Quartile	*ns*	.061	*ns*	**.023**	*ns*	**.005**
Mean FAFSA EFC score	*ns*	*ns*	*ns*	**.040**	*ns*	.072
Minimum FAFSA EFC Score	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Age	.081	**.034**	**.000**	*ns*	*ns*	**.026**

Note that the above table contains two different variables representing GPA. The first contains the unadjusted cumulative GPA upon completion of the teacher preparation program, irrespective of whether the candidate studied at the undergraduate or post-baccalaureate levels. Because graduate programs have different grading practices than undergraduate programs, including higher minimum grade standards for remaining in good academic standing, the GPAs of undergraduates and post-baccalaureates may not be directly comparable. A t-test showed significant differences between the average GPA of undergraduates (3.41) compared to graduate students (3.88), ($t(1302) = -22.44$, $p < .001$).

Thus a second GPA variable was generated using the z-score of the GPA relative to the candidates' peers, i.e. undergraduates are compared to other undergraduates and post-baccalaureate students are compared to other graduate students.

The above summary table shows that several factors appeared to influence job application and hiring outcomes at an exploratory level. It also highlighted that the survey data was less successful than the administrative data in identifying these relationships. In almost all cases, the factors that surfaced in the survey data were also significant in the parallel administrative data; however, the administrative data showed additional relationships that were not present in the survey data analysis.

Survey Model Results

The survey data did not produce robust logit models for any of the three outcome variables. The small number of respondents was insufficient for multivariate modeling, particularly with a pool where proportions of cases are lopsided with respect to the dependent variables. Namely, the fact that only 28 respondents represented the binary category of "did not apply for jobs" in Model 1-Survey and only 36 represented "did not receive a job offer" in Model 2-Survey created difficulties for the analysis.

Table 6, Survey Response Counts by Dependent Variable

	"Yes" category	"No" Category
Graduates Applied for Job	257	28
Applicants Hired for a Job	198	36
Overall Graduates Placed	195	64

Although several variables had significant relationships (at the 90% confidence level) with one or more dependent variables as shown in Table 5—namely, institution attended, post-baccalaureate program completer, program GPA, Praxis I Writing, and age at graduation—the small number of cases in the "no" categories did not provide adequate

information about the variety of possible values for each of these factors. When the logit analysis of job application was attempted with these independent variables, the resulting model resolved to just a single predictor (program GPA) and was not a successful model. It predicted that 100% of cases applied for a job (i.e. there were no cases that were predicted in the "no" category) and had zero increase in the percentage of cases correctly classified.

Model 2-Survey only had one independent variable, age at graduation, with a significant ($p<0.10$) relationship to hiring outcomes for job applicants. Thus, a multivariate model was not attempted. Moreover, the age relationship in 2-Survey was different than for the parallel administrative model, which had no significant relationship for age. In the survey respondents, younger applicants were more likely to be hired, where the administrative data showed a non-significant edge for older individuals in obtaining job offers. As discussed in the prior sections about survey representativeness, this raised questions about the validity of data from the 36 not-hired job applicants in the survey data. Their average age of 33 is substantially higher than the overall average age of the sample (about 26).

As mentioned in the survey results section above, there was a sizeable attrition in the survey. Of the 257 individuals who indicated that they had applied for a job, only 231 continued in the survey to answer whether or not they had received a job offer, and the 26 individuals who quit the survey were significantly younger than those who continued. Moreover, two of the individuals who were in the not-hired category, both over the age of 55, specifically identified their age as a reason they were not hired in an open-ended item. Thus, results of model 2-Survey are suspect with respect to the

importance of age on hiring, and potentially spurious.

As would be expected from the results of models 1-Survey and 2-Survey, a multivariate solution was not found for the overall job placement model (3-Survey). Model 3-Survey was very similar to model 1-Survey with only program GPA surviving in the model and the model predicting that all cases were placed in a job.

In summary, attempts to build multivariate regression models from a survey pool of less than 300 respondents were disappointingly unsuccessful. It would appear that the small numbers of individuals in various subgroups were insufficient for this statistical analysis.

Administrative Model Results

1-Admin (Certification Attainment)

The first of the administrative models explored the factors related to job application intent via the proxy variable of obtaining Maine teacher certification. While it is not a direct measure of whether or not an individual applied for teaching jobs, receipt of Maine teacher certification is an indication that the completer took action towards applying for Maine public school jobs, and met state eligibility criteria. Thus, this model is useful for understanding Maine teacher supply.

Of the twelve independent variables that showed a significant relationship to obtaining Maine certification, six factors remained in the final model solution: (1) state of residence, (2) GPA, (3) post-baccalaureate status, (4) financial commitment to teach, (5) study in a high-need certification area, and (6) year of graduation. As an exploratory model, a threshold of p=.10 was used to retain variables. As described above, two

different GPA variables were attempted; the results of both model versions are included in Table 7.

Table 7, Model 1-Admin, Factors Related to Attainment of Maine Teacher Certification (US Residents)

	Unadjusted GPA Model			Standardized GPA Model		
Factor	Sig. (p-value)	Model Coeff. (B)	Odds Ratio	Sig. (p-value)	Model Coeff. (B)	Odds Ratio
Program GPA	.000	1.178	3.246	--	--	
Post-Bacc Program	.020	.822	2.276	.000	1.368	3.929
In-state Resident	.000	.969	2.635	.000	.982	2.669
Teaching Service Commitment	.041	.709	2.032	.038	.720	2.054
High-need Certification Area	.031	.653	1.922	.030	.660	1.935
GPA Z-score	--	--	--	.000	.391	1.479
Graduation Year	.006	-.284	.753	.007	-.282	.754
Constant	.007	567.2	--	.006	568.1	--

The six variables that did not survive in the multivariate model were institution attended, age at graduation, and the four variables related to Praxis test scores. This may suggest that at least some of the variance that causes these variables to have a significant chi-square or t-test relationship with certification is also explained by another variable that is in the model. Additional analysis to explore possible collinearity between variables is included in a section below where results are provided for each individual factor. Both model versions were significant and produced roughly similar results.

Table 8, Model 1-Admin Statistics

	Unadjusted GPA Model	Standardized GPA Model
Number of Cases (N)	1284	1282
Model Chi-Square (df) and significance	106.41 (6), p<.001	105.17 (6), p<.001
Increase in % Correctly Classified	+ 0.2%	+0.3%
Hosmer & Leshow Sig.	.545	.609
Nagelkerke R^2	.142	.140

The overall explanatory power of this model is not large—only approximately 14% of the possible predictive power of the model is embodied in these six variables, as estimated in the Nagelkerke pseudo-R^2 measure. The model only improves slightly (0.3% for the standardized GPA model, from 85.6% to 85.9%) upon the percent of correctly classified cases. This implies that there are additional factors that influence certification status that were not observed in the data.

2-Admin (Hiring Factors)

The model of hiring factors, i.e. predicting which of the certified completers is matched to a Maine public school teaching position, differed from the application model in several ways. All of the factors that were significantly related to attaining Maine certification were also related to hiring. However, the relative importance of the factors shifted; in particular, being in a post-baccalaureate program was less influential in hiring than for certification and having certification in a high-need subject area was more important. This was evidenced by the odds ratios and relative rank of these variables compared to the Application model. In addition, the two variables of institution attended and age at graduation did not survive in the certification model but were significant in hiring, as summarized in Table 9, with the overall model results set forth in Table 10.

Table 9, Model 2-Admin – Factors Related to Hiring of Maine Certified Teachers

	Standardized GPA Model		
Factor	Significance (p-value)	Coefficient (B)	Odds Ratio (Exp(B))
In-state Resident	.000	1.033	2.810
High-need Certification Area	.000	.876	2.402
Post-Bacc Program	.075	.458	1.582
Institution Group 1 vs. 2: 3: 4:	.031	.325 .644 .561	1.384 1.905 1.752
Teaching Service Commitment	.101	.345	1.412
GPA Z-score	.000	.304	1.355
Graduation Year	.007	-.221	0.802
Age at Completion	.017	-.026	0.974
Constant	.007	444.4	--

Table 10, Model 2-Admin results

	Standardized GPA Model
Number of Cases (N)	1097
Model Chi-Square (df) and Significance	107.60 (10), p<.001
Increase in % Correctly Classified	+3.4%
Hosmer & Leshow Sig.	.787
Nagelkerke R^2	.127

The overall strength of the model was comparable to the certification model (with an R^2 indicating 12.7% of the variance is explained). The modest 3.4% increase in correctly classified cases again suggested that much more is at play in determining hiring outcomes than was captured by the available variables in the study.

3-Admin (Job Placement)

The final administrative model describing the overall job placement of all graduates was very similar to the model of hiring factors. As Table 11 illustrates, all of the same variables were significant, and in roughly the same ranked order.

Table 11, Model 3-Admin of All Graduates' Job Placement

	Standardized GPA Model		
Factor	Significance (p-value)	Standardized Coefficient (B)	Odds Ratio
In-state Resident	.000	1.207	3.343
High-need Certification Area	.000	.882	2.417
Post-Bacc Program	.008	.633	1.883
Teaching Service Commitment	.023	.445	1.561
Institution Group 1 vs. 2: 3: 4:	.047	.249 .591 .454	1.282 1.805 1.574
GPA Z-score	.001	.360	1.434
Graduation Year	.001	-.258	.772
Age at Completion	.042	-.022	.979
Constant	.001	618.9	--

The overall job placement model was slightly stronger than the prior two models, and had approximately a 12% improvement in correctly classified cases compared to the null model. However, it still explained only a fraction of the overall variability in job placement outcomes, with an overall R^2 explaining 17.4% of the variance as shown in Table 12.

Table 12, Model 3-Admin Results

	Standardized GPA Model
Number of Cases (N)	1281
Model Chi-Square (df) and significance	178.48 (10), p<.001
Increase in % Correctly Classified	+11.7%
Hosmer & Leshow Sig.	.322
Nagelkerke R^2	.174

Administrative Models Summary

For convenience, Table 13 provides an abbreviated summary of the factors that were significant across the three administrative data models by providing the odds ratios and the 95% confidence interval of the odds ratios for each independent factor.

Table 13, Summary of Significant Factors in Administrative Models

	1. Application	2. Hiring	3. Overall Job Placement
Individual Factors	*Odds Ratio (95% CI)*	*Odds Ratio (95% CI)*	*Odds Ratio (95% CI)*
In-state Resident	2.67 (1.66-4.29)	2.81 (1.63-4.83)	3.34 (2.03-5.51)
High-need Certification Area	1.94 (1.07-3.51)	2.40 (1.63-3.54)	2.42 (1.69-3.45)
Post-Bacc Program	3.93 (2.05-7.52)	1.58 (.95-2.62)	1.88 (1.18-3.01)
Teaching Service Commitment	2.05 (1.04-4.06)	1.41 (.94-2.13)	1.56 (1.06-2.29)
Institution 1 vs. 2: 3: 4:	--	1.38 (1.00-1.92) 1.90 (1.15-3.16) 1.75 (1.05-2.92)	1.28 (.95-1.73) 1.80 (1.14-2.87) 1.57 (1.00-2.49)
GPA Z-score	1.48 (1.25-1.74)	1.36 (1.18-1.56)	1.43 (1.26-1.63)
Graduation Year	.75 (.62-.92)	.80 (.68-.94)	.77 (.67-.90)
Age at Completion	--	.97 (.95-1.00)	.98 (.96-1.0)

Table 14, Administrative Model Statistics

Number of Cases (N)	1,282	1097	1,281
Model Chi-Square (df) and Significance	105.17 (6), p<.001	107.60 (10), p<.001	178.48(10), p<.001
Increase in % Correctly Classified	+0.3%	+3.4%	+11.7%
HosmerLeshow Sig.	.322	.787	.322
Nagelkerke R^2	.127	.127	.174

The demographic variables that were not significant predictors in any of the models were (1) being of an underrepresented race or ethnicity, (2) mean FAFSA expected family contribution score, and (3) minimum FAFSA expected family contribution score. In addition, none of the standardized test scores (Praxis I Reading, Writing, or Mathematics or the Praxis II exam quartile) were significant in any of the three models. Factors that were significantly related to attainment of Maine certification were (1) in-state residency status, (2) pursuing a high-need certification area, (3) post-baccalaureate preparation program, (4) receipt of financial support with an affiliated teaching service obligation, (5)

relative GPA, and (6) graduation year. All of those factors were also significant in hiring and overall placement, along with two additional factors of institution attended and age at graduation.

Results for Individual Factors

To set the foundation for identifying the potential ways in which the variables included in this study may be influenced by institutional policies, it is helpful to consider each single independent variable and synthesize what was seen in the Chi-square or t-tests, which of the administrative models it seems to influence, how it may interact with other factors, and its relative importance compared to other available variables. To aid in identifying patterns, the independent factors are considered in three clusters: (1) demographic variables, (2) individual student characteristics related to their preparation, and (3) institutional or contextual factors related to their program. Geographic variables are considered in a separate section.

Demographic Variables

State of residency

As described in several sections of this study, the state and country of residency was an overriding factor in the administrative models. In-state residency status was the single most influential factor in both obtaining certification and being hired into a Maine public school. All other factors held equal, in-state residents were 2.67 more likely to become certified in Maine, 2.81 times more likely to be hired in a Maine public school, and 3.34 times more likely to be placed in a job than out-of-state residents. The standardized coefficient in the overall placement model was the largest of all at 1.207.

The finding that residency status was not significantly related to any of the three outcomes in the survey data analysis is less conclusive. The small number of out-of-state students in the survey sample (only 13 who applied for jobs and completed the survey) made it difficult to have confidence in the findings. However, this does provide some support for the supposition that, with more complete and accurate data from program completers about the full range of application and hiring outcomes (including out-of-state and private school jobs), the differences between residency groups may be diminished or even nonexistent.

Race and Ethnicity

Students from underrepresented racial or ethnic groups did not have significant differences from white non-Hispanic students on any of the three outcome variables in either preliminary significance tests, survey data models, or administrative data models.

Gender

As with underrepresented race or ethnicity, the impact of gender in this study did not reflect patterns seen elsewhere in prior literature. The "model 2" hiring rate of males was only six percent higher than that of females, which was not statistically significant ($p=.13$). The total number of males in the administrative data study (248) was substantially larger than the number of individuals from underrepresented groups, which provides greater confidence that this is a true non-effect.

Age

The influence of age on job placement outcomes showed conflicting patterns in the parallel survey and administrative models. In both models, older graduates were more likely to apply for teaching jobs (as defined by attainment of initial Maine

certification in the administrative data model). However, this factor disappeared in the multivariate regression models, even when attempted as an interaction term. The factor was significant in initial modeling attempts until the addition of the post-baccalaureate indicator. Since post-baccalaureate students are, on average, older than undergraduate students, this signals that there was not a discernable affect of age on application behavior above and beyond the degree level in this study.

The initial analyses of age and hiring outcomes, however, showed conflicting results. The survey data showed a significant and negative t-test effect for older job applicants. The average age of hired individuals was 28, while the average age of the 32 non-hired applicants was 34. In the administrative data, the average age of 26.4 for hired applicants was not significantly higher than the mean age of 25.8 for non-hired applicants ($p=.170$). The multivariate model of hiring was not attempted with survey data due to the lack of other factors with a significant chi-square or t-test relationship and the concerns about survey representativeness with particular respect to age.

Interestingly, though, the influence of age did surface in the multivariate administrative model. Although the t-test for age between hiring groups was *not* significant at the $p=.10$ level, age was included in a later stage of the exploratory model development in an effort to understand these conflicting results. In this model, age was a significant and *negative* factor in the final hiring and overall placement models. In other words, after accounting for the positive influence of post-baccalaureate preparation on hiring outcomes (which favors older students), the older graduates were less likely to be hired than younger peers. Age was the least influential of the factors in both the hiring and overall placement models, with a standardized coefficient of just -.022. The odds

ratio of .97 in the hiring model and .98 in the placement model indicated that odds of hiring decreased about 2% per year of age.

To further explore the relationship between age at completion and post-baccalaureate status, an interaction term was added to the hiring model (2-Admin). The interaction term was significant (p=.051), and when present in the model, the main effect of age at completion was no longer a significant predictor (p=.655). Results of post-hoc chi-square testing, accomplished by grouping candidates into four age bands (up to 25, 25-34, 35-44, and 45 and up), revealed that there were no significant differences across age bands for undergraduate completers. Yet significant differences did exist for post-baccalaureate students, with the 25-34 and 35-45 age bands having the best overall placement rates.

This implies that further investigation is needed to discern the impact of age on hiring. Because the pool of program completers is not normally distributed with respect to age, it is possible that the effect of age was disproportionately influenced by a comparatively small number of individuals well over the age of 45 who were not hired, and was not indicative of a more generalizable trend.

Family income

The last demographic variable explored in the study was that of family income, as measured through financial aid data available through University system records. Both the average Expected Family Contribution (EFC) score (if multiple years of data are available) and the minimum EFC score (of any year for which data are available) were analyzed.

Neither version of the EFC variable showed a significant t-test relationship with job application (for the survey model) nor attaining Maine certification (for the administrative model). Thus, these were not attempted in the multivariate job application models. However, the mean EFC score did show a significant t-test relationship to both the hiring and overall placement dependent variables when using an exploratory p=.10 significance threshold. Hired individuals had a significantly lower income (as indicated by a lower expected family contribution) than non-hired applicants ($t(1026)= 2.056$, $p=.040$). The minimum EFC variable did not have a significant relationship to hiring or job placement.

Though the mean EFC factor differed significantly for hired and non-hired groups by t-test, it did not sustain a significant relationship with hiring or overall placement when considered along with other variables in the multivariate regression models. Further analysis revealed that family income is related to post-baccalaureate status. The mean EFC for certified undergraduates was significantly higher than that of graduate students ($9200 compared to $5300 for post-baccalaureate students, $t(627)=6.79$, $p<.001$). Mean EFC score also had a weak but significant negative correlation with age (correlation ($N=1244$) = -0.152, $p<.001$). As typically seen with measures of income, both the mean EFC and minimum EFC variables were skewed, with overall means of $8392 and $5965, respectively, and standard deviations of $10815 and $9481. The median values of $5580 for undergraduate mean EFCs and $3760 for post-baccalaureates show the same trend. This suggests that these other variables provided more explanatory power than family income, and it is the overlap that caused the significant t-test result rather than a true effect. This is bolstered by the finding that minimum EFC score

(another version of the same income metric) was not significantly different between hired and non-hired applicants.

Student Characteristics

Grade Point Average (GPA)

Teacher preparation program Grade Point Average (GPA) was a significant factor in determining job application and hiring outcomes in all three administrative models. It was also the only factor to predict any outcomes in any of the survey models. However, the relative GPA was not among the more important factors; it ranked sixth on the list of eight significant factors in the hiring and overall job placement administrative data models. The odds ratio for the relative GPA variable in the job placement model was 1.43, indicating that chances of being placed in a Maine public school job increased by 43% for an increase of one standard deviation in program GPA.

Certification exam scores

Interestingly, certification exam scores (Praxis I basic skills tests in reading, writing, and math and Praxis II subject-specific tests) were all significantly related to both job application and hiring in the preliminary t-tests analyses of administrative data, yet none of the exams provide additive explanatory power to survive in the multivariate models.

The failure of Praxis scores to survive alongside program GPA in multivariate models suggests that they may not be a factor in job application or hiring practices. This raises the question of why they appeared to be significant in the preliminary t-tests. One might suspect that this could be caused by collinearity with program GPA, where GPA dominates because most of the variance due to Praxis scores is already captured in the

GPA measure. The correlations among Praxis measures and GPA z-scores are weak, yet highly significant, as shown in Table 15.

Table 15, Correlations Between Z-GPA and Praxis Scores

Exam	Correlation to Program GPA Z-Score (Pearson's *r*); (N=1229)
Praxis I Reading	*r*= .205 (p<.001)
Praxis I Writing	*r*= .224 (p<.001)
Praxis I Math	*r*= .157 (p<.001)
Praxis II Score Quartile	*r*= .230 (p<.001)

Correlations to unstandardized GPA are only slightly higher, ranging from .229 to .354.

This small amount of collinearity was likely enough to explain the significant t-test relationships to application and hiring because of the small standard error in the Praxis measures. To illustrate, in the overall job placement comparison, the difference between the Praxis I Math scores of placed and non-placed candidates was 1.0 exam points (181.4 for hired graduates and 180.4 for non-hired). The standard error of measurement for the exam according to the most recently published Educational Testing Service technical bulletin was 2.7, so the difference between the two means was .37 standard deviations. The difference in GPA z-scores for the same two groups was .348. A regression model can be developed to estimate the degree to which Praxis I math scores can be predicted from relative GPA z-score. The regression model is significant, with F(1)=30.21 (p<.001). The coefficient for the GPA z-Score predictor is .752. Thus, the difference of .348 GPA units between the hired and non-hired groups predicts a change of .262 points in Praxis I math scores. This point difference, while small, is .10 standard deviations—enough to trigger a spurious significant t-test result with over 1300 cases. Because the Praxis scores did not add predictive power of their own accord above relative GPA, they were not significant in the models.

Of the 1,346 completers who took Praxis exams, only 14 failed to meet the state minimum Praxis I reading score (when applying the three-point flexibility afforded by Maine's "composite rule"). On the Praxis I Writing exam, only 12 were below minimum, and 16 failed in math. Only 22 completers failed Praxis II exams and there is substantial overlap with several students failing more than one exam. As such, only 3% of the overall pool of completers failed to pass certification exams.

High-need certification areas

After in-state residency, having a certificate in a high-need area was the second strongest predictor of being hired in a Maine public school. As one might expect, after accounting for other factors in the model, those certified in high-need areas were 2.4 times more likely to be hired than those preparing for other areas. In-state residency status also influenced whether candidates applied for and attained Maine teacher certification and was the fourth ranked variable of the six job factors in the application model.

Teaching requirements tied to scholarships

In Maine, there were two financial support mechanisms in place during the time of the students' programs that offered forgivable loans in exchange for a commitment to work as a teacher upon successful program completion. The first of these is the Educators for Maine grant program, and the second was Robert Noyce Teaching Scholarships funded through a grant from the National Science Foundation. As would be expected, students who received these funds were more likely to apply for teaching jobs and attain Maine certification, as they had contractual obligations to do so. With a standardized coefficient of .720, receipt of a financial award with an associated service

commitment was third in the ranks of six factors predicting attainment of Maine certification; those with a service obligation were twice as likely (odds ratio 2.054) to become certified, our proxy indicator of applying for jobs.

Service-based loan recipients also experienced a preference in hiring, as seen in the results for the hiring model. This factor ranked fourth of the eight variables in the hiring model with a standardized coefficient of .345 (odds ratio 1.412). Although an immediate connection may not be seen between financial aid and hiring practices, it is noteworthy that both the Educators for Maine and Noyce grants are competitive and merit-based, so that selection is also an indication of prior academic achievement.

Institutional and Program Factors

Institution attended

The institution attended had a significant relationship to hiring, and to overall placement rates. However, it did not have a significant influence on whether graduates attain Maine certification. The size of the influence of the preparing institution varies. As shown in Table 16, using Institution 1 as the comparison, the effect of attending institution 2 improved the overall odds of being placed in a teaching job by 28% with all other factors held equal (odds ratio 1.282 and standardized coefficient of .249). The best improvement was gained by graduates of institution 3 with an 80% increase in the odds of being hired (standardized coefficient of .591). Attendees of institution 4 had improved hiring odds of 57% compared to Institution 1. However, the overall size of the institutional effect on placement outcomes is small; institution attended is only the fifth most influential variable in an 8-factor model that only explains 17% of total variance in prediction (pseudo-R^2).

Table 16, Job Placement Outcomes Compared to Institution 1

Institution	Job Placement Coefficient (*B*)	Odds Ratio (CI)
Institution 2	.249	1.282 (.95–1.73)
Institution 3	.591	1.805 (1.14–2.87)
Institution 4	.454	1.574 (1.00–2.49)

Year of graduation

The year in which the individual student completed their preparation program, i.e. the graduation cohort to which they belonged, was a significant factor in both attaining certification and obtaining a teaching job in a Maine public school within two years of graduating. Year of graduation had a standardized coefficient of -.258 and an odds ratio of .772 in the overall job placement model. While the factor was weakly related to hiring, ranking last or next to last in importance, the fact that it matters at all is important to the policy conversation. Over the course of the study (with hiring occurring in 2011 through 2014), the effect of the graduation year meant each successive cohort had a 20% smaller chance of being hired than the prior (odds ratio of .80 in model 2-Admin). This supports the conventional wisdom that there are "good" and "bad" hiring years for beginning teachers and appears to establish that job placement rates can be expected to fluctuate from year to year.

Post-baccalaureate programs

Two of the four institution groups had both undergraduate and post-baccalaureate level preparation pathways during the time of the study. In both institutions, the graduate students were significantly more likely to become certified than the undergraduates and also more likely to be hired. Although this variable is not distributed evenly across all of the institutions, because more than one institution had graduate students, the regression

models help to discern its influence. Graduate students were favored over undergraduates in all three models.

In the initial administrative model, identification as a post-baccalaureate student was the single most influential factor in predicting attainment of state certification. These students had nearly a four-fold increase in odds of becoming certified (odds ratio of 3.93), when other factors are held constant. In hiring, the factor is not as powerful an influence, but still ranks as the third most important variable in the model, with an odds ratio of 1.58.

Exploration of Geographic Variables

As described above, a separate set of analyses were conducted in an attempt to discern the influence of geography on each of the three job placement outcomes. These data were only available for Maine residents. Thus, out-of-state completers were not included in these administrative models. Table 17 reports the variables with significant relationships; additional details on the significance tests are included in Appendix B.

Table 17 illustrates that few of the geographic variables were related to outcomes at an exploratory significance level of p=.10. Of the six models, the relationship to self-reported job application (Model 1-Survey) appeared to be the most sensitive to geographic job market measures. However, when the models incorporating geographic variables were attempted using the survey data, the dataset was further restricted to only 192 cases. Although several of the geographic factors showed significant relationships to job application in the above t-test results, none were robust enough to survive in the logit model.

Table 17, T-Test Significance values, $p < 0.100$ for Geographic Factors
(Using Maine residents only)

	Application		**Hiring**		**Overall**	
	1-S	1-A	2-S	2-A	3-S	3-A
Number of cases (N)	*235*	*1159*	*192*	1001	*235*	*1159*
Number of Students in Hometown, 2006	*ns*	*ns*	*ns*	.069	*ns*	*ns*
Number of Students in Hometown, 2014	*ns*	*ns*	*ns*	.079	*ns*	*ns*
Change in Number of Students 2006 to 2014	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
Percent Change in Students in Town from 2006 to 2014	.061	*ns*	*ns*	*ns*	*ns*	*ns*
Number of Students in Hometown LMA†, 2006	.061	*ns*	*ns*	*ns*	*ns*	*ns*
Number of Students in Hometown LMA†, 2014	.060	*ns*	*ns*	*ns*	*ns*	*ns*
Change in Number of Students in LMA† 2006 to 2014	.069	*ns*	*ns*	*ns*	*ns*	*ns*
Percent Change in Students in LMA from 2006 to 2014	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*
FTE Teachers in LMA† 2008	.035	*ns*	*ns*	*ns*	*ns*	*ns*
FTE Teachers in LMA† 2014	.056	*ns*	*ns*	*ns*	*ns*	*ns*
Change in FTE teachers	*ns*	.065	*ns*	*ns*	*ns*	*ns*
Percent Change in FTE Teachers 2008 to 2014	*ns*	*ns*	*.066*	*ns*	*ns*	*ns*

†LMA = Labor market area; see definition in Chapter 3.

Since Model 1-Survey was the most promising for identifying significance based on the t-test data, it was not surprising that the remaining five models also did not show evidence of an influence for any of these twelve measures. This preliminary effort to use some readily-available data points to investigate local "job market" conditions reveals that these effects were small, were difficult to isolate from other variables in the model, or were not well captured by the attempted measures.

Summary of Findings

When the model summary results are considered in total (as in Table 13), it becomes possible to identify patterns. After (1) in-state residency status, the next five

most important factors in the overall placement model were in the "individual characteristics of students" variable group: (2) high-need certification area, (3) post-baccalaureate program level, (4) having a loan-based teaching service commitment, (5) institution attended, and (6) GPA relative to other graduates. The seventh ranked variables of (7) year of graduation is a contextual program attribute. (8) Age at graduation, the least influential of the significant variables, is demographic. The overall job placement model has a pseudo-R^2 of .174, which indicates that the included variables are capturing only a small portion of the total possible predictive power.

Limitations and Delimitations

This study lays a foundation that contributes to an understanding of the meaning of job placement rates for teacher preparation programs. However, it was an initial exploration and had some constraints. One such limitation of this study was the restriction to Maine's six public institutions with teacher preparation programs. Public and private institutions are likely to be different in job outcomes in meaningful ways, and by excluding private institutions, the study did not attempt to shed any light on these discrepancies. However, the University of Maine System (UMS) programs are by far the largest producers of beginning teachers and, as a group, produced 79.3% of all completers from Maine programs in 2011 to 2013. Thus, the included data were a fair representation of the job placement picture in Maine.

A related limitation was that the public preparation programs in Maine are likely to differ from public programs in more urban states. Only two of the six programs are located in metropolitan areas. Because the factors most influencing job placement are not well researched, it is premature to speculate on whether the issues shaping Maine's

supply and demand would be markedly different in larger markets. It is likely so, in which case these findings are most generalizable to public programs in similarly rural states; further replication in more urban states is still needed.

Another sample characteristic that limits generalizability to some states is the comparatively small proportion of underrepresented racial and ethnic groups in Maine and in the UMS. Prior research demonstrates a hiring preference for individuals of color, as schools seek to build faculty that reflect the growing diversity in student populations. Anecdotal reports in Maine affirm that this effect may be present, but it was difficult to investigate with the small numbers of individuals represented. Because the numbers were small, all individuals who were not Caucasian or were of Hispanic origin were combined in one group with a binary "underrepresented race or ethnicity" variable. This increased the chances that an effect, if existing uniformly, could be discerned in the noise of the data. However, if an effect were present for only some subgroups, this would be disguised.

As described in Chapter 2, existing research has established that employers place a high priority on applicants' attitudes and dispositions, and on their perceived "institutional fit." These attributes were not measured or obtained in this study and were not included in the models. The overall fit of the model of hiring factors provided insight (through pseudo-R^2 measures) into how well the included variables were able to estimate the overall odds of hiring and, thus, the relative combined importance of all unobserved factors.

The data set contained a mix of undergraduate and post-baccalaureate program completers. The Grade Point Average (GPA) measure used was the GPA of their UMS

teacher preparation program. For undergraduates, this was their bachelor's degree GPA. For graduate students, this GPA was derived from as little as 33 graduate credits in education courses and may differ substantially from the GPA earned in their bachelor's degree. A potential employer may look at both GPA measures for post-baccalaureate completers. This introduces a concern for the construct validity of the GPA measure; if employers weight the bachelor's degree GPA as much or more than the preparation program GPA when considering post-baccalaureate students, the program GPA variable may have different meaning depending on the level of the student. Also, the standards and academic expectations for graduate students are higher than for undergraduates (typically a 3.0 GPA is required for academic standing as opposed to a 2.0 for undergraduates), which adds to the challenges in analysis and interpretation. The researcher attempted to address this concern by creating a relative GPA variable as the z-score of the completer's GPA compared to peers at the same level (i.e. undergraduates compared to other undergraduates, and post-baccalaureates compared to other graduate students). This mitigates the second concern about direct comparability of the GPA measure across levels but does not address the possibility that the preparation program GPA may carry more or less weight in hiring outcomes, depending on program level. Further study with additional data containing undergraduate GPAs for post-baccalaureate students may help to illuminate.

To allow for potential avenues of future research, the program completer survey and administrative data matching captured data on individuals who were not hired as classroom teachers, but who secured education-related jobs in paraprofessional roles. In this study, these individuals were treated as "not hired" as classroom teachers. However,

an argument could potentially be made that the individuals were successful at gaining employment in an educational setting

The three-year timeframe of the study presented both opportunities and challenges. Using data from additional cohorts, while technically possible, was not necessarily desirable, as the conditions in the hiring market change over time. A longer time horizon may increase the ability to study effects over time but may also reduce the internal consistency of some of the independent variables due to changes over time (e.g. a factor such as program reputation, which is embodied in the institution attended variable, may differ from one year to the next).

The study was also limited by the particular time interval analyzed. The most recent data available, for the graduates from fall 2010 through summer 2013, also coincided with some years of weak employment in public schools due to economic conditions. The forces at work in the labor market are not static, and the issues driving supply and demand during these years may be different in another time interval. The use of three years of data, rather than one or two, helped to increase the study pool and mitigate cohort-to-cohort fluctuations in some independent variables. However, the short (three year) time interval limits the ability to investigate differences in the job market over time.

The study design relied on self-reported survey data to obtain information on candidates' job application behavior and on job outcomes for out-of-state students who are not present in the Maine administrative data. Analysis showed that those hired in Maine were more likely to respond to the survey than those who were not. Graduates who chose not to pursue teaching careers may also have been less inclined to respond to the

survey. This presents a source of potential bias in analyses based on survey data, as the sample's representativeness is in question.

Job placement is an outcome measure in and of itself, as job placement is an antecedent step to any subsequent impact on students and schools, and is the end goal for the candidates themselves. However, it is not a proxy for teacher quality. It would be mistaken to conflate job status with effectiveness and assume that those hired are better teachers than those who are not. Indeed, this lack of interchangeability is an underlying premise for the need for this work. At present, definitive empirical research that convincingly identifies indicators of teacher quality, and the best strategies for preparing teachers so that they meet those standards, remains elusive (Cochran-Smith et al., 2012). However, the current pace of research in this area, and the deluge of new information that statewide teacher evaluation systems will bring, provide hope that the coming years will yield better understanding of the teacher characteristics that impact student outcomes. It will be possible in the future to assess whether or not the factors influencing job placement are aligned to evidence-based indicators of quality. Until then, the hiring factors identified herein will stand on their own so that individual users may at least assign meaning to the institutionally reported data.

Despite these limitations, the overall study established initial findings that will be testable in other conditions. The use of multiple years of systemwide administrative data from multiple institutions at the core yields a sufficiently large dataset to address the questions. Yet the group was small enough to feasibly implement a survey component to attempt to address critical gaps in the administrative data. The University of Maine System context appeared to be suitable for the study.

Chapter 5: Conclusions

The purpose of engaging in this research study was to address four separate research questions. The results and analysis from the logit models provide preliminary answers to the questions. The first research question was "*For traditional teacher preparation program completers, what student and institutional factors were most predictive of whether a candidate applies for teaching jobs?*" In this case, because the model using survey data was not robust, the analysis actually addresses the related question of "*What student and institutional factors were most predictive of whether a candidate attains Maine certification*?" The significant factors in this case, in ranked order starting with the most influential factor, are (1) enrollment in a post-baccalaureate program, (2) in-state residency status, (3) receipt of financial support with an associated teaching service commitment, (4) study in a teacher shortage subject area, (5) GPA relative to other students, and (6) year of graduation.

The second research question was "*For program completers who apply for teaching jobs, what student and institutional factors are most predictive of whether they secure a teaching position?*" As with the first research question, the use of administrative data modified the question addressed to be "*What student and institutional factors are most predictive of whether they secure a teaching position in a Maine public school?*" The ranked order of significant factors was (1) in-state residency status, (2) study in a teacher shortage subject area, (3) enrollment in a post-baccalaureate program, (4) receipt of financial support with an associated teaching service commitment, (5) institution attended, (6) GPA relative to other students, (7) year of graduation, and (8) age at program completion.

The third research question was "*Of the factors identified in questions 1 and 2, which are most influential in determining overall job placement?*" The modified question is "*Of the factors identified in questions 1 and 2, which are most influential in determining overall job placement in Maine public schools?*" The ranked order of significant factors was identical to that of the hiring model: (1) in-state residency status, (2) study in a teacher shortage subject area, (3) enrollment in a post-baccalaureate program, (4) receipt of financial support with an associated teaching service commitment, (5) institution attended, (6) GPA relative to other students, (7) year of graduation, and (8) age at program completion.

The fourth research question was "How well can job placement be predicted from these factors?" The combination of factors in research question 3 provided 17.4% of the possible predictive power in job placement outcomes for graduates of teacher preparation programs at Maine's public universities, as assessed by the Nagelkerke pseudo-R^2. The model correctly classified 65.5% of cases, an improvement of 11.7% over the base model. This is a significant model, yet this suggests that there are more important factors that are driving placement rates than what was represented in the data included in this study.

Discussion of Individual Factors

The results of each independent variable across the preliminary significance tests and the multivariate models provide a foundation for considering their influence on institutional job placement rates. The types of factors that are related to job placement gives contextual understanding about the link between job placement and high-quality program practices. This also invites a discussion of the possible consequences of

encouraging institutions to maximize their placement rates through the levers under their control.

Individual (Demographic) Characteristics

Individual student demographics are typically not easy for teacher preparation programs to manipulate. Non-discrimination policies mean that admissions practices are expected to be neutral with respect to race, ethnicity, gender, income level, and age. While programs can seek to influence their applicant pools by emphasizing certain demographic groups in their recruitment practices, it would be impractical, and potentially not legally defensible, to apply selection criteria based on these factors. State of residency is sometimes used at an institutional level to set admissions quotas for in-state residents at publicly funded universities but has not been seen as a criterion used in program-level entry criteria. Thus this group of variables may be seen as factors over which preparation programs have limited control outside of recruitment efforts.

State of residency

The finding that the state and country of residency was an overriding factor in the administrative models is likely explained by the reliance on Maine-based hiring outcomes. "Job application" was modeled using the proxy variable of obtaining Maine certification, and hiring was determined using only Maine public school positions. Given the documented tendency of teachers to search for jobs in localized areas close to where they grew up, it is expected that Maine residents would be more likely to apply and be hired in Maine than non-residents. The finding that Maine residents were 3.34 times more likely to be placed in a Maine public school teaching job than out-of-state residents demonstrates the strength of this effect.

This finding is of critical importance for policymakers to consider when establishing operational definitions of "job placement" for their states and institutions. If states choose to rely on administratively-available data from public school staffing records to match program completers to jobs, one should expect substantial variance across institutions with differing proportions of in-state residents. For example, Institution D had the highest overall placement rate in Maine public schools, at 70%. Institution D also has the highest proportion of in-state residents of all six institutions. Institution C with the lowest proportion of in-state students also had among the lowest placement rates in Maine public schools. Given the relationship of the state of residency to the likelihood of being hired in a Maine teaching job, policymakers will need to weigh how to compare institutions with different student profiles.

Race and Ethnicity

Students from underrepresented racial or ethnic groups did not have significant differences from white non-Hispanic students on any of the three outcome variables in either survey or administrative data models. This is not consistent with the Boyd et al prior research (2003) that establishes a higher hiring rate for teachers of color, nor with the Goldhaber et al. (2014) study showing an overall placement preference for white non-Hispanic students, especially in the more racially diverse part of the state. This gives rise to at least three possible explanations: (1) the small number of students of color in even the larger administrative dataset (n=46) was insufficient to detect an effect that does exist in Maine, (2) the hiring preference for teachers of color was not present in Maine or not as strong as in other locales, or (3) underrepresented status may interact with another factor that was latent in this study. For example, the students from underrepresented

groups may be non-randomly located in parts of the state with a greater supply of teachers or fewer job openings, and thus more competition for jobs.

This factor merits further study to discern what may be happening with the students of color graduating from Maine's public programs. As the state with the least racial and ethnic diversity in the country, Maine is not an ideal location for studying this factor and replication in other contexts would provide further illumination. Moreover, as the southern regions of Maine experience double-digit growth in the numbers of students of color in our public schools, there is increasing recognition of the need to recruit teachers from a wider range of cultural and racial backgrounds so that the teaching force more closely reflects the school demographics; this challenge is not unique to Maine. Thus this issue carries local as well as national interest.

Gender

Gender was not a significant predictor of job application, hiring, or overall job placement in this study. However, it remains possible that there may be underlying patterns that could be revealed with further analysis or additional cohorts of data; for example, it may be possible that a hiring preference exists for males seeking elementary positions, but not those in secondary subject areas. This was beyond the scope of this initial exploration and is suggested for future study.

Age

The influence of age on job placement outcomes is another area to target for further investigation alongside underrepresented status and gender, based on the conflicting patterns seen in the parallel survey and administrative models. Although age

was the least influential of the factors in both the hiring and overall placement models, this small effect carries noteworthy potential implications.

The preliminary results of the models generate questions. Additional analyses and replication in other contexts (preferably with higher numbers of graduates) would help to illuminate a more nuanced understanding of the impact of age on hiring and overall job placement. A deeper understanding of this variable is important to the overall policy context. If emphasis on job placement rates creates incentives for programs to favor admission of students who are most likely to attain employment, this may put older students at a disadvantage.

Family income

Family income level, as measured by the Expected Family Contribution (EFC) level determined through the Free Application for Federal Student Aid process, did not appear to be related to candidates' likelihood of attaining certification or being hired. However, the descriptive finding that post-baccalaureate students have a lower ability to pay for college (i.e. have lower mean EFC scores) raises policy questions. Post-baccalaureate students are more likely to become certified and more likely to be hired, but they have fewer opportunities for financial support. Part of the reason for lower EFCs among graduate students is that they no longer have parent income included in their ability to pay. For many graduate students, this reflects reality—they must rely on their own resources to pay for their schooling (as parents are no longer footing the bill). This is particularly burdensome in teacher preparation where the need to complete clinical teaching experiences precludes the ability to work in traditional daytime positions.

Yet the Educators for Maine forgivable loans for teachers have higher award amounts for undergraduates than for graduate students, and federal TEACH grants are not available for post-baccalaureate students if the attending institution also offers an undergraduate pathway. The study at hand demonstrates that post-baccalaureate students are more likely to apply for jobs and be hired, yet they have fewer financial supports available to them. This finding suggests a need to revisit federal and state policies regarding apportionment of public funds for graduate students demonstrating financial need to ensure that all prospective teachers have equitable opportunities for support to afford their studies.

Student Characteristics

The next category of variables includes non-demographic factors that are unique to individual students (not cohorts of students) and are influenced by student actions or choices. Unlike demographic attributes that may not always be feasible, or ethical, for programs to influence, these four student characteristics may be encouraged through selection or retention policies.

GPA

Teacher preparation program GPA was a significant factor in determining job application and hiring outcomes in all three administrative models and was the only factor to predict outcomes in any of the survey models. This puts the variable solidly on the list of predictors of job placement. With a 48% increase in the chance of certification attainment for each standard deviation increase, GPA may be serving as a signal to students that affects whether they pursue public school employment. It also predicts hiring, with a 36% increase in the chance of being hired for each increase of one standard

deviation. This implies that it may also be a signal to hiring committees that a candidate is likely well-prepared. Thus this factor is a lever that preparation programs have at their disposal for influencing job placement outcomes.

The conclusion from this finding is that at least one core practice under the control of programs is working as intended. Presuming that GPAs reflect the assessment of the program faculty about which candidates are best meeting their program standards (or at least the standards for their individual courses), they are aligned to the sorting effect that influences who eventually teaches in public schools.

Further study is needed to assess the interaction between grades and institutions. In this study, all institutions were treated equally. However, conventional wisdom suggests that some institutions have more rigorous standards than others and GPAs may not be entirely comparable.

The finding that GPA is related to hiring outcomes also gives rise to speculation about the potential incentives that may be created when attaching consequences to institutional job placement rates. Institutions seeking to improve the hiring outcomes of their graduates may be pressured to inflate student grades in order to raise GPAs to make candidates seem more attractive.

Certification exam scores

As detailed in Chapter 4, the failure of Praxis scores to survive in multivariate models despite apparent relationships in significant t-tests for each individual exam cannot be readily explained by overlapping variance or interactions with other significant variables. Rather, it would seem that the scores may not be related to job application or hiring practices.

This analysis supports a supposition that certification exams may be used as an entrance requirement to preparation programs or as a gatekeeping requirement for access to clinical coursework (i.e. student teaching) but do not appear to play a role as a hiring tool. For example, if hiring committees were using Praxis II as a mechanism to assess comparability of the content knowledge of candidates with similar GPAs from different institutions, then one should expect to see some additional explanatory power from Praxis II scores that would exist alongside GPA in the hiring model. The fact that it does not points to a need for policy conversations and, perhaps, additional study. If exam scores are not weighted strongly (or at all) in the process of evaluating candidates, are their considerable time and expense requirements justified by their value? In other words, is the intent of requiring certification examinations simply to ensure that minimum qualifications have been demonstrated or are they intended to assist hiring schools in distinguishing between candidates with varying levels of preparedness? Qualitative study to discern whether and how hiring committees make use of certification exam scores in their deliberations would add helpful context.

High-need certification areas

It is perhaps not surprising that students who were certified in high-need subject areas (math, science, foreign language, special education, and teaching English language learners) were more likely to be hired than individuals in other subject areas. The fact that they were also more likely to become certified in the first place was less expected. The relationship in this case is less obvious. Perhaps students who were very motivated to find teaching jobs pursued high-need certification areas at a greater rate, or perhaps the

strength of the job market in shortage fields encouraged them to attempt the search process with greater confidence.

The finding that holding certification in a high-need area was the most important influence after residency status (with an odds ratio of overall placement of 2.42) raises conceptual questions about the meaning of placement rates in different subject areas. Because of the requirements placed on schools to hire only credentialed teachers, certification area is more than just an independent variable. Though exceptions exist, it can be seen as a threshold requirement for job application. In essence, the teacher job market can be conceptualized as many separate markets divided by the eligibility requirements for the position. Requirements for high school math teachers and kindergarten teachers are not interchangeable, and those individuals generally do not compete for the same job openings. Because job placement rates combine all positions in one measure, it was not necessary to treat these markets separately for the purposes of this study. However, from a purely conceptual perspective it should be noted that the factors influencing job placement may not be uniform across all sectors.

This is an area that merits further policy conversation. While institutions already work to recruit candidates into shortage areas, this finding that preparation in a high-need area is the most influential non-demographic factor may encourage more intensive interventions at the program level. At the less-invasive end, this could involve increased efforts to make prospective students aware of the benefits of choosing a shortage field (such as loan repayment options and increased odds of finding a job). More intensive measures could involve, for example, imposing limits on the number of candidates accepted in non-shortage fields.

Teaching requirements tied to scholarships

Receipt of a financial award with associated commitments for teaching after program completion was related to both attainment of state certification and improved chanced of being hired. As suggested in the findings section above, the fact that these awards were related to hiring may be partially explained by the knowledge that the loans were merit-based; recipients may also differ in other systematic ways from non-recipients. It is also possible that recipients were more likely to be hired because they were less selective in their application processes, and chose to apply at schools that may be subjectively less desirable (and thus had less competition).

Both of these findings—positive relation to both application and hiring—have useful implications for proponents of such loan-based teacher incentives, including the federal TEACH grant program that has more recently arrived. Given the intent of such programs to recruit and prepare teachers in high-need areas, the study results provide tentative support that recipients are both applying for and securing jobs in public schools at a higher rate.

Institutional and Program Factors

Institution attended

The variable of "institution attended" is critically important to the overall context of this study. Part of the underlying impetus for requiring reporting of institutional job placement rates is the presumption that the policies and practices of teacher preparation programs matter. The logic assumes that "good" programs would have higher placement rates than "bad" programs. If this is true, one should see that the institution attended has an influence on placement outcomes, above and beyond the other individual

characteristics accounted for in the models. Thus the finding in this study that the institution attended does indeed have a significant relationship to hiring and to overall placement rates bolsters the argument for requiring calculation and reporting of institutional placement rates.

However, the institution attended did not have a significant influence on whether graduates attained Maine certification. It is possible that institutions did not vary significantly in their impact on whether graduates seek jobs in the state, or it is possible that such effects existed but were undetectable because of the low proportion of individuals who chose not to become certified or were ineligible.

This variable could be capturing an array of potential distinctions between institutions that are not otherwise reflected in variables included in the study. Some of these differences may be related to program aspects. For example, the institutional effect could be capturing the impact of program reputation on hiring. Some programs may do a better job than others of recruiting, selecting, or retaining candidates with dispositions that are desirable to employers. Some programs may also provide coursework and experiences that are better aligned to meet schools' current contexts, which may in turn lead to stronger job interviews and increased likelihood of hiring.

It is also plausible that the institutional variable may be capturing influences that are not related to program characteristics. Local job markets may influence institutional placement rates, given the regional ties of public institutions. Programs located in parts of the state with a weaker job market, such as areas with declining student enrollment, may thus have lower placement rates if they draw students primarily from the local area. Since

there are no other job market factors in the job placement model in this study, such impacts with a geographic element may load onto the institutional coefficient.

Within the scope of this study, one could not discern what underlying factors are in play; one may only verify that distinctions between institutions are present that are related to hiring and are not explained by the other variables in the models. Although this analysis provides only limited insight into the factors that improve outcomes for an institution's graduates, the existence of a measurable institutional effect raises the possibility of alternate ways of comparing institutions. It is noteworthy that although there was a positive effect of being in institution 2, 3, or 4 compared to institution 1, institution 1 did not have the lowest overall job placement rate. Thus the ability to compare odds ratios is one way of potentially quantifying the unique effect of each institution—in essence, the "value added" by each program. This concept of creating value-added scores has been examined with respect to student achievement, but not for job placement rates.

Within the scope of this study, it was not possible to establish the validity of the institutional coefficients. The analysis provided no insight into whether they are driven by factors under programs' control, such as recruitment and selection policies, or by outside influences such as the local job market. For this reason, the researcher deliberately chose not to reveal the identity of individual institutions, as there is risk of jumping to premature conclusions about the meaning of the odds ratios and relative coefficients. More analysis is needed to validate the construct before it would be appropriate to reveal identities. In addition, while it may be tempting to isolate the institutional impact on hiring through regression model coefficients, it must be

remembered that these influences are small overall given the low predictive power of the placement model.

Year of graduation

The specific year in which a student included in this study completed their program was significantly related to hiring. Although not a very strong influence, the fact that it matters at all is relevant. As described in the findings, odds of hiring decreased 20% for each year over the course of the study, all other factors held equal. Over a longer time span it could be imagined that job placement rates may fluctuate even more. This instability of placement rates over time highlights the inherent relativity of job placement rates. There is no universal, objective benchmark for what constitutes an acceptable rate. This creates an intrinsic challenge for using job placement as a program accountability measure; not only can it be difficult to compare institutions to each other, it can even be challenging to validly compare an institution's placement rates to itself longitudinally. This establishes the importance of contextual data to provide relative comparisons to other similar institutions and to relevant trends (local, regional, or national). It also suggests that there may be value in investigating longer time intervals for obtaining employment when defining job placement to allow smoothing of job outcomes over multiple years.

Post-baccalaureate programs

Participation in a post-baccalaureate pathway (as compared to undergraduate programs) was favored in all three administrative data models. As with other factors, the finding does not explain why this is the case. We do not know *how* this factor influences job placement outcomes or whether it is a proxy for some unobserved attribute. In other

words, there may be a characteristic that is endemic to post-baccalaureate students that is promoting these outcomes and is unrelated to the level of the program. For instance, post-baccalaureate students may be more likely to have interesting work or life experiences that employers find valuable. Alternatively, employers may value the fact that post-baccalaureate students have earned (or made significant progress toward) a master's degree, as this may reduce the financial burden on the district to pay for contractually obligated tuition benefits. Notably, the two post-baccalaureate pathways in Maine each offered extended academic-year internship placements, while undergraduate pathways were predominantly one-semester student teaching experiences. If length of internship was an influential factor it may have interacted with post-baccalaureate status.

This deeper question of why post-baccalaureate pathways are related to hiring outcomes is critical in its policy implications. Post-baccalaureate routes have a higher total entry cost, as students pursue additional courses above and beyond the bachelor's degree. If programs were to move away from undergraduate preparation routes and implement fifth-year programs in their place, this would increase the financial burden for students who know while still an undergraduate that they wish to become teachers. This is a likely barrier for entry to the profession, and one that may disproportionately affect lower-income students. Thus this type of change should be carefully deliberated. Perhaps hiring administrators favor post-baccalaureate program completers in hiring because they are more likely to have had extended clinical placements compared to one-semester student teaching experiences in undergraduate programs. Or perhaps the administrators prefer that applicants have a content area arts or sciences major and not a bachelor's degree in education. If the true influence is not the extra year of study itself

but rather one or more attributes of the two post-baccalaureate pathways in Maine, it would be sufficient to consider making changes to the undergraduate pathways to replicate these characteristics rather than replace them with graduate level pathways. Further study incorporating a larger pool of post-baccalaureate models would help to separate the effects of specific program characteristics from the level of the program. Feedback from hiring administrators, such as from a survey or interviews, would also help to assess the reasons for the relationship between program level and hiring outcomes.

Individual Factors Summary

When the model summary results are considered in total (as in Table 13), it becomes possible to identify patterns. The five most important overall placement factors of (1) in-state residency status, (2) high-need certification area, (3) post-baccalaureate program level, (4) having a loan-based teaching service commitment, and (5) institution attended are heavily regulated by student choice. Programs may influence these choices in the numbers of students recruited and accepted into various pathways. However, students themselves must ultimately decide which options to pursue. In these cases, educating students about the influence of these decisions may merit consideration.

The sixth-ranked significant variable, that of GPA relative to other graduates, is the factor most within the control of the preparation programs. Institutions who wish to improve their job placement rates can review their grading policies, ideally with use of data on GPA for hired and non-hired graduates, to determine whether the assigned grades were accurately identifying the students' readiness for teaching. In other words, programs can work to optimize the "signal" they are sending to both pre-service teachers

and to prospective employers by the grades they assign.

The two least-powerful variables in the hiring and placement models are year of graduation and age at graduation. These are factors over which neither the students nor the preparation programs have much control. It is perhaps reassuring that they are not highly influential, since they cannot be changed. Yet the fact that they do play a role in job placement rates suggests that the measure should be used with caution in high-stakes decisions including program accreditation.

Implications for Data Collection and Reporting

One of the most easily interpreted findings of this study relates to the challenges of collecting data about program outcomes via surveys. Depending on how the definition of "placement" is operationalized, individual institutions will most likely find that they need to conduct surveys of their graduates to obtain the information needed to compile their institutional data. Given the low response rates and other challenges experienced in conducting this study, it is reasonable to expect that this would lead to widespread problems.

A scan of national data showed that these results were not atypical. The state of Ohio conducts a statewide follow-up survey of graduates and in 2014 experienced a 16% response rate. North Carolina suspended its practice of surveying graduates in 2009 after successive years of low responses, and experienced a response rate of only 11.5% in the final year for which data were reported (2008-09). The fact that the low response rate may be par for the course provides some reassurance that the implementation of the survey in this study was not flawed.

This raises larger policy concerns about the ability of programs to collect valid data to meet reporting requirements. The two survey challenges encountered in this study of numbers of respondents and representativeness of respondents have direct implications for preparation programs. Several of the data points that are required for CAEP accreditation and proposed for annual Title II reporting are not (yet) available in state administrative records, and will need to be collected directly from program graduates via questionnaire. Thus the analysis in this study raises the specter that institutions needing to rely on surveys to fulfill reporting requirements may find it a challenge to obtain valid and reliable data.

If an institution is located in a state that does not provide access to administrative data on job placement in public schools, the institution will need to collect job outcome data directly from graduates. But even where they do have the ability to link their graduates to in-state jobs, surveys may be needed to gain the full picture of job placement. The working definition currently in place for CAEP asks for various types of job outcomes on all graduates, including out-of-field teaching positions, private school employment, continued enrollment in higher education, and unemployed. These outcomes would not be available in public school staffing records and would need to be obtained by survey or similar means.

Furthermore, while one common practice for handling survey data is to treat the respondents as a representative sample, the current study suggests that this may also be troublesome. Scaling up survey responses to impute an overall institutional job placement rate would not be a valid practice if the survey respondents are not representative of the true outcomes. This study found that individuals who were

employed in Maine were significantly more likely to respond to the survey. If their data were used to generate overall institutional rates, the placement rates would be overstated. The combination of these factors gives rise to concerns that programs will be challenged to fulfill this reporting requirement with valid and reliable data.

A separate but related concern is the challenge of reporting job placement rates for small programs. Best practice calls for suppressing data when counts are lower than a specified threshold (typically five or ten individuals). Because suppression rules apply when just one cell fails to meet the minimum, even programs with more than ten completers can have suppressed data. For example, in a state with a suppression guideline of five, a program with 20 completers and an 80% placement rate would have only four non-hired individuals, which would trigger suppression of all placement data. In Ohio's 2012-13 follow-up survey, the common practice of minimum reporting thresholds was used to suppress data with fewer than ten students. As a result, only 29% of Ohio's 51 preparation programs had enough respondents to receive an institutional report. Over the scope of national data collection, this results in systematic ongoing exclusion of data from smaller teacher preparation programs. This hampers the ability to further understand the dimensions of job placement, particularly when the smaller programs are located in rural areas and may be the only preparation program serving a given region (as is the case for three of the institutions in this study).

Lastly, the process of compiling data for this study illuminated the challenges and limits of centralized data reporting in Maine. Even with a centralized student information system for the publicly-funded institutions, linking students to state staffing records was not straightforward. States with more robust data linkages may have fewer challenges,

and states with even less centralized data may find that their preparation programs lack the technical capacity to perform such data linkages without external support.

Implications from Survey Results

While preliminary analysis yielded some concerns about the representativeness of the survey data with respect to successful job applicants versus those who were unsuccessful, the 285 responses remain useful for descriptive analysis of the graduates' application processes and outcomes. Though conclusions may be more tentative than if the respondents were more closely representative of the population of graduates, respondents' perspectives are useful to explore and consider.

At least 10% of program completers did not apply for teaching jobs. Though this is suspected to be an underestimate, it is roughly comparable to the 16% of graduates who did not receive Maine certification. This finding raises important questions: what is a reasonable expectation for the proportion of graduates who seek employment related to their degree preparation, and at what point should a program be concerned that the proportion of their graduates choosing non-teaching paths is too high? These are questions that are unlikely to have easy answers.

Next, despite the lack of significance of the geographic measures in the models, the survey data did support the importance of local job market conditions on placement outcomes. Less than half of the survey respondents indicated that they applied for jobs that would require them to relocate, and less than a quarter of those hired chose a position that required relocation. In addition, candidate perceptions of the strength of the job market were influential, and were the most frequently cited reason for not applying for teaching jobs. This indicates that further investigation is warranted.

It was noteworthy to find that the K-12 school connections formed during the pre-service experience seemed to play a key role in placement outcomes. Job applicants received more tangible supports from their mentor teacher, such as letters of recommendation, than from any other source, with preparation program faculty as the next most frequent contributors to the job application process. Moreover, almost 30% of those survey respondents who were hired found jobs in the district where they performed their student teaching or internship. In contrast, institutionally provided career service center supports were not frequently used. This merits further investigation to determine whether those services were offered (and known) to students, or not present. If career services were offered but not perceived as worthwhile by the graduates, alternative strategies with stronger K-12 ties may have more leverage.

Lastly, it is apparent that full and part-time classroom teaching jobs in public schools are only part of the employment story. Program graduates are also serving schools in other ways, including 14% hired in private schools and over 22% hired in education-related non-teaching jobs. Policymakers will need to clearly establish the types of positions that should be counted as "hired" in determining job placement rates. And with 15% of graduates hired out of state, state data on public school classroom teacher employment will not account for everyone who may need to be included.

Implications from Data Models

The overarching and most powerful finding from the three regression models is their weak predictive power. Despite a broad and varied mix of independent variables included in the data analyses, well over 80% of the potential prediction of job placement outcomes is unexplained. This issue, perhaps more than all others, creates doubt about

the appropriateness of using this measure for accountability purposes. This is particularly the case if the measure is narrowly defined as in-state public school placement, which is likely to be a common operative definition because of the ability to gather the needed data from state administrative sources.

It is important to be ever mindful of this context when interpreting the results of individual factors. The use of odds ratios is seemingly quite intuitive, as it describes the proportional impact on hiring odds *when all other factors are held equal*. An odds ratio of 4 for a given attribute would seem highly influential, and it is indeed indicative of a true effect. However, the list of other characteristics that must be "held equal" in these analyses in order to isolate the effect of a single variable is long, and largely unmeasured.

It is also noteworthy that the overall model of job placement of all candidates is very similar to the hiring model of job applicants (those who were certified in Maine in this study). In this research context, it appears that the selection effect of hiring may drive the overall job placement picture. In another environment where teacher shortages mean that a higher proportion of applicants are hired, the application model (supply side) may be expected to exert more influence on the overall picture of job placement. This highlights the importance of repeating this research in other contexts where factors may exert differing types and levels of influence.

Recommendations and Next Steps

The ranked order of factors that were significant in predicting job placement were (1) in-state residency status, (2) study in a teacher shortage subject area, (3) enrollment in a post-baccalaureate program, (4) receipt of financial support with an associated teaching service commitment, (5) institution attended, (6) GPA relative to other students, (7) year

of graduation, and (8) age at program completion. Teacher preparation programs have limited ability to directly influence these outcomes; they can recruit, inform, and attempt to persuade students, but only GPA is fully and firmly controlled by program faculty. In addition, the combination of these factors provides only a fraction of the total possible predictive power of job placement modeling. Given these findings and the conclusions above, several next steps for policy implementation and future research may be recommended.

Operationalizing Job Placement

Individual states may soon be asked to develop systems for rating teacher preparation programs based on measures including job placement. If this comes to pass with anticipated changes in US Department of Education rules under "Title II" teacher quality requirements (to be released in December 2015), all states will be wrestling with how to establish systems that comply with the new rules, including definitions.

This highlights the challenge of deciding between using readily-available administrative data versus measures that rely on survey data. Administrative data is efficient and has the potential to provide some data on nearly all completers, depending on state data collection practices. Survey data is more expensive to gather, and may produce poor results (especially for smaller programs with fewer students upon which to base their calculations). Yet programs with higher proportions of out-of-state residents can expect to have lower public school placement rates in the state, and should not be directly compared to peer institutions with high in-state numbers. There is no one clear answer for resolving this tension among efficiency, accuracy, and validity. Some recommendations include:

- Consider using more than one definition of "placement" to reflect the variety of outcome patterns for institutions with different student demographics. Each version of the definition should be standardized so that there is comparability across institutions using that calculation method, but allowing more than one reporting option will provide institutions with some flexibility.
- If multiple definitions of job placement are permitted, states may wish to mandate at least one type of definition to facilitate at least some cross-institutional comparisons.
- Provide ready means for programs to look up completers in state employment records; even if some versions of placement measures will require information on completers employed out of state or in private schools, this may reduce the number who require more intensive follow-up to discern hiring status.

Importance of Centralized Technical Support

The present study highlighted several technical challenges in compiling, cleaning, matching, and analyzing placement data. These issues were mitigated by the ability to pull data from two central sources (the University of Maine System's shared student records and the Maine Department of Education) on the six included institutions. Decision rules made along the way were applied evenly to all institutions, thus ensuring that data had shared meaning. But in current processes for institutional accreditation and annual Title II reporting, each University must fend for itself. Definitions are applied locally, which creates room for differences in how cases are treated.

To minimize the impact of local interpretation of data and thus improve comparability of data, it may be necessary to invest in staffing support at a central level—

perhaps within the state departments of education—to provide institutional research support for all programs. At a minimum, there should be available technical assistance to provide uniform guidance and interpretation to institutions to facilitate consistency in definitions over time.

Implications for Accreditors

In current practice, CAEP is collecting annual data from institutions that already have data collection on placement outcomes. It is not yet mandating that institutions have the data in order to achieve or sustain accreditation status. In its reporting guide manuals, CAEP implies that it is transitioning to the measure and gathering data that it can analyze and use to set expectations for minimum standards. The findings in this study strongly support the wisdom of this approach.

CAEP should continue to delay the high-stakes use of placement data until enough years of data are available from a variety of institutions to have adequate understanding of institutional patterns, the variance across and within states, and the types of institutional variables that should be used to create comparison groups. Job placement rates for preparation programs should be interpreted with caution, as at least some of the related factors are not within the control of preparation programs (e.g. year of graduation). Furthermore, the use of job placement rates to make high-stakes decisions may provide incentives to programs to implement policies that may not be ethical (such as preferential admission of younger applicants), and is not advisable. Unless more information can be captured to better explain why some graduates are hired and others are not, attributing job placement rates to the quality of preparation programs will be guesswork at best and undeserved or unfair at worst. The current CAEP approach of

collecting placement data with an expressed goal of learning more about its value and limitations before setting guidelines for minimum standards is prudent.

Implications for State and Federal Policymakers

State and federal policymakers should likewise proceed with caution and restraint when weighing whether and how to use job placement rates in their accountability and reporting systems. The intrinsic usefulness of the measure to prospective students must be acknowledged, and the availability of readily accessible data on placement outcomes across a state can inform priority-setting. However, the types of factors found to influence job placement, and the weak predictive power of the models in this study, imply that it may never be appropriate to establish hard-and-fast minimum expectations for ongoing use in assessing the quality of teacher preparation programs.

Further Research

Throughout this document, suggestions for further research have been noted where appropriate. The most salient are reiterated here.

As described in Chapter 2, prior research indicates that additional factors influence hiring that are not included in this study. Some of these (such as dispositions or institutional fit) are challenging to include in empirical study. Others are more feasible but were unsuccessful in the current study and would benefit from renewed attempts since the explanatory power of the factors measured in this study was small. The most notable of these are strength of local teacher job markets (such as teacher turnover by geographic area), the degree to which individual applicants are willing to compromise to attain a position (e.g. number of applications submitted, job search radius), and the selectivity of hiring committees (e.g. number of job applications reviewed). States or

large districts with centralized job application systems may provide a rich environment for this type of effort, as it would be possible to generate variables from administrative data.

Specifically, given the localized nature of teachers' job searches demonstrated in prior research and in the survey results from this study, it would be important to develop improved models that contain a measure of teacher demand such as the "stay ratio" used by Goldhaber et al. (2014). As noted above, any geographic impacts on job placement may be reflected in the "institution attended" coefficients in this study, as institutions tend to have regional patterns of enrollment within the state. If these regional impacts could be isolated from the institution variable, the institutional coefficients would have more credibility as a value added measure of program impact.

Similarly, this study was limited in the ability to investigate the effect of the length of the internship or student teaching experience on job placement. It is important to investigate the preference for post-baccalaureate program completers found in this study to discern if it was due to the extended length of clinical preparation in those pathways or to other factors.

In addition, it may be informative to investigate the distinctions between job placement influences among different contexts. It would be a high priority to replicate the research in other settings, particularly those with atypically high or low teacher supply or demand. This would help to confirm whether the influences in Maine are generalizable to other situations. It would also serve to further illuminate the study findings to investigate whether they differ for certain groups, such as elementary versus secondary teachers. The importance of latent factors (such as dispositions) may vary by

grade level. Similarly, factors may differ for candidates in high-need teaching areas compared to those not in high demand.

Lastly, it would be valuable to further explore these findings with qualitative research with hiring administrators. The top priorities for such an investigation would be discerning the usefulness of certification exam scores in hiring decisions and studying the influence of program level (undergraduate versus post-baccalaureate) in applicant review. Both of these factors were strongly influential in placement outcomes, and each has non-negligible associated costs borne mostly by the prospective teachers.

Summary

In conclusion, the results of this investigation suggest that job placement has some limited usefulness as a teacher preparation program reporting measure. It is a measure that is easily understood by stakeholders and has practical meaning to prospective students. It is related to some factors that are generally considered to be important hallmarks of quality, such as student GPA and preparation in a certification area that is in high demand by public schools. Thus it may be worthwhile for programs to be knowledgeable of their placement data, including application as well as hiring outcomes if possible.

However, placement is also related to factors that are unrelated to existing measures of quality, such as year of graduation and age of the prospective teacher. In addition, the available data are only able to provide limited prediction of job placement, indicating that there is much variance that remains unexplained. Furthermore, there are pressing concerns about institutions' ability to collect and compile data about their graduates validly and reliably. This may result in a measure that does not accurately

describe institutions program quality. Thus, it is inadvisable to use job placement rates to make high-stakes decisions about preparation programs unless additional research is capable of identifying and measuring some of the other key variables affecting job placement rates, and until appropriate policies are put in place to ensure fair treatment of programs.

References

Ballou, D. (1996). Do Public Schools Hire the Best Applicants? *Quarterly Journal of Economics, 111*(1).

Balter, D. & Duncombe, W. (2008, January). Recruiting Highly Qualified Teachers : Do District Recruitment Practices Matter? *Public Finance Review*, *36*(1), 33-62.

Boyd, D., H. Lankford, S. Loeb, & J. Wyckoff (2003). *Analyzing the Determinants of the Matching of Public School Teachers to Jobs: Estimating Compensating Differentials in Imperfect Labor Markets* (NBER Working Paper No. 9878). Cambridge, MA: National Bureau of Economic Research.

Boyd, D., H. Lankford, S. Loeb, & J. Wyckoff (2005). The draw of home, how teachers' preferences for proximity disadvantage urban schools. *Journal of Policy Analysis and Management, 24*(1), 113-34.

Boyd, D., Grossman, P., Lankford, H., Loeb, S. & Wyckoff, J. (2006). How Changes in Entry Requirements Alter the Teacher Workforce and Affect Student Achievement. *Education Finance and Policy, 1*(2).

Boyd, D., Lankford, H., Loeb, S., Ronfeldt, M., & Wyckoff, J. (2011). The role of teacher quality in retention and hiring: Using applications to transfer to uncover preferences of teachers and schools. *Journal of Policy Analysis and Management*, *30* (1), 88-110.

Boyd, D., Lankford, H., Loeb, S., & Wyckoff, J. (2013). Analyzing the Determinants of the Matching of Public School Teachers to Jobs: Disentangling the preferences of teachers and employers. *Journal of Labor Economics, 31*(1), 83-117.

Chambers, J. G., & Fowler, W. J., Jr. (1995). *Public school teacher cost differences across the United States*. Washington, DC: National Center for Education Statistics.

Clotfelter, C. , Ladd, H., & Vigdor, J. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review 26*, 673-682.

Cochran-Smith, M., Cannady, M., Pesola McEachern, K., Mitchell, K., Piazza, P., Power, C., & Ryan, A. (2012). Teachers' Education and Outcomes: Mapping the Research Terrain. *Teachers College Record*, *114*(10).

Cohen, J. (2nd ed.). (1988). *Statistical Power Analysis for the Social Sciences*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Darling-Hammond, L., Amrein-Beardsley, A., Haertel, E., & Rothstein, J. (2012).

Evaluating Teacher Evaluation. *Phi Delta Kappan, 93*(6), 8-15.

Duncan, A. (2011). Our Future, Our Teachers: The Obama Administration's Plan for Teacher Education Reform and Improvement. Washington, DC: U.S. Department of Eduction. Retrieved November 28, 2015 from http://www.ed.gov/teaching/our-future-our-teachers

Duncan, A. (2015). *Fact Sheet – Department of Education Advances Transparency Agenda for Accreditation*. Washington, DC: U.S. Department of Education. Retrieved November 17, 2015 from http://www.ed.gov/accreditation

Engel, M., Jacob, B., & Curran, F. (2014). New evidence on teacher labor supply. *American Educational Research Journal, 51*, 36-72.

Floden, R.E. (2012). Teacher Value Added as a Measure of Program Quality: Interpret With Caution. *Journal of Teacher Education, 63*, 356.

Fowles, J., Butler, J. S., Cowen, J. M., Streams, M. E., & Toma, E. F. (2013). Public employee quality in a geographic context: a study of rural teachers. *The American Review of Public Administration*, 0275074012474714.

Gansle, K. A., Noell, G. H., & Burns, J. M. (2012). Do student achievement outcomes differ across teacher preparation programs? An analysis of teacher education in Louisiana. *Journal of Teacher Education*, *63*(5), 304-317.

Goldhaber, D., Krieg, J., & Theobald, R. (2014). Knocking on the door to the teaching profession? Modeling the entry of prospective teachers into the workforce. *Economics of Education Review* (43), 106-124.

Greenberg, J., McKee, A., & Walsh, K. (2013, June). *Teacher prep review: A review of the nation's teacher preparation programs.* Washington, DC: National Council on Teacher Quality.

Haggstrom, G., Darling-Hammond, L., & Grissmer, D. (1988). *Assessing Teacher Supply and Demand*. Santa Monica, CA: Rand Corporation.

Hanushek, E. A., & Pace, R. R. (1995). Who chooses to teach (and why)? *Economics of Education Review, 14*(2), 101-117.

Harris, D., Rutledge, S., Ingle, W., & Thompson, C. (2010, Spring). Mix and Match: What Principals Really Look for When Hiring Teachers. *Education Finance and Public Policy*, *5*(2), 228-246.

Harris, D. N., & Sass, T. R. (2010). Teacher training, teacher quality and student achievement. *Journal of Public Economics*, *95*, 798-812.

Henry, G. T., Kershaw, D. C., Zulli, R. A., & Smith, A. A. (2012). Incorporating teacher effectiveness into teacher preparation program evaluation. *Journal of Teacher Education*, *63*(5), 335-355.

Ingle, K., Rutledge, S., & Bishop, J. (2011) Context matters: principals' sensemaking of teacher hiring and on-the-job performance. *Journal of Educational Administration, 49*(5), 579-610.

Monk, D.H. (2007) Recruiting and Retaining High-Quality Teachers in Rural Areas. *The Future of Children, 17*(1), 155-174.

Plecki, M., Elfers, A. & Nakamura, Y. (2012). Using Evidence for Teacher Education Program Improvement and Accountability: An Illustrative Case of the Role of Value-Added Measures. *Journal of Teacher Education, 63*, 318.

Podgursky, M., Monroe, R., & Watson, D. (2004), The academic quality of public school teachers: An analysis of entry and exit behavior. *Economics of Education Review, 23*(5), 507-518.

Reback, R. (2006) Entry Costs and the Supply of Public School Teachers. *Education Finance and Policy, 1*(2), 247-265.

Reininger, M. (2012). Hometown disadvantage? It depends on where you're from. Teacher' location preferences and the implications for staffing schools. *Educational Evaluation and Policy Analysis, 34* (2),127-145.

Ronfeldt, M., Schwartz, N., & Jacob, B. (2014). Does pre-service preparation matter? Examining an old question in new ways. *Teachers College Record*, *116*(10), 1-46.

Zumwalt, K. & Craig, E. (2005). Teachers' characteristics: Research on the demographic profile. In M. Cochran-Smith & K.M. Zeichner (Eds.), *Studying teacher education* (pp. 111-156). Washington, DC: American Educational Research Association.

Appendix A: Survey Respondent Representation by Various Characteristics

Table 1: Proportion of Survey Respondents by Various Characteristics

		Total Number of Completers	Number Responding to Survey	Response Rate	Pearson Chi-Square Significance (2-sided) $N = 1,444$
Overall	**--**	**1,444**	**285**	**19.7%**	--
A. Gender	Male	339	64	18.9%	χ^2 (1)= .206, p= .650
	Female	1105	221	20.0%	
B. Residency Status	In-state	1201	245	20.4%	χ^2 (2)= 3.720, p= 0.156
	Out-of-State (U.S. resident)	103	21	20.4%	
	Canadian / International	140	19	13.6%	
C. Race / Ethnicity	Underrep. race or ethnicity	48	9	18.8%	χ^2 (1) = .082, p= .775
	Not Underrep.	1257	257	20.4%	
D. Year of Program Completion	2011	485	92	19.0%	χ^2 (2) = 2.230, p= .328
	2012	495	91	18.4%	
	2013	464	102	22.0%	
E. Institution Attended	Institution A	37	9	24.3%	χ^2 (5) = 38.679, **p< .001**
	Institution B	470	62	13.2%	
	Institution C	381	83	21.8%	
	Institution D	339	100	29.5%	
	Institution E	27	4	14.8%	
	Institution F	190	27	14.2%	
F. Employment Outcome in Maine	Teacher in Maine public school	688	154	22.4%	χ^2 (1) = 5.812, **p=.016**
	Not teacher in Maine school	756	131	17.3%	

Appendix B: Preliminary Analysis of Relationships to Dependent Variables

Table 1A. Relationship of Categorical Independent Variables to Job Application/ Certification Status

		Survey Data		Administrative Data	
		Number (Percent) Applying for Job	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=285)	Number (Percent) U.S. Residents Obtaining Maine Certification	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=1,304)
Overall	--	257 (90%)	--	1100 (84%)	--
Gender	Male	56 (88%)	χ^2 (1) = .667, p= .474	249 (83%)	χ^2 (1) = .301, p=.583
	Female	201 (91%)		851 (85%)	
Residency Status	In-state	221 (90%)	χ^2 (2) = 4.09, p=.130	1033 (86%)	**χ^2 (1) = 31.91, p<.001**
	Out-of-State (U.S. resident)	17 (81%)		67 (65%)	
	Canadian or International	19 (100%)		--	
Race / Ethnicity	Underrep. race, ethnicity	9 (100%)	χ^2 (1) = 1.10, p = .295	38 (83%)	χ^2 (1) = .125, p=.723
	Not Underrep.	229 (89%)		984 (84%)	
Year of Program Completion	2011	82 (89%)	χ^2 (2) = .686, p=.709	385 (88%)	**χ^2 (2) = 10.94, p=.004**
	2012	84 (92%)		375 (85%)	
	2013	91 (89%)		340 (80%)	
Institution Attended	Institution A	7 (78%)	χ^2 (5) = 9.25, p= .100	26 (87%)	**χ^2 (5) = 45.90, p<.001**
	Institution B	52 (84%)		365 (79%)	
	Institution C	74 (89%)		323 (85%)	
	Institution D	95 (95%)		316 (94%)	
	Institution E	3 (75%)		15 (58%)	
	Institution F	26 (96%)		55 (80%)	
Loan-based Teaching Service Obligation	Service Commitment	34 (94%)	χ^2 (1) = .848, p=.357	151 (94%)	**χ^2 (1) = 12.51, p<.001**
	No Service Commitment	223 (90%)		949 (83%)	
Certified in a High-need Field (Math, Science, SPED, etc.)	High-need Teaching Field	68 (94%)	χ^2 (1) = 2.16, p=.142	220 (94%)	**χ^2 (1) = 16.63, p<.001**
	Not High-need	183 (88%)		880 (84%)	
Post-Bacc Program	Post-Bacc	87 (95%)	χ^2 (1) = 2.96, p=.086	274 (96%)	**χ^2 (1)= 36.67, p<.001**
	Not Post-Bacc	170 (88%)		826 (81%)	

Table 1B. Relationship of Continuous Independent Variables to Job Application/ Certification Status: Mean Values and t-Tests

	Survey Data			Administrative Data		
	Mean Values		t-Test	Mean Values		t-Test
Independent Variable	Job Applicants	Non-Applicants		U.S. Residents Obtaining Certification	U.S. Residents, No Maine Certification	
Academics						
Program GPA	3.64	3.48	**t(233) = -2.292, p=.023**	3.55	3.31	**t(1302)= -8.878, p<.001**
GPA Z-score				.021	-.427	**t(1300)= -6.160, p<.001**
Praxis I Reading	181.02	180.00	t(268) = -1.547 , p=.123	180.3	179.4	**t(1228)= -3.103, p=.002**
Praxis I Writing	178.20	176.79	**t(268) = -2.177 p=.030**	177.6	176.9	**t(1228)= -2.593, p=.010**
Praxis I Math	181.80	180.39	t(268) = -1.560, p=.120	181.0	180.4	**t(1227)= -1.730, p=.084**
Praxis II Score Quartile	2.97	2.68	t(260) = -1.515, p=.131	2.79	2.64	**t(1180)= -1.873, p=.061**
Demographics						
Mean FAFSA EFC score	7755	7454	t(252) = -.155 , p= .877	8378	8470	t(1216)= .107, p=.915
Minimum FAFSA EFC Score	5635	4903	t(252) = -.433, p=.666	5938	6109	t(1216)= .228, p=.819
Age	28.32	25.36	**t(283) = -2.222 , p=.081**	26.2	25.1	**t(1302)= -2.125, p=.034**

Geographic Factors (Maine residents)						
Number of Students in Hometown, 2006	1941.8	1489.9	t(233)= -1.069, p=.286	1624	1677	t(1162)= .356, p=.722
Number of Students in Hometown, 2014	1843.8	1348.0	t(232)= -1.207, p=.229	1530	1558	t(1157)= .191, p=.848
Change in # Students 2006 - 2014				-98.2	-118.8	t(1157)=-1.518, p=.129
% Change in Students 2006 - 2014	-8.9%	-10.0%	**t(232)= -1.881, p=.061**	-9.3%	-9.4%	t(1157) = -.119, p=.905
Number of Students in Hometown LMA, 2006	17051	11205	**t(233) = -1.886, p=.061**	14540	13192	t(1162)= -1.226, p=.220
Number of Students in Hometown LMA, 2014	15827	10291	**t(233) = -1.891, p=.060**	13467	12177	t(1162)= -1.242, p=.214
Change in # Students in LMA 06-14				-1073	-1015	t(1162)= .814, p=.416
% Change Students in LMA 06-14	-9.8%	-11.4%	**t(233) = -1.312 , p=.191**	-9.8%	-10.0%	t(1162) = -.503, p=.615
FTE Teachers in LMA 2008	1137	763	**t(233) =-1.805, p=.072**	967	884	t(1162)= -1.130, p=.259
FTE Teachers in LMA 2014	1065	667	**t(233) = -1.922, p=.056**	908	804	t(1162)= -1.423, p=.155
Change in # FTE Teach. 2008-14				-59.4	-80.2	**t(1162)=-1.972, p=.049**
% Change in FTE teachers 2008 - 2014	-10.8%	-17.2%	**t(233) =-1.392 , p=.165**	-8.7%	-11.4%	t(1162)= -1.510, p=.131

Table 2A. Relationship of Categorical Independent Variables to Receipt of Job Offer/ Maine Public School Employment Status (Job Applicants)

		Survey Data		Administrative Data	
		Number (Percent) of applicants Receiving Job Offer	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=231)	Number (Percent) Hired in Maine Public School	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=1,100)
Overall	--	198 (85%)	--	688 (62%)	--
Gender	Male	40 (82%)	χ^2 (1) = .846, p= .358	166 (67%)	χ^2 (1) = 2.33, p=.127
	Female	158 (87%)		522 (61%)	
Residency Status	In-state	172 (86%)	χ^2 (2) = 0.026, p=.987	664 (64%)	**χ^2 (1) = 21.75, p<.001**
	Out-of-State (U.S. resident)	13 (87%)		24 (36%)	
	Canadian or International	13 (87%)		--	
Race / Ethnicity	Underrep. race or ethnicity	6 (100%)	χ^2 (1) = 0.968, p = .325	23 (60%)	χ^2 (1) = .055, p=.815
	Not Underrep.	179 (86%)		614 (62%)	
Year of Program Completion	2011	61 (82%)	χ^2 (2) = 1.38, p=.501	254 (66%)	**χ^2 (2) = 7.26, p=.027**
	2012	66 (89%)		241 (64%)	
	2013	71 (86%)		193 (57%)	
Institution Attended	Institution A	5 (71%)	χ^2 (5) = 6.06, p= .301	17 (65%)	**χ^2 (5) = 34.65, p< .001**
	Institution B	41 (84%)		212 (57%)	
	Institution C	60 (92%)		179 (55%)	
	Institution D	69 (81%)		236 (74%)	
	Institution E	3 (100%)		9 (45%)	
	Institution F	20 (91%)		35 (63%)	
Loan-Based Service Obligation	Service Commitment	28 (88%)	χ^2 (1) = .097, p=.756	107 (71%)	**χ^2 (1) = 5.17, p=.023**
	No Service Commitment	170 (85%)		581 (61%)	
High-need Field	High-need Teaching Field	51 (85%)	χ^2 (1) = 0.01, p=.932	173 (79%)	**χ^2 (1) = 30.39, p<.001**
	Not High-need	141 (86%)		515 (58%)	
Post-Bacc Program	Post-Bacc	67 (86%)	χ^2 (1)=.003, p=.955	211 (77%)	**χ^2 (1) =32.58, p<.001**
	Not Post-Bacc	131 (86%)		477 (58%)	

Table 2B. Relationship of Continuous Independent Variables to Receipt of Job Offer/ Maine Public School Employment Status (Job Applicants)

	Survey Data			Administrative Data		
	Mean Values		t-Test	Mean Values		t-Test
Independent Variable	Job Offer (N= 186)	No Job Offer (N=32)		Certified Grads Hired in Maine Public School	Certified Grads, No Maine Teaching Position	
Academics						
Program GPA	3.64	3.58	t(233) = -.776, p=.439	3.60	3.46	**t(1098)= -6.845, p<.001**
GPA Z-score				.115	-.136	**t(1096)= -4.385, p<.001**
Praxis I Reading	180.85	181.06	t(217) = .339 , p=.735	180.6	179.9	**t(1047)= -3.207, p=.001**
Praxis I Writing	178.04	178.42	t(217) = .622 p=.535	177.8	177.2	**t(1047)= -3.037, p=.002**
Praxis I Math	181.86	181.12	t(217) = -.870, p=.385	181.4	180.4	**t(1046)= -3.585, p<.001**
Praxis II Score Quartile	2.97	2.84	t(212) = .731, p=.466	2.84	2.70	**t(1012)= -2.274, p=.023**
Demographics						
Mean FAFSA EFC score	7463	10,123	t(205) = 1.363 , p= .174	7867.6	9241.4	t(1026)= 2.056, **p=.040**
Minimum FAFSA EFC Score	5322	7733	t(205) = 1.414, p=.159	5740.1	6273.8	t(1026)= .935, p=.350
Age	27.70	33.91	**t(229) = 3.803 , p=<.001**	26.4	25.8	t(1097)= -1.373, p=.170
Geographic Factors (Maine residents)						
# Students Hometown, 2006	1961.4	2004.9	t(190)= .105, p=.917	1698.1	1492.6	**t(999)= -1.797, p=.073**
# Students Hometown, 2014	1860.9	1929.6	t(189)= .170, p=.865	1600.3	1405.5	**t(994)= -1.737, p=.083**

Chg # Students in Town				-100.9	-93.5	t(994)= -0.694, p=.488
% Change in Students 2006 - 2014	-9.1%	-8.0%	t(189)= .516, p=.606	-9.4%	-9.3%	t(994) = .084, p=.933
Number of Students in Hometown LMA, 2006	16375	18683	t(190) = .777, p=.438	14631.6	14379.5	t(999)= -.291, p=.771
Number of Students in Hometown LMA, 2014	15185	17408	t(190) = .792, p=.429	13560.2	13302.5	t(999)= -.315, p=.753
Chg in # in LMA				-1071.3	-1077.1	t(999)= -.102, p=.919
% Change in Students in LMA 2006 to 2014	-10.0%	-9.4%	t(190) = .522 , p=.602	-9.7%	-10.0%	t(999)= -.771, p=.441
FTE Teachers in LMA 2008	1093	1249	t(190) =.785, p=.433	973.6	956.4	t(999)= -.297, p=.766
FTE Teachers in LMA 2014	1017	1196	t(190) =.903, p=.368	912.8	899.4	t(999)= -.233, p=.816
Chg in # FTE				-60.7	-56.9	t(999)= .464, p=.642
% Change in FTE teachers 2008 - 2014	-11.5%	-5.8%	**t(190) =1.376 , p=.170**	-8.5%	-9.0%	t(999) = -.337, p=.736

Table 3A. Relationship of Categorical Independent Variables to Receipt of Job Offer/ Maine Public School Employment Status (All Graduates)

		Survey Data		Administrative Data	
		Number (Percent) of applicants Receiving Job Offer	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=231)	Number (Percent) Hired in Maine Public School	Pearson Chi-Square Significance (2-sided) χ^2 (df, N=1,123)
Overall	--	198 (86%)	--	688 (53%)	--
Gender	Male	39 (68%)	χ^2 (1) = 1.853, p=.173	166 (56%)	χ^2 (1)= 1.22, p= .270
	Female	156 (77%)		522 (52%)	
Residency Status	In-state	169 (75%)	χ^2 (2)=1.529, p=.466	664 (55%)	**χ^2 (1) = 39.06, p<.001**
	Out-of-State (U.S. resident)	13 (68%)		24 (23%)	
	Canadian or International	13 (87%)			
Race / Ethnicity	Underrep. race or ethnicity	6 (100%)	χ^2 (1) = 1.984, p=.159	23 (50%)	χ^2 (1) = 0.134, p = .714
	Not Underrep.	177 (75%)		614 (53%)	
Year of Program Completion	2011	61 (73%)	χ^2 (2) = 0.959, p=.619	254 (58%)	**χ^2 (2) = 14.94, p=.001**
	2012	64 (79%)		241 (55%)	
	2013	70 (75%)		193 (45%)	
Institution Attended	Institution A	5 (56%)	χ^2 (5) = 6.135, p=.293	17 (57%)	**χ^2 (5) = 56.80, p<.001**
	Institution B	40 (68%)		212 (46%)	
	Institution C	59 (80%)		179 (47%)	
	Institution D	68 (76%)		236 (70%)	
	Institution E	3 (75%)		9 (35%)	
	Institution F	20 (87%)		35 (52%)	
Loan-based Service Obligation	Service Commitment	28 (82%)	χ^2 (1) = 1.05, p=.306	107 (67%)	**χ^2 (1)= 13.91, p<.001**
	No Service Commitment	167 (74%)		581 (51%)	
High-need Field	High-need Teaching Field	50 (78%)	χ^2 (1) = 0.531, p=.466	173 (74%)	**χ^2 (1) =48.00, p<.001**
	Not High-need	139 (74%)		515 (49%)	
Post-Bacc Program	Post-Bacc	66 (80%)	χ^2 (1)= 1.174 p=.279	211 (74%)	**χ^2 (1) =65.15, p<.001**
	Not Post-Bacc	129 (73%)		477 (47%)	

Table 3B. Relationship of Continuous Independent Variables to Receipt of Job Offer/ Maine Public School Employment Status (All Graduates)

	Survey Data			Administrative Data		
	Mean Values		t-Test	Mean Values		t-Test
Independent Variable	Hired	Not hired		U.S. Residents Obtaining Maine Teaching Job	U.S. Residents, No Maine Teaching Job	
Academics						
Program GPA	3.64	3.52	t(216) = -2.375, p=.018	3.60	3.41	**t(1302)= -9.918, p<.001**
GPA Z-score				.115	-.233	**t(1300)= -6.569, p<.001**
Praxis I Reading	180.9	180.6	t(245) = -.549 , p=.584	180.6	179.7	**t(1228)= -4.180, p<.001**
Praxis I Writing	178.1	177.6	t(245) = -1.054 p=.293	177.8	177.1	**t(1228)= -3.830, p<.001**
Praxis I Math	181.9	180.8	t(245) = -1.598, p=.111	181.4	180.4	**t(1227)= -3.903, p<.001**
Praxis II Score Quartile	2.97	2.78	t(237) = -1.401, p=.163	2.84	2.68	**t(1180)= -2.841, p=.005**
Demographics						
Mean FAFSA EFC score	7545	8495	t(232) = .654 , p= .514	7868	8985	t(1216)= 1.801, **p=.072**
Minimum FAFSA EFC Score	5412	6019	t(232) = .485, p=.514	5740	6219	t(1216)= .880, p=.379
Age	27.7	29.8	t(257) = 1.634, p=.104	26.4	25.6	**t(1302)= -2.231, p=.026**

Geographic Factors (Maine residents)						
Number of Students in Hometown, 2006	1961	1771	t(214) = -.601, p=.549	1698	1550	t(1162)= -1.439, p=.150
Number of Students in Hometown, 2014	1861	1664	t(213) = -.640, p=.523	1600	1453	t(1157)= -1.461, p=.144
Change in # Students 06-14	-108	-107	t(213) = .033, p=.974	-101	-101	t(1157)= -.059, p=.953
% Change in Students in Town from 2006-14	-9.1%	-10.2%	t(213) = -.698, p=.486	-9.4%	-9.4%	t(1157)= 0.023, p=.982
Number of Students in Hometown LMA, 2006	16433	15074	t(214) = -.601, p=.549	14632	14010	t(1162)= -.810, p=.418
Number of Students in Hometown LMA, 2014	15239	13980	t(214) = -.589, p=.557	13560	12952	t(1162)= -.839, p=.401
Change in Students in LMA from 2006-14	-1194	-1094	t(214) = .715, p=.475	-1071	-1058	t(1162)= .272, p=.786
% Change in Students in LMA from 2006-14	-10.0	-10.2	t(214) = -.211, p=.833	-9.7%	-10.0%	t(1162)= -.913, p=.361
FTE Teachers in LMA 2008	1096	1017	t(214) = -.525, p=.600	973.6	933.9	t(1162)= -.773, p=.440
FTE Teachers in LMA 2014	1021	941	t(214) = -.532, p=.595	912.8	869.7	t(1162)= -.846, p= .398
Change in FTE teachers 2008-14	-74.8	-75.9	t(214) = -.057, p=.955	-60.7	-64.2	t(1162)= -.466, p=.641
% Change in FTE teachers 2008-14	-11.3	-11.6	t(214) = -.074, p=.941	-8.5%	-9.8%	t(1162)= -.975, p= .330

Appendix C: SPSS Output for Administrative Models

Model 1-Admin – Factors Related to Attainment of Maine Teacher Certification (US Residents); Unadjusted Program GPA

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
PostBaccFlag(1)	.822	.354	5.395	1	.020	2.276
InStateResident(1)	.969	.242	16.075	1	.000	2.635
ServiceCommitment(1)	.709	.348	4.160	1	.041	2.032
CurrentYear_ETS	-.284	.104	7.407	1	.006	.753
HighNeedFlagA(1)	.653	.303	4.662	1	.031	1.922
TeacherPrepGPA	1.178	.250	22.205	1	.000	3.246
Constant	567.150	209.589	7.323	1	.007	2.043E+246

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	106.409	6	.000
	Block	106.409	6	.000
	Model	106.409	6	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	948.815[a]	.080	.142

Classification Table[a]

			Predicted		
			Certified		Percentage
	Observed		.00	1.00	Correct
Step 1	Certified	.00	6	178	3.3
		1.00	3	1097	99.7
	Overall Percentage				85.9

Model 1-Admin – Factors Related to Attainment of Maine Teacher Certification (US Residents); Standardized GPA

	B	S.E.	Wald	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
InStateResident(1)	.982	.242	16.476	.000	2.669	1.661	4.288
PostBaccFlag(1)	1.368	.331	17.098	.000	3.929	2.054	7.515
ZTcherPrepGPA	.391	.084	21.483	.000	1.479	1.253	1.745
ServiceCommitment	.720	.347	4.294	.038	2.054	1.040	4.059
HighNeedFlagA(1)	.660	.304	4.724	.030	1.935	1.067	3.508
CurrentYear_ETS	-.282	.104	7.356	.007	.754	.615	.925
Constant	568.12	209.22	7.373	.007	5.381 E+246		

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	105.167	6	.000
	Block	105.167	6	.000
	Model	105.167	6	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	949.439[a]	.079	.140

Classification Table[a]

			Predicted		
			Certified		Percentage Correct
	Observed		.00	1.00	
Step 1	Certified	.00	6	178	3.3
		1.00	3	1095	99.7
	Overall Percentage				85.9

Model 2-Admin – Factors Related to Hiring of Certified Teachers

	B	S.E.	Wald	Sig.	Exp(B)	95% C.I.for Lower	95% C.I.for Upper
InStateResident(1)	1.033	.276	13.980	.000	2.810	1.635	4.830
PostBaccFlag(1)	.458	.258	3.165	.075	1.582	.954	2.621
InstitutionGroup			8.848	.031			
InstitutionGroup(1)	.325	.168	3.744	.053	1.384	.996	1.923
InstitutionGroup(2)	.644	.259	6.191	.013	1.905	1.147	3.164
InstitutionGroup(3)	.561	.260	4.642	.031	1.752	1.052	2.917
ZTcherPrepGPA	.304	.071	18.392	.000	1.355	1.179	1.557
ServiceCommitment	.345	.210	2.691	.101	1.412	.935	2.131
HighNeedFlagA(1)	.876	.198	19.535	.000	2.402	1.629	3.542
CurrentYear_ETS	-.221	.082	7.287	.007	.802	.683	.941
AgeAtCompletion	-.026	.011	5.668	.017	.974	.953	.995
Constant	444.39	164.75	7.276	.007	9.883 E+192		

Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Model	107.601	10	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1343.485[a]	.093	.127

Classification Table[a]

Observed		Predicted: ApplicantsEmployment As Teacher .00	Predicted: ApplicantsEmployment As Teacher 1.00	Percentage Correct
ApplicantsEmployment AsTeacher	.00	121	290	29.4
	1.00	84	602	87.8
Overall Percentage				65.9

Model 3-Admin - Model of All Graduates' Job Placement

	B	S.E.	Wald	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
InStateResident(1)	1.207	.255	22.415	.000	3.343	2.028	5.510
PostBaccFlag(1)	.633	.239	7.021	.008	1.883	1.179	3.006
InstitutionGroup			7.976	.047			
InstitutionGroup(1)	.249	.154	2.609	.106	1.282	.948	1.734
InstitutionGroup(2)	.591	.236	6.247	.012	1.805	1.136	2.869
InstitutionGroup(3)	.454	.233	3.775	.052	1.574	.996	2.487
ZTcherPrepGPA	.360	.064	31.313	.000	1.434	1.264	1.626
ServiceCommitment(1)	.445	.196	5.139	.023	1.561	1.062	2.293
HighNeedFlag(1)	.882	.181	23.702	.000	2.417	1.694	3.448
CompletionYear_	-.258	.075	11.841	.001	.772	.667	.895
AgeAtCompletion	-.022	.011	4.132	.042	.979	.958	.999
Constant	518.9	151.074	11.799	.001	2.356E+225		

Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Model	178.480	10	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1590.893[a]	.130	.174

Classification Table[a]

		Predicted		
		CandidatesEmployed_Teacher		Percentage Correct
Observed		.00	1.00	
Candidates Employed_Teacher	.00	358	237	60.2
	1.00	207	479	69.8
Overall Percentage				65.3

Appendix D: Job Outcomes in Maine by Specific Certification Areas

(Sorted by Percent of Total Graduates Prepared Hired)

	Total	Certified	Employed	% of Eligible Hired	% of Total Hired
Mathematics (7-12)	61	54	49	90.70%	80.30%
Special Education (7-12)	12	11	9	81.80%	75.00%
Special Education (K-8)	95	91	69	75.80%	72.60%
Physical Science (7-12)	27	24	18	75.00%	66.70%
ESL (K-12)	21	20	13	65.00%	61.90%
French or Spanish (K-12)	13	11	8	72.73%	61.54%
English (7-12)	104	83	55	66.30%	52.90%
General Elementary (K-8)	641	498	317	63.70%	49.50%
Life Science (7-12)	31	26	15	57.70%	48.40%
OVERALL	**1,444**	**1,106**	**688**	**62.20%**	**47.60%**
Music (K-12)	74	57	33	57.90%	44.60%
Visual Arts (K-12)	44	33	18	54.50%	40.90%
Social Studies (7-12)	119	86	47	54.70%	39.50%
Early Elementary (K-3)	56	51	18	35.30%	32.10%
Physical Education (K-12)	52	31	14	45.20%	26.90%
Special Education (PreK)	16	12	3	25.00%	18.80%
Health (K-12)	10	7	1	14.30%	10.00%
Early Childhood (PreK)	26	9	1	11.10%	3.80%
No Cert Area Found	40	0	0	0.00%	0.00%
Industrial Arts (K-12)	2	2	0	0.00%	0.00%

Biography of the Author

The author was born in New York State and graduated from Scotia-Glenville High School. She earned her bachelor of science degree with a major in Chemistry from the State University of New York at Buffalo in 1994, and her master of science in education degree in secondary education from Duquesne University in 1999. After earning her bachelor's degree she worked as an intern for the Department of Energy in Richland, Washington. She subsequently worked as a chemist and then in student affairs at Duquesne University in Pittsburgh, Pennsylvania. Since 1999 she has worked at the University of Southern Maine, first in roles supporting students in the College of Education and Human Development and moving to a research role in the Center for Education Policy, Applied Research, and Evaluation (CEPARE) in 2008. She has served as Assistant Director of CEPARE since 2011, and as co-Director of the Maine Education Policy Research Institute since 2015. She is a member of the American Educational Research Association, the American Evaluation Association, and the American Association of Colleges for Teacher Education. She is a candidate for the Doctor of Philosophy degree in Public Policy from the University of Southern Maine in December, 2015.