UNC Teacher Quality Research: Teacher Portals Effectiveness Report

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Authors:

Kristina M. Patterson
Kevin C. Bastian

EDUCATION POLICY INITIATIVE *at* CAROLINA

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Executive Summary of Findings

The purpose of this report is to compare the relative effectiveness, evaluation ratings, and persistence of early-career teachers in North Carolina public schools who entered the teaching profession through different routes of preparation or "portals." In the body of this report we detail our teacher portal categories, data and sample, research methods, and results. Below, we summarize our findings for five policy relevant teacher portals.

UNC Undergraduate Prepared: Teachers traditionally prepared at the undergraduate level by UNC system institutions are the largest source of teachers in North Carolina public schools—33% of the teacher workforce in 2011-12—and the most likely group to remain in the state's public school classrooms—76% return for a fifth year of teaching. In comparison to other sources of teachers, UNC traditionally prepared undergraduates are significantly more effective in 12 value-added comparisons, significantly less effective in 15 value-added comparisons, and perform no differently in 67 value-added comparisons.[1] It is important to note that UNC undergraduate prepared teachers outperformed teachers from the largest suppliers of North Carolina public school teachers (e.g. out-of-state undergraduate, alternative entry, and NC private undergraduate prepared teachers), while underperforming considerably smaller portals (e.g. Teach For America). UNC undergraduate prepared teachers have similar odds of being rated above proficient (accomplished or distinguished) as teachers from most other portals on all five North Carolina Professional Teaching Standards.

NC Private Undergraduate Prepared: Teachers traditionally prepared at the undergraduate level by private or independent colleges or universities in North Carolina are the 4th largest source of teachers in North Carolina public schools—12% of the teacher workforce in 2011-12—and persist at similar rates to UNC undergraduate prepared teachers—76% return for a fifth year of teaching. In comparison to UNC undergraduate prepared teachers, NC private undergraduate prepared teachers are significantly less effective in 3 value-added comparisons and no different in 8 value-added comparisons. NC private undergraduates have similar odds of being rated above proficient on all five North Carolina Professional Teaching Standards as UNC undergraduate prepared teachers.

Out-of-State Undergraduate Prepared: Teachers traditionally prepared at the undergraduate level at a college or university outside of North Carolina are the 2nd largest source of teachers in North Carolina public schools—23% of the teacher workforce in 2011-12—and demonstrate significantly lower persistence rates than UNC undergraduate prepared teachers—58% return for a fifth year of teaching. In comparison to UNC undergraduate prepared teachers, out-of-state undergraduate prepared teachers are significantly less effective in 4 value-added comparisons and no different in 7 value-added comparisons. Out-of-State undergraduate prepared teachers have similar odds of being rated above proficient as UNC undergraduate prepared teachers on all five North Carolina Professional Teaching Standards.

Teach For America: Teachers entering the teaching profession through Teach For America (TFA) are the smallest source of teachers in North Carolina public schools—0.50% of the teacher workforce in 2011-12—and demonstrate significantly lower persistence rates than UNC undergraduate prepared teachers—approximately 10% return for a fifth year of teaching. On average, TFA corps members

[1] UNC traditionally prepared undergraduates are our reference group for value-added analyses. In total, across our elementary, middle, and high school value-added models, there are a total of 94 effectiveness comparisons between UNC undergraduate prepared teachers and teachers from other preparation portals.

are the most effective source of early-career teachers in North Carolina public schools, significantly outperforming UNC undergraduate prepared teachers in 9 value-added comparisons and performing no differently in 2 value-added comparisons. In comparison to UNC undergraduate prepared teachers, TFA corps members have significantly greater odds of being rated above proficient on all five North Carolina Professional Teaching Standards.

Alternative Entry: Teachers entering the teaching profession prior to completing all requirements for initial licensure are the 3rd largest source of teachers in North Carolina public schools—15% of the teacher workforce in 2011-12—and demonstrate significantly lower persistence rates than UNC undergraduate prepared teachers—approximately 56% return for a fifth year of teaching. In comparison to UNC undergraduate prepared teachers, alternative entry teachers are significantly less effective in 3 value-added comparisons and no different in 8 value-added comparisons. Alternative entry teachers have significantly lower odds of being rated above proficient than UNC undergraduate prepared teachers on all five North Carolina Professional Teaching Standards.

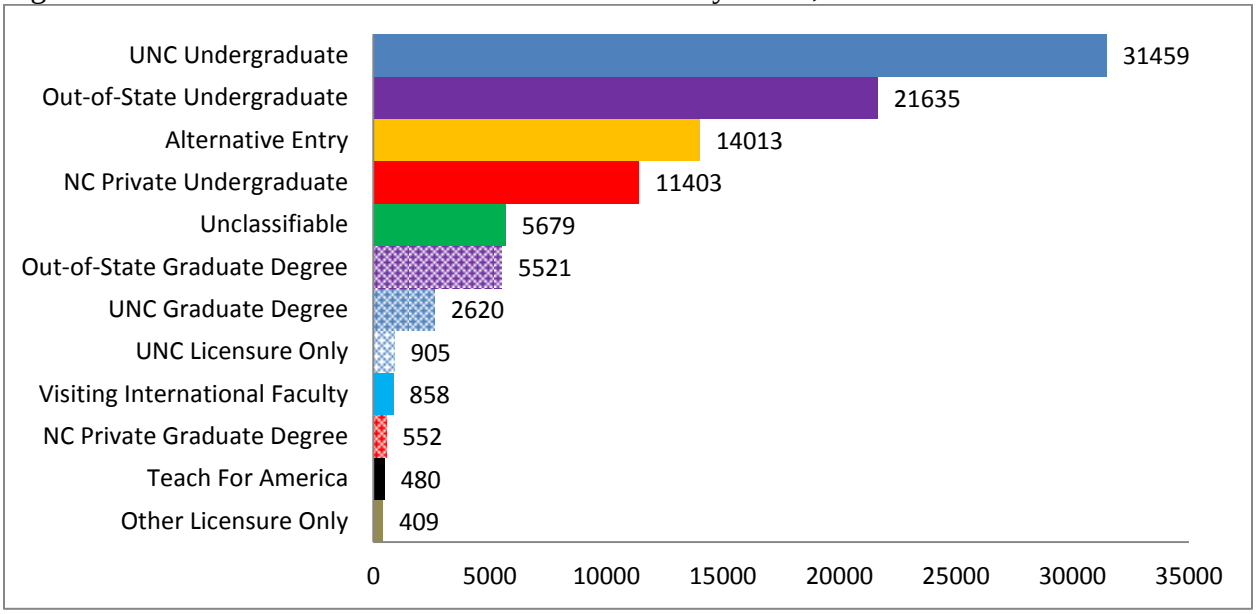
Introduction

The proliferation of teacher preparation routes over the last several decades has sparked the following research question: Are teachers from some preparation sources more effective and more persistent than teachers entering the profession through other preparation sources (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2006; Boyd, Goldhaber, Lankford, & Wyckoff, 2007; Henry, Purtell, Bastian, Fortner, Thompson, Campbell, & Patterson, 2014; Kane, Rockoff, & Staiger, 2008)? To address this question, the purpose of this report is to compare the relative effectiveness, evaluation ratings, and persistence of early-career teachers in North Carolina public schools who entered teaching through one of eleven different routes of preparation or "portals." As the largest source of teachers in North Carolina public schools, and in response to the UNC system's commitment to evaluate and strengthen their teacher preparation programs, in this report we benchmark the performance of teachers traditionally prepared at the undergraduate level by UNC system institutions against that of teachers entering the profession through one of ten additional entry portals. Results from these analyses can provide state officials with evidence to better structure teacher licensure/certification policy and aid school districts with teacher recruitment and hiring. Furthermore, findings may encourage teacher preparation programs to identify, adopt, and evaluate evidence-based program improvements.

To consider the impact of a teacher portal on K-12 education in North Carolina, it is important to consider not only the performance and persistence of teachers who are prepared through this portal, but also, the number of teachers who enter the profession through the portal. Portals with large numbers of teachers can have a greater impact (positive or negative) on student performance and on the state's teacher workforce than portals that prepare fewer teachers. In Figure 1, we display the total number of North Carolina public school teachers, employed in 2011-12, that entered the teaching profession through each of the 11 teaching portals. Overall, the UNC system—the undergraduate, graduate, and licensure only levels—supplied nearly 37% of the state's teacher workforce and North Carolina private or independent colleges and universities supplied approximately 12.5% of the teacher workforce. Teachers prepared outside North Carolina, at the undergraduate, graduate, or licensure only levels, comprised over 28% of the workforce in 2011-12.[2] Nearly 15% of the state's workforce entered the profession alternatively, meaning they originally began teaching prior to completing all requirements for initial licensure. Teach For America (TFA) corps members receive frequent policy and media attention, yet comprise approximately 0.50% of the state's teacher workforce. Finally, the data needed to accurately assign teachers to a portal was missing for approximately 6% of the workforce and we assigned them to an unclassifiable category.

[2] See "Teachers Without Borders: Consequences of Teacher Labor Force Mobility" (forthcoming in *Educational Evaluation and Policy Analysis*) for more details on out-of-state prepared teachers.

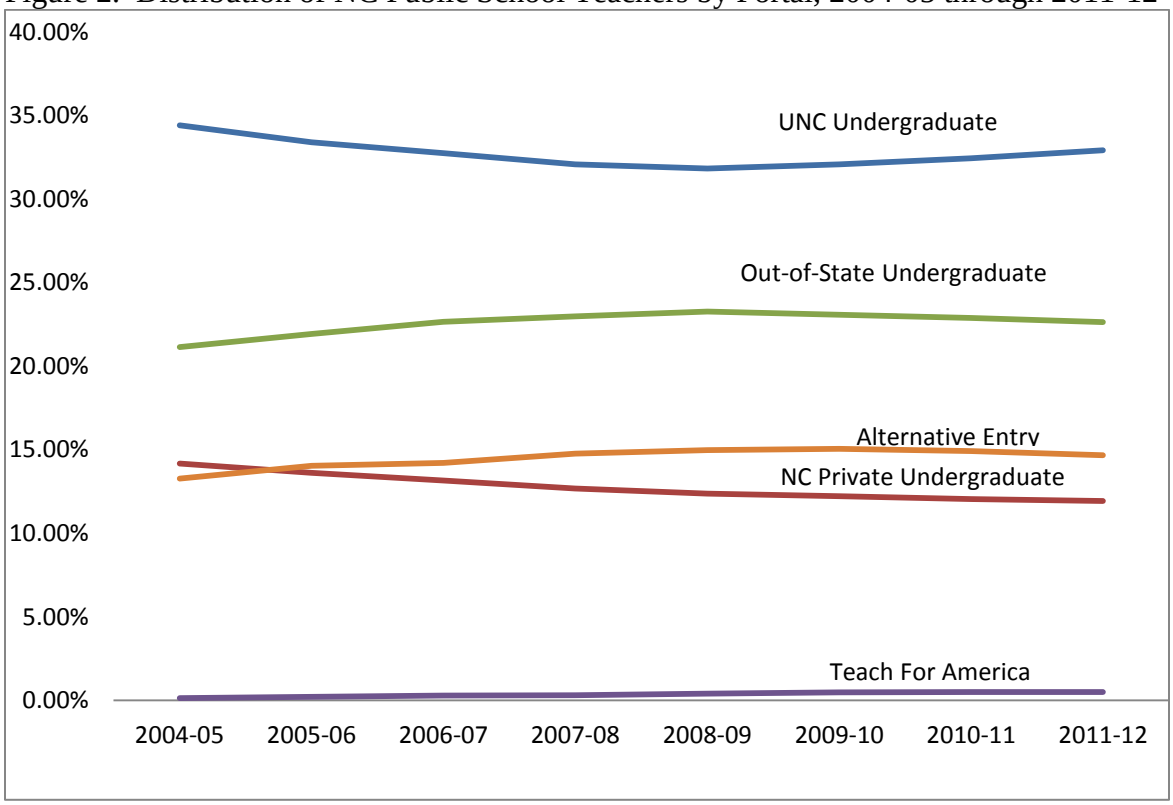
Figure 1. Distribution of NC Public School Teachers by Portal, 2011-12



Note: In the 2011-12 academic year there were 95,534 individuals paid as teachers in North Carolina public schools. This figure displays the teacher portals arranged from largest (top) to smallest (bottom).

To complement the static values shown in Figure 1, Figure 2 (below) displays trends in the distribution of teachers to portals over the period of 2004-05 through 2011-12 for five policy relevant portals. In the figure's initial years, the share of in-state traditionally prepared undergraduates (public and private university) declined as the share of out-of-state prepared undergraduates and alternative entry teachers increased. More recently, the percentage of UNC undergraduate prepared teachers has increased as the share of out-of-state prepared undergraduates and alternative entry teachers has leveled off. While still supplying a small percentage of the state's teacher workforce (approximately 0.50%), TFA has grown considerably in North Carolina since 2004-05. Due to the recent increase in funding for TFA by the North Carolina General Assembly, this portal will continue to grow over the next few years.

Figure 2. Distribution of NC Public School Teachers by Portal, 2004-05 through 2011-12



Note: This figure displays the percentage of teachers in five policy relevant portal categories from the 2004-05 through 2011-12 academic years.

Background

This report, produced in collaboration with the UNC General Administration, presents the third[3] set of results assessing the performance of teachers entering the profession through different routes or portals. The UNC General Administration commissioned this research agenda in 2009 in an effort to better understand the composition of the teacher workforce in North Carolina and to quantify the impact of UNC traditional teacher preparation programs on student achievement.

To assess the effectiveness of UNC system prepared teachers, as compared to teachers from other sources, we classify public school teachers in North Carolina into one of eleven categories, which we refer to as portals. A portal is a fixed and exclusive category that captures a teacher's preparation upon first entering the profession, with assignment to a portal based on the highest degree earned, set of courses completed, or other preparation that an individual acquired before becoming a classroom teacher. A teacher who entered through the alternative entry portal, for example, may eventually complete all licensure requirements and become fully certified, however, for the purpose of this study, she would continue to be classified as alternative entry since that reflects her qualifications when beginning teaching.

Four questions guided our classification of teachers into portals. First, was the teacher fully qualified—that is, had she met all requirements for initial licensure—when she became a classroom teacher for the first time? Second, if so, was her qualification based on a set of education-related courses taken in the process of earning an undergraduate or graduate degree or through a program that terminated with a licensure/certificate only? Third, what was the highest level of degree—undergraduate or graduate—that she held when first entering the teaching profession? Finally, if fully qualified, from what type of institution did she earn the degree or teaching license: UNC system, NC private college or university, or an out-of-state university? Based on answers to these questions, we created eleven mutually exclusive categories that capture the portal through which an individual entered the teaching profession.[4] Our eleven portals are as follows: UNC undergraduate prepared, UNC graduate prepared, NC private undergraduate prepared, NC private graduate prepared, out-of-state undergraduate prepared, out-of-state graduate prepared, UNC licensure only, out-of-state licensure only, Teach For America, Visiting International Faculty, and alternative entry (see Table 1 for definitions of each portal).

[3] See Henry, G.T., Thompson, C.L., Bastian, K.C., Fortner, C.K., Kershaw, D.C., Purtell, K.M., and Zulli, R.A. (2010). *Portal Report: Teacher Preparation and Student Test Scores in North Carolina*. Chapel Hill, NC: Education Policy Initiative at Carolina. Available online at: http://publicpolicy.unc.edu/files/2014/02/Portal_TeachPrep-TestScore_June2010_Final.pdf and Education Policy Initiative at Carolina. (2012). *UNC Teacher Quality Research: Teacher Portals Effectiveness Analysis.* Chapel Hill, NC: Education Policy Initiative at Carolina. Available online at: http://publicpolicy.unc.edu/files/2014/02/PortalsEffectivenessReport_2012.pdf

[4] There is one additional category containing individuals who cannot be classified, based on available data, into any of these 11 entry portals. We retain these unclassifiable teachers in our analyses but do not present their results in this report.

Table 1. Portal Definitions

Teacher Portal	Definition
UNC Undergraduate Prepared	A North Carolina public school teacher who completed the requirements for initial licensure at a University of North Carolina system institution by earning (a) a Bachelor's degree in education or (b) a Bachelor's degree in another major while simultaneously completing the required education-related coursework, before beginning teaching.
UNC Graduate Prepared	A North Carolina public school teacher who earned a graduate degree from a UNC system institution and qualified for an initial license before beginning teaching.
NC Private Undergraduate Prepared	A North Carolina public school teacher who completed the requirements for initial licensure at a private or independent institution in North Carolina by earning (a) a Bachelor's degree in education or (b) a Bachelor's degree in another major while simultaneously completing the required education-related coursework, before beginning teaching.
NC Private Graduate Prepared	A North Carolina public school teacher who earned a graduate degree from a private or independent North Carolina institution and qualified for an initial license before beginning teaching.
Out-of-State Undergraduate Prepared	A North Carolina public school teacher who completed the requirements for initial licensure at an institution outside of North Carolina by earning a Bachelor's degree in education before beginning teaching.
Out-of-State Graduate Prepared	A North Carolina public school teacher who earned a graduate degree from a university outside of North Carolina and qualified for an initial license before beginning teaching.
UNC Licensure Only	A North Carolina public school teacher who, after earning a Bachelor's degree at any public or private institution in any state, then separately completed the education-related coursework required for teacher licensure at a UNC system institution, before beginning teaching.
Out-of-State Licensure Only	A North Carolina public school teacher who, after earning a Bachelor's degree at any public or private institution in any state, then separately completed the education-related coursework required for teacher licensure at a university outside of North Carolina, before beginning teaching.
Teach For America	A North Carolina public school teacher who entered teaching through Teach For America.
Visiting International Faculty	A North Carolina public school teacher who entered teaching through the Visiting International Faculty program.
Alternative Entry	A North Carolina public school teacher who entered the profession prior to completing requirements for initial licensure (Teach For America corps members excluded).

In order to classify teachers into the appropriate portal, we used administrative data from four sources. First, we used data from the UNC General Administration to identify teachers prepared by the UNC system at the undergraduate, graduate, or licensure only level. Second, TFA provided us

with identifiers for their corps members in North Carolina. Third, the Visiting International Faculty (VIF) program supplied data identifying their teachers in the state. We classified TFA and VIF teachers into separate portals, rather than the alternative entry portal, because a primary goal of the portals is to create finer-grained categories to better account for the diversity in teacher preparation experiences. Finally, we used teacher education, licensure audit, and certified salary files from the NCDPI. From these data sets we determined when an individual began teaching, the basis for an individual's first teaching license(s), and an individual's graduation year, degree type, and degree granting institution (UNC system, NC private or independent college or university, or out-of-state). If a teacher earned multiple degrees prior to entering the profession, we categorized her according to the degree most proximate to beginning teaching. We placed a teacher into the unclassifiable category for three reasons: (1) her college graduation year is missing from the data (2) her highest degree earned prior to entering the classroom was less than a Bachelor's degree or (3) the NCDPI data indicate that she was teaching more than one year prior to her graduation year. For a more complete description of specific data sources and portal decision rules, see Table A.3 in the Appendix.

For teachers with less than five years experience in the 2011-12 academic year, Table 2 presents individual and school characteristics for five policy relevant portals. Regarding individual teacher characteristics, Table 2 indicates that UNC undergraduate, NC private undergraduate, and out-of-state undergraduate prepared teachers are comparable across many characteristics. However, in comparison to these traditionally prepared portals: (1) Teach For America corps members are younger and score higher on licensure exams and are more likely to teach a tested-grade or subject, work in a middle or high school, and hold a math, reading/English, or science teaching license and (2) alternative entry teachers are more likely to be male and a racial/ethnic minority, are older, score lower on licensure exams, and are more likely to work in a middle or high school and hold a science, career-technical, or exceptional children teaching license. For school characteristics, Table 2 shows that teachers entering through a traditionally prepared undergraduate portal work in comparable environments, while TFA corps members work in lower-performing schools with higher concentrations of minority and free and reduced-price lunch students.

Table 2: Individual and Workplace Characteristics for Early-Career Teachers

Individual Teacher Characteristics					
Characteristic	*UNC Under Grad*	*NC Private Under Grad*	*Out-of-State Under Grad*	*TFA*	*Alternative Entry*
Female Percentage	82.52	86.02	77.96	79.46	69.89
Minority Percentage	15.74	11.11	10.34	19.36	34.86
Age in 2011	27.29	29.65	29.80	23.72	33.94
Teaching Experience	1.81	1.95	2.17	1.02	2.46
Test Average Post (std.)	0.255	0.231	0.280	0.467	0.106
Tested Subject Percentage	31.89	31.95	36.46	55.68	32.79
Teaching Licenses Percentages					
Pre-K	2.89	2.79	11.46	0.66	2.10
Elementary	52.29	62.66	57.37	21.83	9.54
Math	12.61	9.55	13.68	24.23	13.97
Reading/English	19.46	13.69	23.34	26.64	16.81
Science	7.55	4.94	10.89	23.14	17.21
Social Studies	11.39	8.16	15.31	10.48	11.54
Foreign Language	1.24	1.55	2.43	3.71	5.19
Arts	6.64	5.09	5.76	0.66	5.52
PE/Health	5.06	6.17	4.65	0.44	5.12
Career-Technical	3.71	2.31	3.47	0.00	14.45
Exceptional Children	10.59	12.26	13.73	10.70	18.04
School Level Percentages					
Elem. & Elem/MS Combination	57.58	64.89	56.04	25.77	21.40
Middle School	17.80	15.09	22.22	30.57	29.87
High School	23.97	19.63	21.16	43.23	47.22
K-12	0.65	0.40	0.57	0.44	1.51
School Characteristics					
School Performance Composite	76.09	76.09	75.88	66.15	74.27
School Minority Percentage	50.74	47.44	55.99	88.85	57.44
School FRL Percentage	61.18	62.01	58.27	76.80	61.23

Note: For teachers with less than five years experience in the 2011-12 academic year, this table displays individual teacher and workplace characteristics for five policy relevant portals.

Data and Methods

The purpose of this study is to examine the relationship between teachers' preparation prior to entering the profession and three measures of teacher quality. Specifically, we estimate teacher quality in terms of teacher value-added to student achievement, teacher evaluation ratings, and teacher persistence in North Carolina public schools. These multiple outcomes allow us to assess a range of ways in which teachers impact education and examine the effects of teacher preparation for a broader sample—not just tested-grade/subject—of early-career teachers. For all of our analyses, the results for each teacher portal capture the impact of both selection into the teacher portal and the quality of preparation provided by that portal. For each of our outcomes of interest, we detail our analysis sample, covariates, and research methods below.

Value-Added Models

For our value-added analyses we use student, classroom, and school data for public schools in North Carolina from the 2007-08 through 2011-12 academic years. We restrict our analysis sample to teachers with less than five years of experience for two reasons: 1) the quality of teacher preparation portals/programs may change over time and 2) the effects of a teacher's preparation will likely diminish over time as a teacher learns from classroom experience, principal and peer feedback, and other professional development. The outcome variable for these analyses is students' test score performance on the North Carolina End-of-Grade (EOG) or End-of-Course (EOC) exams. We standardize all EOG tests within subject, grade, and year and all EOC tests within subject and year to remove secular trends in the data. For our analyses we separate the data into 11 grade-level/subject combinations: three models for EOG exams in elementary grades (4-5)—mathematics, reading, and fifth grade science[5]; three models for EOG exams in middle grades (6-8)—mathematics, reading, and eighth grade science; one model for an EOC exam in middle grades—algebra I—and four models for EOC exams in high school grades (9-12)—mathematics (algebra I, algebra II, and geometry), English 1, science (biology and physical science), and social studies (U.S. history and civics/economics). In elementary grades, student test score data are available for all five years for mathematics and reading and from 2008-09 through 2011-12 for fifth grade science. In middle grades, student test score data are available for all five years for each subject. Finally, in high school grades, student test score data are available for all five years for algebra I, English 1, and biology; from 2007-08 through 2010-11 for algebra II, U.S. history, civics/economics, and physical science; and from 2007-08 through 2009-10 for geometry. Overall, we estimate models using 2.9 million student test score records from 1.4 million students taught by 28,223 North Carolina public school teachers with less than five years of experience.[6]

We include extensive student, classroom, and school level control variables, as well as a limited set of teacher controls (years of experience and out-of-field teaching) to isolate the effect of the teacher preparation portals on adjusted-average student achievement gains. Table 3 displays a complete list of covariates included in our value-added models. The definitions for three of the variables may not be obvious: structural mobility refers to students who changed schools due to the grade range of a school (e.g. 6th grade students in a 6th-8th grade middle school), between-year mobility refers to students who attended or tested at a different school in the prior academic year (excluding structural movers), and within-year mobility refers to students who were enrolled in the school in which they took their EOG/EOC exams for less than the full school year.

[5] After the 2008-09 school year North Carolina stopped administering the 3rd grade EOG pre-test. Therefore, we include 3rd grade students in our value-added analyses for the 2007-08 and 2008-09 years only.

[6] We only report value-added estimates for teacher portals with at least ten teachers in a given subject/grade-level analysis.

Table 3: Value-Added Model Control Variables

Student	Classroom & Teacher	School
1. Prior test scores (reading & math) 2. Classmates prior test scores (peer effects) 3. Days absent 4. Structural mobility 5. Between-year mobility 6. Within-year mobility 7. Gender 8. Race/ethnicity 9. Poverty 10. Gifted 11. Disabled 12. Currently limited English proficient 13. Previously limited English proficient 14. Overage for grade (held back or retained at least once) 15. Underage for grade (promoted two grades)	16. Years of experience 17. Teaching out-of-field 18. Number of students 19. Advanced curriculum (MS and HS only) 20. Remedial curriculum (MS & HS only) 21. Dispersion of prior achievement within classroom	22. School size (ADM) 23. School size squared 24. Suspension rate 25. Violent acts rate 26. Total per pupil expenditures 27. District teacher supplements 28. Racial/ethnic composition 29. Concentration of poverty

To estimate adjusted-average portal effectiveness, our preferred estimation approach is a three-level hierarchical linear model (HLM) that accounts for the nesting of students within classrooms and classrooms within schools. Estimates of portal effects are based on comparisons with the reference group, UNC undergraduate prepared teachers. For each of our 11 value-added models, the equation used to estimate the average effect of the teacher portal is as follows:

$$Y_{ijst} = \gamma_0 + \gamma_1 Test_{it-n} + \beta_1 Portal_2 + \cdots + \beta_{11} Portal_{12} + \gamma Student_{ijs} + \beta Classroom_{js} + \delta School_s + \mu_i + \varepsilon_j + \theta_s \quad (1)$$

Where Y_{ijst} represents student i's test score in classroom j in school s at time t;

$Test_{it-n}$ represents a student's prior scores on the End of Grade tests;

$Student_{ijs}$ represents a set of individual student controls;

$Classroom_{js}$ represents a set of classroom level and teacher controls;

$School_s$ represents a set of school level controls;

and μ_i , ε_j, and θ_s represent unexplained variation at the student, classroom, and school levels, respectively.

The model coefficients $\beta_1 - \beta_{11}$ provide estimates of the average difference in student achievement between teachers trained in traditional UNC undergraduate teacher preparation programs and teachers prepared through the specified portal.

Although our models control for a rich set of school characteristics, there may be unobserved aspects of school context, such as principal leadership or a school's ability to attract high-quality teachers, that affect student achievement and the preparation (portal) of teachers working at the school (Boyd, Grossman, Ing, Lankford, & Loeb, 2011; Kennedy, 2010; Loeb, Kalogrides, & Beteille, 2012). Therefore, in addition to our preferred approach (equation 1), which estimates the relationship between teacher portals and student achievement, statewide, we estimated supplementary models that limit effectiveness comparisons to teachers working in the same school.[7] Results from these supplementary models are displayed in Tables A.5, A.6, and A.7 in the Appendix.

Teacher Evaluation Ratings

Since many important aspects of teaching quality, such as assuming school leadership roles and reflecting on practice, may not be well-captured by value-added estimates and only a minority of North Carolina public school teachers teach in a tested-grade or subject-area, we complement our value-added analyses with an analysis of teacher evaluation ratings. Specifically, we examine whether teachers entering the profession through certain teacher portals earn higher evaluation ratings than those entering from a different portal. For these analyses we limit our sample to teachers with less than five years of experience and focus on teacher evaluation ratings from the 2010-11 and 2011-12 academic years. We use teachers' evaluation ratings to create a binary outcome variable of rating "above proficient"—a rating of either accomplished or distinguished—for Standards 1-5 of the North Carolina Professional Teaching Standards (NCPTS).[8] To assess whether the odds of rating above proficient significantly differ across teacher portals, we specify a logistic regression controlling for teacher portals (in reference to UNC undergraduate prepared teachers), teacher experience, and a set of school contextual factors and we cluster-adjust standard errors at the school-by-year level to account for dependence in the data. For each NCPTS, the equation to estimate the comparative odds of rating above proficient is as follows:

$$\Pr(Above\_Proficient_{jst} = 1) = \frac{\exp(Portal_j + Experience_{jt} + School_{jt})}{1 + \exp(Portal_j + Experience_{jt} + School_{jt})} \quad (2)$$

where $Above\_Proficient_{jst}$ is a binary outcome equal to 1 for teacher *j* and evaluation standard *s* at time *t* if the school principal rated the teacher as accomplished or distinguished;

[7] In addition to limiting value-added comparisons to teachers working in the same school, these school fixed effects exclude observations for schools that (1) only employ UNC undergraduate prepared teachers or (2) do not employ any UNC undergraduate prepared teachers.

[8] Please see http://www.ncpublicschools.org/docs/effectiveness-model/ncees/instruments/teach-eval-manual.pdf for more information about the teacher evaluation process and standards in North Carolina. The five NCPTS are as follows: Standard 1—Teachers Demonstrate Leadership; Standard 2—Teachers Establish a Respectful Environment for a Diverse Population of Students; Standard 3—Teachers Know the Content They Teach; Standard 4—Teachers Facilitate Learning for Their Students; and Standard 5—Teachers Reflect on Their Practice.

$Portal_j$ represents a set of binary teacher portal variables in reference to UNC undergraduate prepared teachers;

$Experience_{jt}$ represents a set of single-year teacher experience indicators in reference to first year teachers;

and $School_{jt}$ represents a set of school contextual factors.

While these models control for a rich set of school characteristics to better isolate the relationship between teacher portals and evaluation ratings, there are unobserved school characteristics, such as a school's ability to attract high-quality teachers or differences in the rating tendencies of principals, which may influence evaluation ratings (Boyd, Grossman, Ing, Lankford, & Loeb, 2011; Kennedy, 2010; Loeb, Kalogrides, & Beteille, 2012; Whitehurst, Chingos, & Lindquist, 2014). Therefore, in addition to our preferred approach (equation 2), which estimates the relationship between teacher portals and evaluation ratings, statewide, we specify a logistic regression with school-by-year fixed effects that limits evaluation rating comparisons to teachers working in the same school and year.[9] For the results of these fixed effects models, see Table A.8 in the Appendix.

Teacher Persistence

Because it is costly to hire and train new teachers and teacher turnover may adversely affect school stability and student achievement, we assess whether teachers entering the profession through certain portals remain teaching in North Carolina public schools longer than their peers from other portals (Alliance for Excellent Education, 2004; Ronfeldt, Loeb, & Wyckoff, 2013). For this analysis we identified four cohorts of first-time teachers in the 2005-06, 2006-07, 2007-08, and 2008-09 academic years and used salary data provided by the NCDPI to track the percentage of each cohort that persists as teachers in North Carolina public schools over a three and five year period. We then used independent sample t-tests to determine whether a given portal's persistence rates significantly differ from those of UNC undergraduate prepared teachers. These results do not adjust for teacher or school characteristics that may influence teacher persistence, but rather, provide an unadjusted measure of retention in North Carolina public schools.

[9] In addition to limiting evaluation rating comparisons to teachers working in the same school-year, these school-year fixed effects exclude observations for schools that (1) only employ UNC undergraduate prepared teachers or (2) do not employ any UNC undergraduate prepared teachers.

Findings

UNC Undergraduate Prepared Teachers

The primary motivation for this research is to assess how UNC undergraduate prepared teachers perform in comparison to teachers who entered the profession through each of the 10 other portals. Overall, we found that UNC undergraduate prepared teachers significantly outperform teachers from other portals in 12 comparisons, significantly underperform teachers from other portals in 15 comparisons, and perform similarly to teachers from other portals in 67 comparisons. It is important to note that UNC undergraduate prepared teachers outperformed teachers from the largest suppliers of North Carolina public school teachers (e.g. out-of-state undergraduate, alternative entry, and NC private undergraduate prepared teachers), while underperforming considerably smaller portals (e.g. TFA). For example, in high school mathematics UNC undergraduate prepared teachers outperformed out-of-state undergraduate, VIF, and alternative entry teachers, who comprise 67 percent of the non-UNC undergraduate teachers in the high school mathematics analysis, while they underperformed UNC graduate degree holders and TFA corps members, who comprise 10 percent of the non-UNC undergraduate teachers in the high school mathematics analysis (see Appendix Table A.4).

Elementary Grades: As shown in Table 4, UNC undergraduate prepared teachers were significantly more effective than out-of-state undergraduate prepared teachers in elementary mathematics; out-of-state licensure only teachers in elementary grades reading; and NC private undergraduate and out-of-state undergraduate prepared teachers in fifth grade science. It may be useful to consider these impacts in terms of days of student learning. Here, elementary grades mathematics students taught by a UNC undergraduate prepared teacher gained an average of over five days of learning as compared to similar students taught by an out-of-state undergraduate prepared teacher; elementary grades reading students taught by a UNC undergraduate prepared teacher gained an average of nearly 18 days of learning as compared to similar students taught by an out-of-state licensure only teacher. For information on computing days equivalency, see the Appendix.

UNC undergraduate prepared teachers were significantly less effective than TFA corps members in elementary grades mathematics and fifth grade science. UNC undergraduate prepared teachers also significantly underperformed Visiting International Faculty teachers in elementary grades mathematics and reading. In all other comparisons, UNC undergraduate prepared teachers performed similarly to other teacher portals. For elementary grades effectiveness comparisons that are limited to teachers working in the same schools, see Appendix Table A.5.

Table 4. Elementary Grades: UNC Undergraduate Prepared Teachers vs. All Other Teachers

Portal	Elementary Grades Mathematics		Elementary Grades Reading		5th Grade Science	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	0.012	0.014	-0.003	0.011	-0.007	0.029
NC Private University Undergraduate Degree	-0.004	0.006	-0.003	0.005	**-0.039***	0.011
NC Private University Graduate Degree	-0.043	0.026	-0.031	0.020	-0.034	0.051
Out-of-State University Undergraduate Degree	**-0.018***	0.005	-0.007	0.004	**-0.039***	0.010
Out-of-State University Graduate Degree	-0.012	0.008	-0.002	0.006	-0.020	0.016
UNC Licensure Only	0.013	0.016	-0.004	0.012	0.032	0.024
Out-of-State Licensure Only	-0.030	0.029	**-0.059***	0.026	—	—
Teach For America	**0.053***	0.018	0.006	0.014	**0.080***	0.034
Visiting International Faculty	**0.042***	0.015	**0.034***	0.012	0.036	0.034
Alternative Entry	-0.015	0.009	0.005	0.007	-0.036	0.019

*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level.*

Table 5. Middle Grades: UNC Undergraduate Prepared Teachers vs. All Other Teachers

Portal	Middle Grades Mathematics		Middle Grades Reading		8th Grade Science		Middle Grades Algebra I	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	-0.008	0.021	-0.007	0.010	-0.089	0.064	—	—
NC Private University Undergraduate Degree	**-0.031***	0.011	-0.000	0.006	**-0.099***	0.034	-0.068	0.052
NC Private University Graduate Degree	—	—	-0.030	0.021	—	—	—	—
Out-of-State Undergraduate Degree	-0.002	0.007	-0.002	0.004	-0.004	0.017	0.001	0.024
Out-of-State Graduate Degree	-0.004	0.013	-0.003	0.006	-0.019	0.028	-0.072	0.040
UNC Licensure Only	-0.023	0.023	0.000	0.009	—	—	—	—
Out-of-State Licensure Only	—	—	0.033	0.030	—	—	—	—
Teach For America	**0.128***	0.018	**0.022***	0.010	**0.224***	0.032	**0.244***	0.053
Visiting International Faculty	0.009	0.017	0.015	0.020	0.015	0.059	—	—
Alternative Entry	-0.013	0.007	0.003	0.004	**-0.035***	0.016	-0.022	0.031

*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level*

Middle Grades*:* As shown in Table 5, UNC undergraduate prepared teachers were significantly more effective than North Carolina private university undergraduate prepared teachers in middle grades mathematics and 8th grade science. In terms of days of learning, students taught by a UNC undergraduate prepared teacher gained an average of over 19 days of learning more than similar students taught by an NC private undergraduate prepared teacher. UNC undergraduate prepared teachers also significantly outperformed alternative entry teachers in eighth grade science. UNC undergraduate prepared teachers were significantly outperformed by TFA corps members in all four middle grades comparisons. For middle grades effectiveness comparisons that are limited to teachers working in the same schools, see Appendix Table A.6.

High School*:* As shown in Table 6, UNC undergraduate prepared teachers were significantly more effective than out-of-state undergraduate prepared, VIF, and alternative entry teachers in high school mathematics and out-of-state undergraduate prepared and alternative entry teachers in high school social studies. UNC undergraduate prepared teachers were significantly outperformed by UNC graduate degree and TFA corps members in high school mathematics; out-of-state graduate degree teachers in high school English I; NC private graduate degree, UNC licensure only, and TFA corps members in high school science; and TFA corps members in high school social studies. For high school effectiveness comparisons that are limited to teachers working in the same schools, see Appendix Table A.7.

Evaluation Ratings: As shown in Table 7, UNC undergraduate prepared teachers have significantly greater odds of being rated above proficient on all five North Carolina Professional Teaching Standards (NCPTS) than alternative entry teachers. Further, UNC undergraduate prepared teachers have significantly greater odds of being rated above proficient on Standard 1 (Teachers Demonstrate Leadership) than VIF teachers. UNC undergraduate prepared teachers are as likely to be rated above proficient on all five NCPTS as teachers in the NC private undergraduate, out-of-state undergraduate and graduate, and out-of-state licensure only portals. UNC undergraduate prepared teachers have significantly lower odds of being rated above proficient on all five NCPTS than UNC graduate degree and TFA corps members. Additionally, UNC undergraduate prepared teachers have significantly lower odds of rating above proficient than NC private graduate degree teachers on Standards 1-3 (Teachers Demonstrate Leadership, Teachers Establish a Respectful Environment for a Diverse Population of Students, and Teachers Know the Content They Teach) and UNC licensure only teachers on Standard 3 (Teachers Know the Content They Teach). For evaluation rating comparisons that are limited to teachers working in the same schools and years, see Appendix Table A.8.

Persistence: UNC undergraduate prepared teachers demonstrate high levels of commitment to teaching in North Carolina public schools. Specifically, UNC undergraduate prepared teachers were significantly more likely to return for a fifth year of teaching than teachers from all other portals except North Carolina private undergraduate prepared teachers. More than 86% of UNC undergraduate prepared teachers who begin teaching in North Carolina public schools stay for at least three years and over 76% return for a fifth year of teaching (See Figure 3).

Table 6. High School: UNC Undergraduate Prepared Teachers vs. All Other Teachers

Portal	High School Mathematics		High School English I		High School Science		High School Social Studies	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	**0.048***	0.021	0.010	0.010	0.055	0.028	-0.018	0.021
NC Private University Undergraduate Degree	-0.011	0.015	0.008	0.009	-0.009	0.029	-0.027	0.018
NC Private University Graduate Degree	0.020	0.027	0.025	0.017	**0.218***	0.041	-0.004	0.031
Out-of-State Undergraduate Degree	**-0.028***	0.012	-0.002	0.008	-0.029	0.022	**-0.038***	0.017
Out-of-State Graduate Degree	-0.019	0.025	**0.031***	0.012	-0.017	0.024	-0.009	0.023
UNC Licensure Only	-0.040	0.038	-0.002	0.016	**0.084***	0.039	0.016	0.027
Out-of-State Licensure Only	—	—	—	—	—	—	—	—
Teach For America	**0.130***	0.026	0.022	0.016	**0.176***	0.035	**0.090***	0.043
Visiting International Faculty	**-0.077***	0.033	0.031	0.034	0.004	0.053	—	—
Alternative Entry	**-0.036***	0.011	-0.003	0.006	-0.019	0.016	**-0.028***	0.014

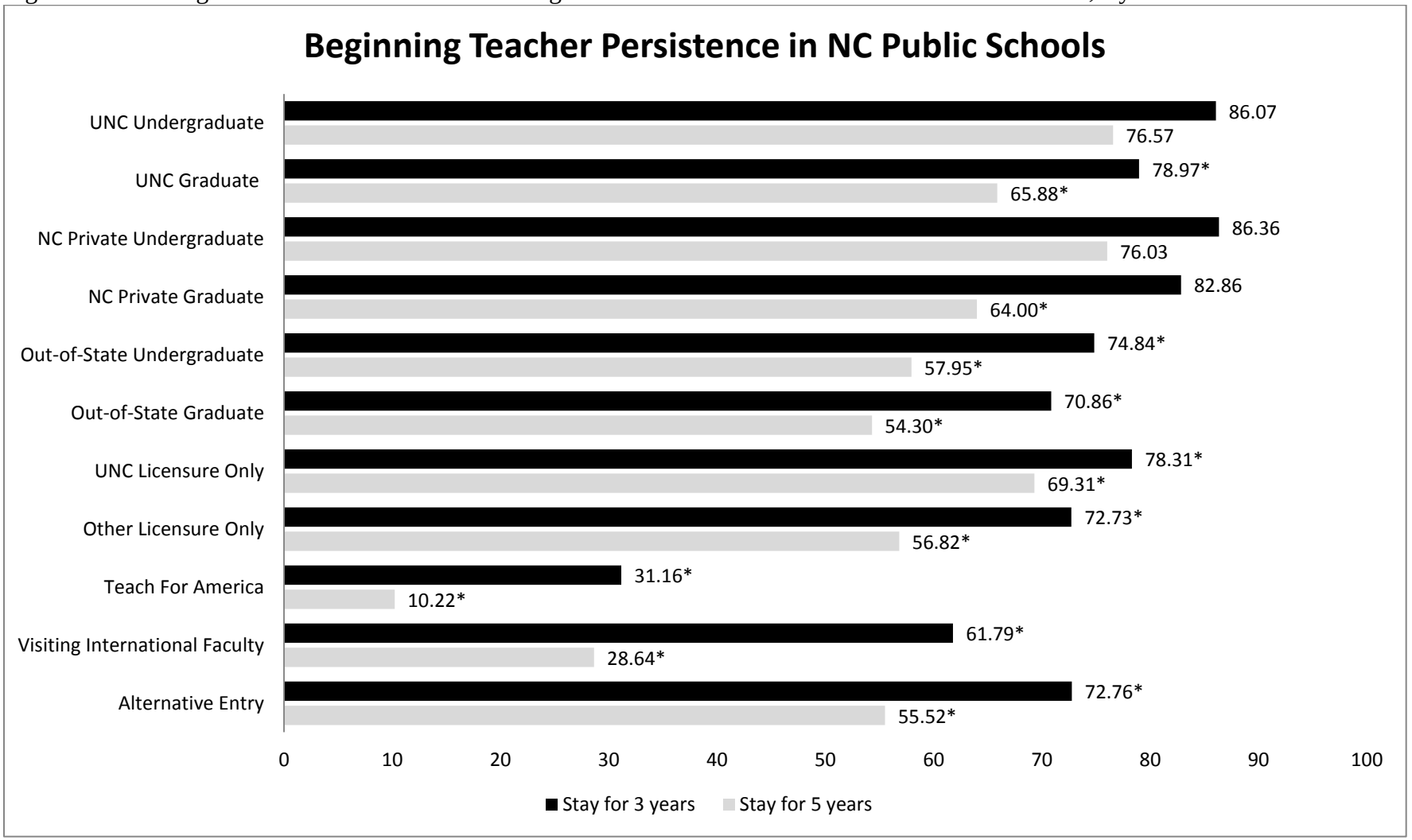
*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level.*

Table 7. Evaluation Ratings: UNC Undergraduate Prepared Teachers vs. All Other Teachers

Portal	Standard 1: Leadership	Standard 2: Classroom Environment	Standard 3: Content Knowledge	Standard 4: Facilitating Student Learning	Standard 5: Reflecting on Teaching
UNC Graduate Degree Prepared	**1.265***	**1.317***	**1.463***	**1.219***	**1.319***
NC Private University Undergraduate Degree	1.059	1.049	1.001	1.038	1.043
NC Private University Graduate Degree	**1.334***	**1.373***	**1.361***	1.172	1.253
Out-of-State Undergraduate Degree	0.978	0.964	0.977	0.956	0.976
Out-of-State Graduate Degree	1.038	1.070	1.034	1.023	0.955
UNC Licensure Only	0.926	1.092	**1.249***	0.966	0.937
Out-of-State Licensure Only	0.793	0.718	1.187	0.988	1.164
Teach For America	**1.708***	**1.404***	**1.352***	**1.359***	**1.397***
Visiting International Faculty	**0.816***	1.202	1.207	1.079	0.889
Alternative Entry	**0.795***	**0.867***	**0.884***	**0.828***	**0.818***

*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level.*

Figure 3. Percentage of First Year Teachers Persisting in North Carolina Public Schools for 3 and 5 Years, By Portal



*Note: * Indicates rates of persistence that are significantly lower than UNC Undergraduate Prepared teachers.*

UNC Graduate Prepared Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who received a graduate degree from a UNC system institution, prior to entering the classroom, were significantly more effective in high school mathematics (See Table 6). UNC graduate degree prepared teachers performed similarly to UNC undergraduate prepared teachers in all other grade levels and subject areas, although there were insufficient UNC graduate prepared middle grades algebra I teachers to report results from these comparisons. For comparisons of UNC graduate prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: UNC graduate degree prepared teachers had significantly greater odds of being rated above proficient on all five NCPTS than UNC undergraduate prepared teachers (See Table 7). For comparisons of UNC graduate prepared teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: UNC graduate degree prepared teachers demonstrate significantly lower rates of persistence in North Carolina public schools than UNC undergraduate prepared teachers. Nearly 79% of UNC graduate degree prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and nearly 66% return for a fifth year of teaching (See Figure 3).

NC Private Undergraduate Prepared Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who received undergraduate degrees from North Carolina private and independent institutions were significantly less effective in 5th grade science, middle grades mathematics, and 8th grade science (See Tables 4 and 5). In middle grades mathematics, on average, a student of a UNC undergraduate prepared teacher could gain over 19 days of learning more per year than a similar student instructed by a teacher prepared as an undergraduate at a NC private college or university. NC private undergraduate prepared teachers performed similarly to UNC undergraduate prepared teachers in all other grade level and subject areas (See Tables 4, 5, and 6). For comparisons of NC private undergraduate prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: NC private university undergraduate degree prepared teachers have similar odds of being rated above proficient on all five NCPTS as UNC undergraduate prepared teachers (See Table 7). For comparisons of NC private undergraduate prepared teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence*:* NC private university undergraduate prepared teachers demonstrate similar rates of persistence in North Carolina public schools as UNC undergraduate prepared teachers. More than 86% of NC private undergraduate degree prepared teachers who begin teaching in North Carolina public schools, stay for at least three years and over 76% return for a fifth year of teaching (See Figure 3).

NC Private Graduate Prepared Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who received graduate degrees from North Carolina private and independent institutions were

significantly more effective at increasing students' End-of-Course scores in high school science (See Table 6). NC private graduate degree prepared teachers performed similarly to UNC undergraduate prepared teachers in elementary grades mathematics and reading, 5th grade science, and middle grades reading (See Tables 4 and 5). There were insufficient NC private graduate degree prepared teachers in middle grades mathematics, middle grades algebra I, and 8th grade science to report results from these comparisons. For comparisons of NC private graduate prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: NC private university graduate degree prepared teachers have significantly greater odds of being rated above proficient on Standards 1-3 of the NCPTS (Teachers Demonstrate Leadership, Teachers Establish a Respectful Environment for a Diverse Population of Students, and Teachers Know the Content They Teach) than UNC undergraduate prepared teachers (See Table 7). For comparisons of NC private graduate prepared teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: NC private university graduate prepared teachers demonstrate similar rates of persistence for three years in North Carolina public schools; however, they demonstrate significantly lower levels of persistence for five years than UNC undergraduate prepared teachers. Nearly 83% of NC private graduate degree prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and 64% return for a fifth year of teaching (See Figure 3).

Out-of-State Undergraduate Prepared Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who received undergraduate degrees from out-of-state institutions are significantly less effective at increasing student test scores in elementary grades mathematics, 5th grade science, high school math, and high school social studies (See Tables 4 and 6). These elementary grades value-added results are particularly noteworthy, since out-of-state undergraduate prepared teachers comprise approximately 30 percent of the early-career elementary tested-grades teacher workforce (See Appendix Table A.4). In terms of days of learning, on average, an elementary grades mathematics student of a teacher with an undergraduate degree from a UNC system institution could expect to gain over 5 days of learning per year more than a similar student with an out-of-state undergraduate prepared teacher. Out-of-state undergraduate degree prepared teachers performed similarly to UNC undergraduate prepared teachers in all other grade level and subject areas (See Table 4, 5, and 6). For comparisons of out-of-state undergraduate degree prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: Out-of-state undergraduate degree prepared teachers have similar odds of being rated above proficient on all five NCPTS as UNC undergraduate prepared teachers (See Table 7). For comparisons of out-of-state undergraduate prepared teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Out-of-state undergraduate prepared teachers demonstrate significantly lower rates of persistence in North Carolina public schools than UNC undergraduate prepared teachers. Nearly 75% of out-of-state undergraduate prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and nearly 58% return for a fifth year of teaching (See Figure 3).

Out-of-State Graduate Prepared Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who received graduate degrees from out-of-state institutions are significantly more effective at increasing student EOC scores in high school English I (See Table 6). Out-of-state graduate degree prepared teachers performed similarly to UNC undergraduate prepared teachers in all other grade level and subject areas (See Table 4, 5, and 6). For comparisons of out-of-state graduate prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: Out-of-state graduate degree prepared teachers have similar odds of being rated above proficient on all five NCPTS as UNC undergraduate prepared teachers (See Table 7). For comparisons of out-of-state graduate prepared teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Out-of-state graduate prepared teachers demonstrate significantly lower rates of persistence in North Carolina public schools than UNC undergraduate prepared teachers. Approximately 71% of out-of-state graduate degree prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and approximately 54% return for a fifth year of teaching (See Figure 3).

UNC Licensure Only Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who completed licensure only programs at UNC system institutions are significantly more effective at increasing student EOC scores in high school science (See Table 6). UNC licensure only prepared teachers perform similarly to UNC undergraduate prepared teachers in all elementary grades comparisons, middle grades mathematics and reading, and high school mathematics, English I, and social studies (See Tables 4, 5, and 6). There were insufficient UNC licensure only prepared teachers in 8th grade science and middle grades algebra I to report results of those comparisons. For comparisons of UNC licensure only prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: UNC licensure only teachers have significantly greater odds of being rated above proficient on Standard 3 of the NCPTS (Teachers Know the Content They Teach) than UNC undergraduate prepared teachers (See Table 7). For comparisons of UNC licensure only teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: UNC licensure only prepared teachers demonstrate significantly lower rates of persistence in North Carolina public schools than UNC undergraduate prepared teachers. Over 78% of UNC licensure only prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and more than 69% return for a fifth year of teaching (See Figure 3).

Out-of-State Licensure Only Teachers

Value-Added*:* In comparison to UNC undergraduate prepared teachers, teachers who completed licensure only programs at out-of-state universities are significantly less effective in elementary grades reading (See Table 4). In terms of days of learning, students of UNC undergraduate prepared teachers gain an average of nearly 18 days of learning more than similar students taught by out-of-state licensure only teachers. Out-of-state licensure only prepared teachers

perform similarly to UNC undergraduate prepared teachers in elementary grades mathematics and middle grades reading (See Tables 4 and 5). There were insufficient out-of-state licensure only prepared teachers in the remaining subjects and grade levels to report results of those comparisons. For comparisons of out-of-state licensure only prepared teachers that are limited to teachers in the same schools, see Appendix Tables A.5 and A.6.

Evaluation Ratings: Out-of-state licensure only prepared teachers have similar odds of being rated above proficient on all five NCPTS as UNC undergraduate prepared teachers (See Table 7). For comparisons of out-of-state licensure only teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Out-of-state licensure only prepared teachers demonstrate significantly lower rates of persistence in North Carolina schools than UNC undergraduate prepared teachers. Nearly 73% of out-of-state licensure only prepared teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and almost 57% return for a fifth year of teaching (See Figure 3).

Teach For America

Value-Added*:* Although a very small source of North Carolina public school teachers, Teach For America corps members are the most effective source of early career teachers in the state. In comparison to UNC undergraduate prepared teachers, Teach For America corps members are significantly more effective in elementary grades mathematics, 5th grade science, middle grades mathematics and reading, 8th grade science, middle grades algebra I, and high school mathematics, science, and social studies (See Tables 4, 5, and 6). In terms of days of learning, middle grades mathematics students of a TFA corps member could gain an average of over 80 days of learning more than a similar student taught by a UNC undergraduate prepared teacher. TFA corps members perform similarly to UNC undergraduate prepared teachers in elementary grades reading and high school English I. For comparisons of TFA corps members that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: Teach For America corps members have significantly greater odds of being rated above proficient on all five NCPTS than UNC undergraduate prepared teachers (See Table 7). For comparisons of TFA corps members that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Teach For America corps members demonstrate the lowest rates of persistence in teaching in North Carolina public schools of any of the teacher preparation portals. The TFA program involves a two year commitment, and thus, unsurprisingly, fewer than one third (31%) of corps members return for a third year of teaching, and just over 10% return for a fifth year (See Figure 3).

Visiting International Faculty

Value-Added*:* In comparison to UNC undergraduate prepared teachers, Visiting International Faculty (VIF) teachers are significantly more effective in elementary grades mathematics and reading (See Table 4). VIF teachers perform similarly to UNC undergraduate degree prepared teachers in 5th grade science, middle grades mathematics and reading, 8th grade science, high school English I and science (See Tables 4, 5, and 6). VIF teachers significantly underperformed UNC undergraduate prepared teachers in high school mathematics comparisons.

There were insufficient VIF teachers in middle grades algebra I and high school social studies to report results of those comparisons. For comparisons of VIF teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6, and A.7.

Evaluation Ratings: Visiting International Faculty teachers have significantly lower odds of rating above proficient on Standard 1 of the NCPTS (Teachers Demonstrate Leadership) than UNC undergraduate prepared teachers (See Table 7). For comparisons of VIF teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Visiting International Faculty teachers demonstrate significantly lower rates of persistence in North Carolina public schools than UNC undergraduate prepared teachers. Fewer than 62% of VIF teachers return for a third year of teaching, and fewer than 29% return for a fifth year (See Figure 3).

Alternative Entry

Value-Added*:* In comparison to UNC undergraduate prepared teachers, alternative entry teachers are significantly less effective in 8th grade science and high school mathematics and social studies. These value-added results are particularly noteworthy, since alternative entry teachers comprise 38, 30, and 23 percent, respectively, of the early-career teachers in these tested subject-areas. Alternative entry teachers perform similarly to UNC undergraduate prepared teachers in all elementary grades comparisons, middle grades mathematics, reading, and algebra I, and high school English I and science (See Tables 4, 5, and 6). For comparisons of alternative entry teachers that are limited to teachers in the same schools, see Appendix Tables A.5, A.6 and A.7.

Evaluation Ratings: Alternative entry teachers have significantly lower odds of being rated above proficient on all five NCPTS as UNC undergraduate prepared teachers (See Table 7). For comparisons of alternative entry teachers that are limited to teachers in the same schools and years, see Appendix Table A.8.

Persistence: Alternative entry teachers demonstrate significantly lower levels of persistence in North Carolina schools than UNC undergraduate prepared teachers. Nearly 73% of alternative entry teachers who begin teaching in North Carolina public schools stay for at least three years of teaching and more than 55% return for a fifth year of teaching (See Figure 3).

Conclusion

Through our study of the distribution, quality, and persistence of teachers in North Carolina public schools, we found that teachers' preparation prior to entering the profession has significant effects on student achievement, evaluation ratings, and persistence in teaching. Notably, the traditional undergraduate teacher preparation programs at UNC system institutions are a valuable source of teachers to North Carolina public schools. UNC undergraduate prepared teachers are outperforming some of the largest sources of teachers in North Carolina, while underperforming smaller, more specialized sources. The UNC system should continue their use of evidence based policies to (1) increase productivity where they perform particularly well (and where other large portals perform poorly); (2) improve programs where they perform less well; and (3) develop, pilot and evaluate innovations in their programs, modelled on particularly successful portals such as TFA.

The negative performance of out-of-state undergraduate prepared teachers and alternative entry teachers is cause for concern. Out-of-state undergraduate prepared teachers are less effective in elementary grades mathematics and 5th grade science, where they constitute nearly 30% of the work force. Alternative entry teachers are less effective in 8th grade science, where they make up over 38% of the work force, and in high school mathematics, where they constitute nearly 30% of the work force. Alternative entry teachers also have significantly lower odds of being rated above proficient on all five NCPTS than UNC undergraduate prepared teachers. These two sources of teachers also demonstrate significantly lower levels of persistence in North Carolina public schools. Research suggests that although the average performance of teachers from these sources is lower, there is a wide range of teacher quality in these groups, meaning there are many highly effective out-of-state prepared and alternative entry teachers (Bastian & Henry, 2014; Boyd, Goldhaber, Lankford, & Wyckoff, 2007). The answer, then, is not to eliminate alternative entry programs or licensure reciprocity agreements, but rather, to adopt policies that improve the quality and persistence of these teachers through more effective hiring procedures and more intensive supports for beginning teachers.

Teach For America corps members are the most effective source of early career teachers in North Carolina public schools. They perform well across grade levels and subject areas and have significantly greater odds of being rated above proficient on all five NCPTS. However, TFA corps members represent a very small percentage of the teaching workforce in North Carolina (0.5%) and demonstrate very low levels of persistence in North Carolina public schools. Therefore, they are not a widespread replacement for traditionally prepared teachers. Instead, the TFA model provides an opportunity to identify highly effective recruitment, selection, and support practices that can be scaled up to a university, district, or statewide level. For example, TFA selects corps members on the basis of both strong academics and soft skills, such as perseverance, leadership, and the ability to engage students.

Finally, we found some evidence that content knowledge may be important for improving student outcomes in high school STEM courses. For example, teachers with graduate degrees from NC private universities, those with licensure only preparation from UNC institutions and those entering teaching as TFA corps members were more effective in high school science; similarly, TFA corps members and those with graduate degrees from UNC institutions were more effective in high school mathematics. Teachers from these portals would likely have more STEM-related coursework than those from a traditional teacher preparation program and thus, unsurprisingly, teachers from these portals also have significantly greater odds of rating above proficient on Standard 3—Teachers Know the Content They Teach. Content based coursework, that would be part of a graduate program or a major in a science or mathematics discipline, then, may be more important in some subjects. Additional research into this relationship may provide evidence to improve traditional teacher preparation programs in STEM-related fields.

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Appendix: Calculating Days Equivalency

Results in elementary and middle grades mathematics and reading models may be interpreted in terms of the equivalent days of instruction gained (or lost) by comparable students whose teacher is from a particular portal compared to the reference group. Table A.1 contains values for interpretation of effectiveness estimates (coefficients) depending on the model under consideration. For example, comparable students in similar classrooms and schools are expected to score as if they had attended 14 and one-third extra days of school when they are taught by a teacher whose effectiveness estimate (coefficient) is five percent of a standard deviation higher than the reference group in elementary grades mathematics. These estimates vary based on the subject and grade level and the exact formulas for calculating values based on different results is found below.

Table A.1. Key for the Interpretation of Coefficients (Days Equivalency)

Result Values	ES Math	ES Reading	MS Math	MS Reading
0.15	42.73 days	45.26 days	94.08 days	78.06 days
0.10	28.48 days	30.17 days	62.72 days	52.04 days
0.05	14.24 days	15.09 days	31.36 days	26.02 days
0.02	5.70 days	6.03 days	12.54 days	10.41 days

Note: These result values show days equivalency in relation to the reference group; negative result values have negative days equivalency results.

Table A.2. Necessary Information for Days Equivalency Calculations

End of Grade Test	Standard Deviation	Average Yearly Gains
Elementary School Mathematics	9.151	5.782
Elementary School Reading	9.319	5.559
Middle School Mathematics	8.924	2.561
Middle School Reading	8.627	2.984

Days Equivalency Equation= ((Result value x Standard Deviation) / (Avg. Yearly Gain)) x 180

Example for Elementary School Mathematics

Step One

- Result value from Table 4= 0.053
- Standard Deviation (9.151) and Average Yearly Gains (5.782) from the table above

Step Two

- Insert the result value into the days equivalency equation
    - ((0.053 x 9.151)/(5.782)) x 180 = 15.10 days of learning

Days Equivalency for High School and Middle Grades Science/Algebra I

For elementary and middle grades mathematics and reading tests, days equivalency values can be calculated because the tests are interval scaled and students have prior test scores for the subject. In high school subjects and middle grades science and algebra, however, prior test scores do not exist. Therefore, days equivalency values were not provided for these tested subjects.

Table A.3. Portal Data Sources and Decision Rules

Portal	Data Source/Variables Used	Decision Rule
UNC Undergraduate Prepared	**UNC General Administration Data** -Undergraduate degree graduation year -University attended -Education major -Education licensure **DPI Certified Salary Data** -Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure **DPI Education Data** (for pre-1980 graduates) -Undergraduate degree graduation year -University attended -Undergraduate degree level	**Individuals were placed into the UNC Undergraduate Prepared portal if:** 1) They graduated with a Bachelor's degree from a UNC system school; 2) Their undergraduate degree is their highest degree prior to teaching; 3) They have an education major or an education licensure from a UNC institution to indicate traditional training; and 4) Their first year teaching comes after their graduation year. Or 5) They graduated from a UNC school with an undergraduate degree prior to 1980 (too early for the UNC GA data), according to DPI education data, and their earliest basis code was a 1 or 2.
UNC Graduate Prepared	**UNC General Administration Data** -Graduate degree graduation year -University attended **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the UNC Graduate Prepared portal if**: 1) They graduated with a graduate degree from a UNC system school; 2) Their most proximate degree prior to entering the profession is the UNC graduate degree; 3) Their first year teaching comes after their graduate degree graduation year; and 4) Their earliest basis code is not lateral entry (A,B,C,E,L,R,7). Or 5) They graduated from a UNC school with a graduate degree prior to 1980 (too old for the UNC GA data) and their earliest basis code was a 1 or 2.

Table A.3. Portal Data Sources and Decision Rules, Continued

Portal	Data Source/Variables Used	Decision Rule
NC Private Undergraduate Prepared	**DPI Education Data** -Undergraduate degree graduation year -University attended -Undergraduate degree level **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the NC Private Undergraduate Prepared portal if**: 1) They graduated with a Bachelor's degree from a NC Private university; 2) Their undergraduate degree is their highest degree prior to teaching; 3) Their first year teaching comes after their graduation year; and 4) Their earliest basis code is not lateral entry (A,B,C,E,L,R,7).
NC Private Graduate Prepared	**DPI Education Data** -Graduate degree graduation year -University attended -Graduate degree level **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the NC Private Graduate Prepared portal if**: 1) They graduated with a graduate degree from a NC private university; 2) Their most proximate degree prior to entering the profession is the NC private graduate degree; 3) Their first year teaching comes after their graduate degree graduation year; and 4) Their original basis code is not lateral entry (A,B,C,E,L,R,7).
Out-of-State Undergraduate Prepared	**DPI Education Data** -Undergraduate degree graduation year -University attended -Undergraduate degree level **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Out-of-state Undergraduate portal if**: 1) They graduated with a Bachelor's degree from an out-of-state university; 2) Their undergraduate degree is their highest degree prior to teaching; 3) Their first year teaching comes after their graduation year; and 4) Their original basis code is not lateral entry (A,B,C,E,L,R,7).

Table A.3. Portal Data Sources and Decision Rules, Continued

Portal	Data Source/Variables Used	Decision Rule
Out-of-State Graduate Prepared	**DPI Education Data** -Graduate degree graduation year -University attended -Graduate degree level **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Out-of-state Graduate portal if**: 1) They graduated with a Bachelor's degree from an out-of-state university; 2) Their most proximate degree prior to entering the profession is the out-of-state graduate degree; 3) Their first year teaching comes after their graduation year; and 4) Their original basis code is not lateral entry (A,B,C,E,L,R,7).
UNC Licensure Only	**UNC General Administration Data** -UNC licensure only program completion year **DPI Education Data** -Graduation year **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the UNC Licensure Only portal if:** 1) They graduated with a Bachelor's or graduate degree from any in-state or out-of-state university; 2) They completed licensure only work at a UNC institution after (not concurrent with) earning their undergraduate or graduate degree, and before entering teaching; and 3) Their original basis code is not lateral entry (A,B,C,E,L,R,7).
Out-of-State Licensure Only	**DPI Education Data** - Graduation year - University attended **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Out-of-state Licensure Only portal if:** 1) First year of teaching comes after graduation year; 2) They have a degree from a North Carolina University; and 3) Their basis code indicates they received training out-of-state, but not a degree, between the time of their North Carolina degree and their entry into the classroom.

Table A.3. Portal Data Sources and Decision Rules, Continued

Portal	Data Source/Variables Used	Decision Rule
Teach For America	**Teach For America Data** - Files from Teach For America identify North Carolina corps members **UNC General Administration Data** -Education major -Education licensure	**Individuals were placed into the Teach For America portal if:** 1) They were North Carolina Teach For America corps members; and 2) They were not traditionally trained at a UNC institution prior to teaching.
Visiting International Faculty	**DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Visiting International Faculty portal if:** 1) They were identified as VIF by program administrators; or 2) They have a basis code of F in the licensure audit file.
Alternative Entry	**DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Lateral Entry portal if:** 1) They were teaching prior to completion of an education degree or licensure program; and 2) Their original basis code corresponds with lateral entry (A,B,C,E,L,R,7).
Unclassifiable	**UNC General Administration Data** -Graduation year -Completion of an education major or licensure program **DPI Education Data** -Graduation year -Degree level **DPI Certified Salary Data** - Fiscal year minus teacher's years of experience to calculate first year teaching **DPI Licensure Audit Data** -Earliest basis code for licensure	**Individuals were placed into the Unclassifiable portal if:** 1) Based on the decision rules for the teaching portal categories above, data limitations prohibited them from being classified into any of the portals. **Examples:** -Their education/degree level was less than a Bachelor's. -They do not have a graduation year in the DPI education data. -They were teaching more than one year prior to their graduation year, and they do not have a lateral entry basis code.

Table A.4. Teacher Counts by Portal, Level, and Subject

Portal	ES Math	ES Read	ES Science	MS Math	MS Read	MS Science	MS Alg. I	HS Math	HS English	HS Science	HS Social Studies
UNC Undergraduate Prepared	3359	3436	1104	996	982	249	173	696	528	254	469
UNC Graduate Prepared	156	163	58	36	87	13	8	65	112	62	105
NC Private Undergraduate Prepared	1344	1374	438	229	237	39	28	174	112	47	126
NC Private Graduate Prepared	50	51	21	9	20	3	4	36	31	17	30
Out-of-State Undergraduate Prepared	2836	2890	880	800	822	262	121	361	286	201	269
Out-of-State Graduate Prepared	686	708	209	167	235	64	32	110	102	106	98
UNC Licensure Only	123	128	42	34	53	8	5	13	27	21	41
Out-of-State Licensure Only	26	26	3	6	12	1	1	4	4	7	2
Teach For America	119	126	45	115	116	55	16	99	67	75	38
Visiting International Faculty	196	206	60	79	48	19	6	38	33	29	0
Alternative Entry	569	597	165	948	1077	455	148	679	553	756	360
Unclassifiable	209	220	61	55	73	22	8	19	31	23	47

**Highlighted cells have fewer than ten teachers and therefore do not have any results reported.*

Table A.5. Elementary Grades: UNC Undergraduate Prepared Teachers vs. All Other Teachers in the Same School

Portal	Elementary Grades Mathematics		Elementary Grades Reading		5th Grade Science	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	0.009	0.014	0.006	0.010	0.014	0.029
NC Private University Undergraduate Degree	-0.011	0.006	-0.004	0.005	**-0.049***	0.013
NC Private University Graduate Degree	-0.037	0.028	-0.032	0.019	0.017	0.054
Out-of-State University Undergraduate Degree	**-0.019***	0.005	**-0.010***	0.004	**-0.038***	0.011
Out-of-State University Graduate Degree	**-0.015***	0.007	-0.004	0.006	-0.004	0.017
UNC Licensure Only	-0.001	0.015	-0.006	0.012	0.024	0.027
Out-of-State Licensure Only	**-0.065***	0.030	**-0.081***	0.027	—	—
Teach For America	**0.056***	0.020	0.003	0.015	0.051	0.040
Visiting International Faculty	0.031	0.016	**0.034***	0.013	**0.078***	0.035
Alternative Entry	-0.015	0.009	-0.001	0.007	-0.037	0.021

*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level*

Table A.6. Middle Grades: UNC Undergraduate Prepared Teachers vs. All Other Teachers in the Same School

Portal	Middle Grades Mathematics		Middle Grades Reading		8th Grade Science		Middle Grades Algebra I	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	0.001	0.022	-0.004	0.010	-0.087	0.059	—	—
NC Private University Undergraduate Degree	**-0.042***	0.011	0.000	0.007	**-0.113***	0.033	**-0.148***	0.061
NC Private University Graduate Degree	—	—	-0.030	0.021	—	—	—	—
Out-of-State Undergraduate Degree	-0.006	0.007	-0.000	0.004	-0.014	0.017	-0.027	0.030
Out-of-State Graduate Degree	-0.010	0.014	-0.006	0.007	**-0.063***	0.029	-0.069	0.043
UNC Licensure Only	-0.012	0.022	0.006	0.010	—	—	—	—
Out-of-State Licensure Only	—	—	0.022	0.028	—	—	—	—
Teach For America	**0.124***	0.022	**0.024***	0.011	**0.325***	0.039	0.133	0.101
Visiting International Faculty	0.012	0.018	0.035	0.020	-0.018	0.054	—	—
Alternative Entry	-0.013	0.007	0.006	0.004	-0.032	0.017	-0.079	0.041

Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers.
**Indicates statistical significance at the .05 level.*

Table A.7. High School: UNC Undergraduate Prepared Teachers vs. All Other Teachers in the Same School

Portal	High School Mathematics		High School English I		High School Science		High School Social Studies	
	Value	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*	*Value*	*Standard Error*
UNC Graduate Degree Prepared	**0.062***	0.023	0.013	0.011	**0.058***	0.024	-0.004	0.020
NC Private University Undergraduate Degree	-0.011	0.014	-0.001	0.009	0.002	0.028	-0.014	0.018
NC Private University Graduate Degree	0.021	0.027	0.028	0.019	**0.230***	0.043	0.006	0.033
Out-of-State Undergraduate Degree	**-0.044***	0.012	-0.008	0.008	-0.037	0.021	**-0.043***	0.016
Out-of-State Graduate Degree	**-0.057***	0.027	**0.024***	0.012	**-0.053***	0.023	-0.009	0.024
UNC Licensure Only	-0.022	0.038	0.008	0.018	0.025	0.045	0.000	0.027
Out-of-State Licensure Only	—	—	—	—	—	—	—	—
Teach For America	**0.157***	0.028	**0.045***	0.017	**0.116***	0.034	0.087	0.047
Visiting International Faculty	**-0.127***	0.035	0.047	0.042	-0.047	0.048	—	—
Alternative Entry	**-0.043***	0.011	0.000	0.007	**-0.031***	0.015	**-0.026***	0.013

*Note: Comparisons with fewer than ten teachers are not reported. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level*

Table A.8. Evaluation Ratings: UNC Undergraduate Prepared Teachers vs. All Other Teachers in the Same School in the Same Year

Portal	Standard 1: Leadership	Standard 2: Classroom Environment	Standard 3: Content Knowledge	Standard 4: Facilitating Student Learning	Standard 5: Reflecting on Teaching
UNC Graduate Degree Prepared	**1.216***	**1.273***	**1.370***	1.120	**1.254***
NC Private University Undergraduate Degree	1.011	0.988	0.940	1.010	1.004
NC Private University Graduate Degree	1.310	**1.341***	**1.373***	1.312	1.327
Out-of-State Undergraduate Degree	0.965	0.985	1.018	0.966	0.988
Out-of-State Graduate Degree	1.018	1.111	1.053	1.015	0.932
UNC Licensure Only	**0.674***	0.787	0.852	**0.663***	**0.763***
Out-of-State Licensure Only	0.602	0.813	1.531	0.924	1.057
Teach For America	**2.504***	**2.243***	**2.185***	**2.393***	**2.034***
Visiting International Faculty	1.067	**1.667***	**1.681***	**1.565***	1.148
Alternative Entry	**0.815***	**0.890***	**0.811***	**0.839***	**0.826***

*Note: This table displays results from models estimating the probability that teachers earn an evaluation rating above proficient. All results are in reference to UNC undergraduate prepared teachers. *Indicates statistical significance at the .05 level.*

Department of Public Policy  Education Policy Initiative at Carolina
University of North Carolina at Chapel Hill
140 Friday Center Drive, Chapel Hill, NC 27599-9000
919-962-0668 publicpolicy.unc.edu