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Front End to Back End: Teacher Preparation, Workforce Entry, and Attrition

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Abstract

We use a novel database of over 15,000 teacher candidates from 15 teacher education programs in Washington state to investigate the connections between specific teacher preparation experiences (e.g., endorsements, licensure test scores, and student teaching placements) and the likelihood that these candidates enter and leave the state's public teaching workforce within their first 2 years. As has been found in prior research, candidates with endorsements in hard-to-staff subjects like science, technology, engineering, and math and special education are significantly more likely to enter the public teaching workforce than candidates with elementary endorsements. We also find large differences in hiring rates over time, as candidates who graduated in the years prior to and during the Great Recession are far less likely to be hired than candidates in recent years. Finally, teacher candidates hired into the same school type (elementary, middle, or high school) or into schools and classrooms with similar student demographics as their student teaching placement are more likely to stay in the teaching workforce than other candidates who experience less alignment.

1. Introduction

Student teaching internships provide prospective teachers with their first formalized teaching experiences before entering the workforce and are regularly touted as the most important component of teacher training (Anderson & Stillman, 2013; National Council for Accreditation of Teacher Education, 2010). Mounting quantitative evidence has buttressed the notion that student teaching experiences influence teachers' inservice outcomes. Recent findings discussed in the next section suggest that characteristics of the student teaching school, the effectiveness of the cooperating teacher who supervised the student teaching placement, and the alignment between student teaching and early-career teaching experiences are all predictive of both the value added and inservice evaluations of teacher candidates once they enter the workforce.

A much smaller body of literature focuses on connections between student teaching and the probability that teacher candidates become teachers and are subsequently retained in their positions (e.g. Goldhaber, Krieg, & Theobald, 2014; Ronfeldt, 2012). There are, however, good reasons to consider the connections between teacher candidates' preparation experiences and their future career paths. Aspects of teacher preparation have been found to be predictive of teacher candidates' perceptions of their readiness to teach (e.g., Matsko et al., 2020), which may influence their probability of entering the workforce. Further, the connections between teacher preparation and teacher effectiveness discussed above may imply connections to teacher attrition since more effective teachers are less likely to leave the workforce (e.g., Feng & Sass, 2017; Goldhaber, Gross, & Player, 2011).

We contribute in several ways to understanding the role that student teaching may play in teacher workforce participation (both initial employment in public schools as a teacher and attrition from teaching). Specifically, we combine data from Washington state's Office of the Superintendent of Public Instruction (OSPI) on public school students and teachers with data on student teaching placements provided by a group of 15 teacher education programs (TEPs) training the vast majority of the new teachers trained in Washington state. The data we employ include far more detailed information about cooperating teachers and student teaching classrooms than has been previously considered. In particular, we link specific characteristics of cooperating teachers and student teaching classrooms to the teacher workforce participation of teacher candidates. The sample of over 15,000 teacher candidates that we utilize is also far larger than that in prior studies, allowing us to estimate relationships between student teaching and teacher labor market outcomes with considerable precision. Finally, this is the first paper to investigate the extent to which the alignment between student teaching experiences and first job experiences is predictive of teacher attrition.

Our descriptive findings on workforce entry document the dramatic impact of the Great Recession on teacher labor market entry, as candidates who graduated in the years prior to and during the Great Recession were far less likely to be hired than graduates in recent years. Importantly, a smaller percentage of these graduates entered the workforce even within a decade of graduation than recent 1- to 3-year hiring rates, which suggests that many graduates from eras with slack labor markets are ultimately lost to the system after not initially securing a teaching job.

The findings from our analytic models of workforce entry are consistent with those of prior literature (Bardelli & Ronfeldt, 2020; Goldhaber et al., 2014) showing that teacher endorsement area is by far the strongest predictor of teacher candidates' participation in the teacher labor market. Teachers with endorsements in hard-to-staff areas like science, technology, engineering, and math (STEM) and special education are five to 15 percentage points (or 6% to 14%) more likely to be observed in Washington public schools after completing student teaching than teachers with an elementary education endorsement, all else being equal. Few other characteristics of candidates, student teaching schools, or cooperating teachers are significantly predictive of workforce entry.

When we use these same measures to predict retention, we again find few significant relationships between student teaching experiences and the likelihood that teachers are retained in public schools for more than 2 years. But measures of the *alignment* between student teaching and first-job characteristics are predictive of retention. In particular, teachers who teach in the same school type (elementary, middle, or high) as their student teaching placement are considerably less likely to leave the workforce than early-career teachers who teach in a different school type than their student teaching placement. Likewise, teachers whose classrooms and schools have similar student demographics as their student teaching placements are less likely to leave the workforce than teachers who are teaching in very different settings than their student teaching placement. Both findings suggest that alignment between training and workforce experiences is important for the longer term stability of the teacher workforce.

The models we employ include a rich set of control variables, and the findings are robust to the inclusion of TEP, school, and district fixed effects. Still, we are cautious about interpreting our findings as causal given the likelihood that unobserved preservice characteristics of teacher candidates or their experiences could be correlated with labor market participation. Thus, we also follow Altonji and colleagues (2005) and Oster (2017) to estimate the amount of additional sorting on unobservables necessary to explain away the same school alignment finding. While not definitive, we conclude that our alignment finding is robust to extreme assumptions of sorting on unobservables (e.g., Altonji, Elder, & Taber, 2005).

2. Background Literature

This study seeks to contribute to three different existing literatures: research on teacher preparation and student teaching, research on teacher workforce entry, and research on teacher retention. This is the first study, to our knowledge, to unify these three different strands of literature.

As discussed above, a growing body of literature suggests the importance of teacher candidates' student teaching preparation and student teaching for their early-career effectiveness. Characteristics of the *schools* in which teacher candidates student taught, such as teacher turnover and collaboration, are predictive of the value added of teacher candidates who become teachers (Ronfeldt, 2012; 2015). Measures of the alignment between student teacher and early-career teaching experiences have also been shown to be predictive of teacher effectiveness in the workforce (Boyd, Lankford, Loeb, & Wyckoff, 2009; Goldhaber, Krieg, & Theobald, 2017; Henry et al., 2013; Krieg et al., 2020a; Ronfeldt, 2015).[1]

There is also a growing body of evidence suggesting that the inservice teacher supervising student teaching experiences (referred to as the "cooperating" teacher) influences the inservice outcomes of those candidates who themselves become teachers. Specifically, both the effectiveness and instructional performance of cooperating teachers have been found to be associated with the future effectiveness and instructional performance of their teacher candidates who themselves become teachers (Bastian, Patterson, & Carpenter, 2020; Goldhaber et al.,

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[1] The idea that alignment of preservice and inservice experiences might be beneficial for the development of the specific human capital of teachers is also buttressed by inservice studies showing that the returns to teaching experiences are higher when the experience is consistently in the same grade (Ost, 2014) and that there are test score benefits to students associated with having the same teacher multiple times (Wedenoja, Papay, & Kraft, 2020).

2020a, 2020c; Matsko et al., 2020; Ronfeldt, Brockman, & Campbell, 2018a, 2020b).[2] Two recent experimental studies build on this observational work by providing evidence that candidates randomly assigned to "better" student teacher placements report better preparedness (Ronfeldt et al., 2018b) and receive better preservice clinical observation ratings (Goldhaber et al., 2020d) than candidates randomly assigned to "worse" placements.

Despite this rapidly growing evidence base on preservice predictors of teacher effectiveness, few prior studies have connected these same measures to patterns of teacher workforce entry and retention. There are, however, reasons to think that preservice factors could influence workforce participation. Miller and Youngs (2021), for instance, describe person-environment fit theory that predicts that the degree of congruence between the values and goals of employees and their organizations should improve the likelihood of retention. They also find empirical evidence that teachers who report better fit with their jobs (colleagues, teaching assignments, and student populations) are more likely to remain in their schools. Similarly, Bartanen and Kwok (2020) find that preservice teachers with higher clinical observation scores were significantly more likely to find employment in the same school in which they completed their student teaching. These findings echo prior work on teacher labor markets (e.g., Boyd et al., 2013) and a broader labor economics literature on the importance of job matches (e.g., Jovanovic, 1979a; Jovanovic, 1979b; Ju & Li, 2019; Merz, 1999; Munasinghe, 2005).

Only a small amount of literature uses preservice teacher candidate characteristics and experiences to predict workforce participation. In terms of teacher workforce entry, research finds candidates' subject-area endorsements are the greatest predictors of workforce entry, with candidates in hard-to-staff areas like STEM and special education more likely to be hired as

[2] The effectiveness of the cooperating teachers is measured by their value added, and the instructional performance is measured by observation scores.

teachers than teachers with an elementary education endorsement (Bardelli & Ronfeldt, 2020; Goldhaber et al., 2014; Theobald, Goldhaber, Naito, & Stein, 2020).[3] Recent work has also found that teacher candidates with higher observational scores during student teaching are more likely to enter the teaching profession (Vagi, Pivovarova, & Miedel Barnard, 2019).

A small body of literature finds some connections between teacher education and the attrition of teachers. Ingersoll and colleagues (2012), Papay and associates (2012), and Ronfeldt and colleagues (2014) each find positive effects of more extensive teacher training on teacher retention, while Goldhaber and colleagues (2011) and Feng and Sass (2017) find that more effective teachers are more likely to remain in the workforce. Ronfeldt (2012, 2015) finds that teachers who student taught in schools with lower rates of annual teacher turnover and higher levels of collaboration are less likely to leave the teaching workforce. Finally, Vagi and associates (2019) find that teacher candidates with higher observational scores during student teaching are more likely to stay in the profession within the first 2 years after graduation. We are unaware of prior research that considers information about cooperating teachers or the alignment between student teaching and early-career experiences as predictors of teacher retention.

3. Data and Setting

3.1 Data Sources

The data we use combine student teaching data supplied by 15 Washington TEPs participating in the Teacher Education Learning Collaborative (TELC)[4] with K–12 administrative data provided by OSPI in Washington state. The TELC data include information about when and where each teacher candidate's student teaching occurred, as well as the

[3] Theobald and colleagues (2020) also find that special education candidates whose cooperating teacher is also endorsed in special education were more likely to enter special education classrooms.
[4] At the time of data collection between 2014 and 2016, there were 21 total TEPs in Washington. Nine additional TEPs have been certified since then. For more information about TELC, see www.telc.us.

classroom teacher who supervised their internship. A key feature of the data is that we only observe student teaching placements for teachers who graduate from one of the TEPs participating in TELC. This excludes in-state teachers from other TEPs and all new teachers trained out of state. Recent papers using the same dataset have shown that new teachers in the TELC data are not particularly representative of all new teachers in the state; for example, TELC programs prepare over 90% of all new in-state teachers west of the Cascade Mountains but only about 60% of new in-state teachers in the eastern half of the state (Goldhaber et al., 2020a). Thus, the results of this analysis should only be generalized to graduates of the 15 TEPs that participated in this study.

We focus on school years 2007–08 to 2018–19, since these are the years in which we can both match teachers to students in individual classrooms and follow student teaching candidates into the state's teaching workforce (the most recent year of available data is 2019–20). Also, to account for censoring, we limit observations to candidates who completed their student teaching prior to the 2018–19 school year.[5] Over this 11-year time span, we observe 17,626 teacher candidates who graduated from TELC institutions and can be linked to their student teaching placements. Of these candidates, 13,915 (79%) are later observed in a teaching position in a Washington public school.

The OSPI data consist of three types: building-level information, student data, and teacher personnel records. The building data contain information used to replicate prior studies focused on student teaching schools (e.g., Goldhaber et al., 2017), including geographic information, aggregated program participation (e.g., gifted programs, free or reduced-price lunch [FRL], and special education), and aggregated student demographics. The student-level data

[5] We further address the issue of censoring in Section 4.

include annual standardized test scores, demographic information, and program participation for all K–12 students in the state. The data also include a variable enabling the linking of students to their teachers so that the value added of cooperating teachers can be estimated (as discussed in Section 3.2).[6]

We merge these three datasets with the TELC data using the classroom certification number and building information to identify the students in the classrooms where candidates student taught as well as in their classrooms after being hired into their first teaching jobs. Thus, we can create public school employment histories for each teacher in the state.

3.2 Student-Level Data

The student-level data from OSPI include annual standardized tests scores in math and English language arts that can be linked to the TELC dataset through unique teacher identification numbers for the cooperating teacher. We use these standardized test scores to calculate the value added of the cooperating teacher, which we later use as a predictor of future candidate outcomes (e.g., likelihood of hiring).

We calculate cooperating teachers' value added in two ways. The first approach relies on the Chetty and colleagues (2014a) "leave out" approach to value added, in which we regress student standardized test scores on prior student test scores and student/classroom characteristics with teacher fixed effects. One advantage of this leave-out specification is that it has been validated as an out-of-sample predictor of both short- and long-term student outcomes (Chetty et al., 2014a, 2014b). This approach also takes advantage of as many years of data as possible while

[6] The state's CEDARS data system, introduced in 2009–10, allows classroom teachers to be linked to their classrooms and students through unique course identifiers. CEDARS data include fields designed to link students to their individual teachers based on reported schedules. However, limitations of reporting standards and practices across the state may result in ambiguities or inaccuracies around these links.

still removing any endogenous contribution of the teacher candidate to student test scores by removing the year of student teaching from the estimation.

There is some evidence, however, that serving as a cooperating teacher has developmental impact on teacher effectiveness, i.e., teacher value added is increased after serving as a cooperating teacher (Goldhaber et al., 2020a). Given the potential that teacher value added could be endogenous to a teacher's role as a cooperating teacher, we also calculate cooperating teachers' value added a second way, using data *for all years prior to the student teaching placement* in generating the value-added measure. This "pre-student teaching" approach allows us to remove the endogeneity of the student teachers' impact on student performance both in the year that they are hosted (Ronfeldt et al., 2018a) *and* in the years following the student teaching placement (Goldhaber et al., 2020a).

Importantly, we use the student-level standardized test scores *only* to calculate the cooperating teacher value added. All of our remaining analyses either focus on all candidates (i.e., our hiring dataset as described in Section 3.3) or candidates who are hired (i.e., our attrition dataset as described in Section 3.4).

3.3 Hiring Dataset

The summary statistics describe the dataset we utilize to investigate the extent to which teacher preparation experiences (e.g., endorsements and student teaching placements) are predictive of the likelihood that the teacher candidates enter the state's public teaching workforce. **Table 1** provides summary statistics for teacher candidates for the years in which we have TELC data, broken out by hiring outcome. The t-tests reported in the table indicate some significant differences between those hired into public teaching and non-teaching roles as compared to those who are not hired. The largest differences are for teacher endorsement areas, with candidates endorsed in hard-to-staff areas much more likely to be hired. Although candidates whose cooperating teacher held the same subject-area endorsement were more likely to be hired into teaching positions, we find few differences in the student teaching experience associated with differential workforce entry outcomes. In Appendix Table 1, we present additional summary statistics including candidates' prior/concurrent experience, quarter of internship, and licensure test scores. Here, we similarly find few significant differences among hired and unhired candidates.

3.4 Attrition Dataset

We next present the summary statistics for our attrition sample—i.e., the sample we use to investigate predictors of teacher attrition—in **Table 2**. The attrition subsample is limited only to candidates who were hired into teaching positions in public school and only includes data for the first 2 years in the workforce after completing student teaching to isolate the impact of the preparation experiences on early attrition from the profession; importantly, our measure of attrition only captures movement out of Washington public schools and could include teachers who move to private schools, move to another state, or leave the teaching profession altogether. Table 2 breaks out the attrition sample by timing of workforce attrition: after 1 year, after 2 years, and those who remain in the workforce longer than 2 years. Approximately 12% of teachers leave public education after their first year, while another 10% of the remaining teachers leave after their second year. Together, approximately 20% of teachers in the sample leave within 2 years of entering the workforce. These attrition rates are higher than previously reported annual attrition rates of 7% to 8% across the whole state (Goldhaber & Cowan, 2014) but are consistent with national estimates for first- and second-year teacher attrition (Gray & Taie, 2015).[7]

We then compare the characteristics of those who attrit after 1 year and 2 years (columns 2 and 3) with those who remain in the workforce longer than 2 years (column 3). We find some differences by teacher endorsement area, with teachers with STEM and other endorsements more likely to leave and teachers with special education and elementary endorsements less likely to leave. Additionally, teachers with a higher percentage of FRL students at their internship school appear less likely to leave the workforce. The analytic models described in the next section are intended to explore these differences further.

Finally, in Table 3, we examine measures of the alignment between candidates' student teaching placements and first jobs. Column 1 summarizes all hired teachers and shows that, consistent with prior research (Krieg et al., 2020a), about 25% of candidates are hired into the same grade, about 80% are hired into the same school type (elementary, middle, or high school), 16% are hired into the same school, and 40% are hired into the same district as their student teaching placement. The average teacher also begins their career in a classroom with 6 percentage points more FRL students in their classroom and in a school with 3 percentage points more FRL students in their school than experienced during their student teaching.

Also consistent with Krieg and colleagues (2020a), there is substantial variation in alignment across teachers who begin their careers in different school levels (columns 2–5 of Table 3). For example, while over 90% of elementary teachers in the sample also student taught in an elementary school and about 80% of high school teachers student taught in a high school, only 45% of middle school teachers student taught in a middle school. This suggests that fewer

[7] It is also important to note that many teachers who leave the workforce later re-enter; we do not model re-entry as part of this analysis.

candidates student-teach in middle school than are hired into middle schools. We explore this further in **Figure 1**, which plots the proportion of candidates from each internship year who student taught (dashed line) and are hired (solid line) in each school level. Panel B shows that while only about 12% to 16% of all candidates student-teach in middle schools over the years of available data, 18% to 22% are hired into middle schools. Interestingly, in the early years of data (2010–13), more candidates student taught in elementary schools than were hired into these schools, while in high school the misalignment is in the later years of data (2013–18, in which more candidates student taught in high schools than were hired into these schools).

4. Empirical Strategy

Our analysis considers a series of binary outcomes (entrance into the workforce and attrition from the workforce), so our primary analytic approach consists of a series of logistic regression models. First, to investigate predictors of workforce entry, we define $E_{ikt'}$ as a binary indicator for whether candidate *i* who graduated from institution *k* in year t' enters the public teaching workforce. The models that consider workforce entry take the following form:

$$\log\left(\frac{Pr(E_{ikt'}=1)}{Pr(E_{ikt'}=0)}\right) = \alpha_0 + \alpha_1 X_i + \alpha_{t'} + \varepsilon_{ik} \qquad (1)$$

The model in equation 1 predicts the log odds of workforce entry as a function of observable characteristics of the candidate (X_i), including all the preservice characteristics summarized in Table 1. We estimate these models with and without institution effects, α_k, because one potential source of confounding (discussed below) is that there may be variation in both preparation experiences and hiring rates across different institutions. Models without an institution fixed effect make comparisons across all candidates in the sample (i.e., any differences in hiring rates across institutions gets attributed to the variables in X_i), while models with an institution fixed effect make comparisons between candidates from the same institution (i.e., removing all variation at the institution level). We include internship year effects α_t in all specifications to account both for time trends in the data and for right censoring of some observations from the later years of TELC data.

Next, to investigate predictors of teacher retention, we define A_{iklt} as a binary indicator for whether candidate *i* from institution *k* who is teaching in district *l* in year *t* leaves the teacher workforce the following year. As described in Section 3, we drop all data after each teacher's second year *in the workforce* based on prior evidence that teacher preparation effects tend to "fade out" the longer teachers are in the workforce (e.g., Goldhaber, Liddle, & Theobald, 2013; Goldhaber et al., 2017) and that a disproportionate amount of teacher attrition occurs in teachers' first 2 years in the workforce (e.g., Goldring, Taie, & Riddles, 2014). The attrition models are discrete-time hazard models of the following form:

$$\log\left(\frac{Pr(A_{ilkt}=1)}{Pr(A_{ilkt}=0)}\right) = \beta_0 + \beta_1 X_i + \beta_2 X_{it} + \beta_t + \varepsilon_{ilt} \quad (2)$$

The model in equation 2 predicts the log odds of attrition from the workforce as a function of time-invariant observable characteristics of the candidate (X_i), including the same variables considered for equation 1 and time-variant observable characteristics (X_{it}), such as teacher experience and the characteristics of the teacher's current school or classroom. As described previously, we estimate these models with and without institution (β_l) effects to account for sorting across different institutions in the sample. As robustness checks, we also estimate models with and without district fixed effects (β_k) to account for an additional source of bias discussed below, the nonrandom sorting of teacher candidates to hiring districts. We include year effects β_t in all specifications to account for time trends in attrition rates. We account for multiple observations per teacher by clustering the standard errors at the teacher level. Finally, we estimate versions of the model in equation 2 in which R_{ilkt} is a binary indicator for attrition from a specific school or district, respectively.

We build on the attrition model (equation 2) to explore the importance of alignment between student teaching and early-career teaching positions in two ways. First, we include four binary measures of alignment as part of the vector of time-variant observable characteristics in X_{it}: teaching in the same grade as student teaching, teaching in the same school level (elementary, middle, or high) as student teaching, teaching in the same school as student teaching, and teaching in the same district as student teaching. The "same grade" variable is calculated from student-level data linked to teachers' student teaching and current placements, and equals one if the modal student grade taught in student teaching (i.e., the most common grade among the students in the cooperating teacher's classrooms) is the same as the modal student grade in the teacher's current classrooms.

Second, we consider the alignment between the student demographics of a teacher's current school/classroom and their student teaching school/classroom. Following Goldhaber and colleagues (2017) and Krieg and associates (2020a), we focus on the percentage of students receiving FRL in a teacher's classroom or schools and include flexible polynomials for the differences between the first classroom and their student teaching experience in the attrition model in equation 2. Specifically, let FRL_{jt} be the percentage FRL of teacher j's current classroom/school, and let $FRL_{jt'}$ be the percentage FRL of that teacher's student teaching classroom/school. We construct flexible polynomial models of the difference between the FRL status in the teacher's first year and the FRL status when they served as a student teacher:

$$\gamma_1 FRL_{jt} + \sum_{k=1}^{3} \gamma_{k+1}\left(FRL_{jt} - FRL_{jt'}\right)^{k} + FRL_{jt} \sum_{k=1}^{3} \gamma_{k+4}\left(FRL_{jt} - FRL_{jt'}\right)^{k} \quad (3)$$

The first term in equation 3 is the main effect of the FRL on teacher retention, the second term is a polynomial of the match between current and internship experiences, and the third term interacts this polynomial with the main effect of the current characteristics. Instead of reporting the coefficients from these models, we use the estimates from these models to create heat maps of predicted rates of teacher attrition for each combination of school/classroom current and student teaching FRL.

The logit coefficients in equations 1 and 2 are difficult to interpret, so we calculate average marginal effects of all coefficients of interest. These can be interpreted as the expected change in the probability of a given outcome associated with a one-unit change in the given predictor variable for the average teacher in the sample. Importantly, despite the extensive controls in these analytic models, we do not interpret these marginal effects as causal effects on candidate outcomes given that candidates nonrandomly sort into different teacher preparation institutions and school districts. We therefore pursue a number of robustness checks of our primary results. Our primary robustness checks are the fixed-effects specifications described in equations 1 and 2 that remove variation across different institutions and districts, but even within institutions and districts, it is likely that candidates nonrandomly sort to specific preparation experiences and school settings. We therefore pursue one additional robustness check outlined in Altonji and colleagues (2005) and further developed by Oster (2017) that quantifies the amount of nonrandom sorting on unobservables that would be necessary to explain away some of the noteworthy empirical relationships that we discuss below.

5. Results

5.1 Labor Market Participation Trends Over Time

We begin by presenting simple trends in the labor market in Washington state over time. **Figure 2** reports the trends over time in the 1-year and 3-year hiring rates (defined as the proportion of candidates who are teaching in a Washington public school within 1 year and within 3 years of student teaching) for the teacher candidates in the TELC sample.[8] These hiring rates increased dramatically in the years since the Great Recession: Less than 30% of TELC candidates who student taught in 2009 were hired into a Washington state public school within 1 year of completing their student teaching in 2009, compared to over 70% of candidates who completed their student teaching in 2015. It is notable that many of the teacher candidates who are not hired in periods of slackness in the labor market appear lost to the teaching profession. For instance, as shown in **Figure 3**, we observe only about 67% of those teacher candidates who completed student teaching in the "pre-recession" period in the labor market in any of the next 3 years. And, if we continue to follow this cohort all the way to the 2018–19 school year, only an additional 9% of the original sample of teacher candidates are employed as a public school teacher in any of the subsequent years. Put another way, the 3-year window we use to assess whether a teacher candidate in these years will show up as an employed public school teacher captures 88% of the teacher candidates who would be observed in the labor market over the next 13 years.[9]

Now consider a much tighter teacher labor market in later years. For instance, we observe about 84% of the "post-recession" cohort of teacher candidates in the labor market in the next

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[8] Given the definition of hiring within 1 or 3 years, the figure predates the years in which we are focused on inservice workforce outcomes by 3 years.
[9] This is simply the likelihood of observing teacher candidates from 2007 employed in any of the next 3 years (67% as in Figure 1) divided by the likelihood of observing those candidates in any of the next 12 years, 76%.

3 years. If one makes the assumption that the desire to become a teacher among teacher candidates is not radically different between these cohorts, the above figures imply that we might expect that at least an additional 17% (the difference between 84% and 67%) of the pre-recession cohort of teacher candidates desired to get a job but were unable to find one. Yet, as noted above, only 9% of those show up over the next decade. This suggest that a significant number of individuals received a credential to teach in the state, and had an interest in teaching, but likely became engaged in other sectors of the workforce when they failed to find a teaching job during the period of slack demand for new teachers.

It is also striking to focus on the trends for teacher candidates who have different teaching endorsements. In **Figure 4**, we break out the figures reported in Figure 2 (the 1- and 3-year hiring rates) by endorsement category over time. Consistently over the years of data—but particularly in periods with lower rates of teacher hiring (e.g., during the recession)—candidates with endorsements in STEM and special education are more likely to enter the state's public teaching workforce within 1 year than candidates with other endorsements. These differences are less stark in 3-year hiring rates, which may be due to the delayed teacher hiring illustrated in Figure 3.

5.2 Factors Predicting Teacher Labor Market Participation

The previous subsection describes the overall trends for workforce entry. In this subsection, we turn to describing estimates from the analytic models (discussed in Section 4) for in-state public-school teacher workforce entry. **Table 4** presents the marginal effects of the various teacher preparation variables: Column 1 of the table presents models that include candidate characteristics, cooperating teacher characteristics, and measures of the student teaching *school*; columns 2 and 3 replace the student-teaching school measures with measures of the student-teaching *classroom* (percentage of FRL students and average prior performance, respectively), and columns 4 and 5 are estimated only for the subset of candidates for whom we observe their cooperating teacher's value added.

Consistent with prior work in Washington (Goldhaber et al., 2014), we find that candidates with endorsements in hard-to-staff areas like STEM and special education are considerably more likely to enter the workforce than candidates with just an elementary endorsement. All else being equal, candidates with a STEM endorsement are 4.4 percentage points more likely to enter the workforce than candidates with just an elementary endorsement, while candidates with a special endorsement are 11.8 percentage points more likely to enter the workforce than candidates with just an elementary endorsement.[10]

These models also include interactions between endorsement areas and an indicator for whether the candidate holds multiple endorsements. The interaction terms are difficult to interpret, so we plot the predicted probability of workforce entry for the eight most comment endorsement combinations in **Figure 5**; these estimates differ from the earlier descriptive figures because they hold all other variables in the models constant**.** Candidates with only an elementary or a subject area ("Other") endorsement are the least likely to enter, while candidates with a special education endorsement (either only special education or a dual endorsement in elementary and special education) are the most likely to enter, all else being equal. In fact, candidates with only an elementary endorsement are more than twice as likely not to enter the workforce than candidates with both an elementary endorsement and a special education endorsement.

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[10] For the endorsement*multiple endorsement interactions, we interact STEM, special education, other, and elementary indicators with an indicator for whether an intern holds multiple endorsements. English language learner (ELL), unlike the other categories, is a secondary endorsement, which means that interns endorsed in ELL must be endorsed in another area. We therefore do not interact the ELL and the multiple endorsement indicator. The STEM, special education, and other coefficients are therefore interpreted relative to elementary education, while the ELL coefficients are measured relative to all interns not endorsed in ELL.

While candidate endorsement areas are by far the greatest predictor of workforce entry, a few other findings (significant and otherwise) are potentially important. For example, we find that the probability of workforce entry decreases with candidate age. We also find no more significant relationships than we would expect by random chance between characteristics of the cooperating teacher (including their value added) and the probability that the candidates they supervise enter the workforce. It is worth noting that the standard errors of these estimates are very small (generally less than 1 percentage point) due to the large sample sizes, so we can rule out even relatively modest relationships between cooperating teacher characteristics and the probability of workforce entry.[11]

We next turn to predictors of teacher attrition from the public school teacher workforce in **Table 5**. The columns of this table add classroom variables and cooperating teacher value added in additional columns as in Table 4. We again find some variation across teacher endorsement areas, this time as predictors of teacher attrition; teachers with a STEM endorsement, an ELL endorsement, and a subject-area ("Other") endorsement are all more likely to leave the workforce than teachers with an elementary endorsement, all else being equal. Older teachers and teachers who took longer to enter the workforce are both more likely to leave the workforce, while teachers with a graduate degree are less likely to leave.

When we turn to the cooperating teacher characteristics, though, we again find little evidence that observable characteristics of cooperating teachers are predictive of the future attrition of the student teachers they supervise. Candidates with a female cooperating teacher are less likely to leave the workforce, though this is the only one of the nine cooperating teacher characteristics that is significantly predictive of teacher attrition, which is not much more than

[11] We also consider licensure test scores for the subsample of candidates with these scores as predictors of workforce entry, and do not find that these scores are significantly predictive of workforce entry; see Appendix Table 2.

we would expect by random chance. Importantly, unlike Ronfeldt (2012), we do not find evidence relating the amount of teacher turnover at the student teaching school (the "stay ratio") to future teacher attrition (Ronfeldt, 2012).[12] We also find little evidence in columns 4 and 5 that cooperating teacher value added is predictive of teacher attrition.

Measures of the alignment between candidates' student teaching and current teaching positions (discussed in Section 4) are more predictive of attrition. Specifically, we find evidence that alignment in terms of school type (i.e., elementary, middle, and high) are predictive of teacher attrition; these teachers are about 5 percentage points less likely to leave the workforce, even controlling for other measures of alignment between student teaching and current placements. To further explore the school type match finding, we plot the predicted probabilities of attrition for each combination of current school type and student-teaching school type in **Figure 6**. Within each cluster of current school types (i.e., each set of three estimates), teachers who student taught at the same school level are the least likely to leave the workforce. Thus, this finding is related to school type matches at all three school levels.

We also estimate specifications that include measures of the alignment between the percentage of students eligible for FRL of the teachers' student-teaching classroom/school and current classroom/school. The coefficients from these models based upon equation 3 are difficult to interpret directly, so we instead present results as heat maps in **Figure 7**. The colors in Figure 7 represent the predicted probability of attrition for each combination of student-teaching classroom (Panel A) and school (Panel B) FRL on the x-axis and current classroom/school FRL on the y-axis. The negative signs indicate combinations of student-teaching and first-job demographics where the predicted probabilities of attrition are statistically significantly lower

[12] This null relationship holds even in models that drop additional control variables to better replicate the models in Ronfeldt (2012).

than the average probability of attrition. In both panels of the figure, there is evidence that having a student-teaching experience with students who demographically match the students that teachers have in a first job reduces attrition (see the negative signs in the areas along the 45-degree line). This looks to be particularly important for *school-level* measures of FRL alignment, teachers in a school with student poverty levels similar to those at their student teaching school (i.e., near the 45-degree line in Figure 6, panel B). Conversely, teachers are more likely to leave teaching in schools with very different student poverty levels than their student teaching school (i.e., the top left and bottom right corners in the figure). These findings for alignment and teacher attrition are directionally consistent with findings relating these same measures to teacher value added in Goldhaber and colleagues (2017) and Krieg and associates (2020a).[13]

5.3 Nonrandom Sorting Robustness Checks

As discussed earlier, we have to be cautious about interpreting the above findings as reflecting causal relationships between preservice teacher candidate characteristics and experiences and teacher workforce participation outcomes. As a first set of robustness checks, we estimate a series of models with institution and/or district fixed effects. These account for time-invariant institution-, school-, or district-level confounders that could be correlated with the variables of interest and that could influence both entry and retention decisions.[14] As shown in Appendix Tables 3 through 5, all significant results discussed in Section 5.2—perhaps most notably, the relationship between the alignment between student teaching school level and

[13] Directionally consistent in the sense that Goldhaber and colleagues (2020) and Krieg and associates (2020a) find that better alignment is predictive of higher value added, and, as we report, it also is predictive, as expected, of lower attrition.
[14] In these specifications, the coefficients are identified based on within-TEP variation and/or within-school-district variation and/or within-school variation.

current school level and the probability of attrition—are robust to the inclusion of these fixed effects.[15]

We may still worry that the estimated relationships could be biased by unobserved factors associated with nonrandom sorting of teacher candidates/students into student teaching and inservice school or classroom types (e.g., if more committed candidates are more likely to be hired into the same school level in which they student taught). As a first check on this possibility in the context of the same school type finding, we examine the distribution of teacher licensure test scores across our measures of preservice-inservice alignment. And we do find a significant difference in basic skills licensure test scores between teachers who do and do not experience a match in terms of their school level.[16] While not dispositive, this finding suggests that sorting of teachers into schools/classrooms along unobserved dimensions is a concern.

Thus, to further address the concern of nonrandom sorting, we utilize methods developed by Altonji and colleagues (2005) and Oster (2017) that quantify the amount of sorting on unobservables that would be necessary to explain away the relationship between the alignment between student teaching school level and current school level and the probability of attrition.[17] We calculate that the amount of sorting on unobservables would need to be 1.82 times the amount of sorting on observables for the true relationship between school-level match and attrition to be zero. This level of sorting on unobservables is unlikely (i.e., it exceeds the

[15] Appendix Tables 6 and 7 show that this result also holds when we model attrition from districts and schools, respectively. Appendix Table 8 shows that this result is consistent for attrition beyond the first 2 years of teaching, and Appendix Table 9 demonstrates this same result when examining attrition among teachers who have changed schools.

[16] Teachers who experience a school type match score .07 standard deviations higher on the WEST-B than teachers who teach in a different school level than their student teaching school.

[17] We are not able to implement this approach for the demographic match findings as these results are based on many estimated coefficients, used to create the heat maps shown in Figure 7.

recommended benchmark of 1 suggested by Altonji et al., 2005), implying in turn that the statistically significant findings are unlikely due to selection on unobservables.

6. Conclusions

One unique contribution of this paper is the consideration of long-run labor market participation trends *among teacher candidates who completed formal teacher preparation and received a credential to teach in the state.* The dramatic variation in hiring rates over time, combined with associated analysis suggesting that many candidates who aren't hired in eras with slack teacher labor markets are simply lost to the system (i.e., they do not enter the Washington public school labor market over the next 13 years), suggests that school systems might want to consider ways to keep candidates engaged with the system even when they are not hired immediately when labor markets are slack, so that they do not face a hiring crunch when teacher labor markets are tight. For example, as schools consider new models of instruction following the COVID-19 pandemic (Hill & Jochim, 2020), they could also consider new types of positions for candidates who have not immediately been hired as teachers due to associated district budget cuts across the state.

The formal analysis of teacher workforce entry and retention is novel for three reasons: (a) We consider information about cooperating teachers as predictors of teacher career paths, (b) the dataset we utilize is far larger than that in prior studies connecting teacher preparation to workforce entry and retention, and (c) this is the first paper to investigate the extent to which the alignment between student teaching experiences and first job experiences is predictive of teacher retention.

We draw several broad conclusions aligned with these contributions of the paper. First, we replicate prior findings (e.g., Goldhaber et al., 2014) about the large differences in hiring rates between teacher candidates with different teaching credentials. For example, all else being equal, candidates with a special education endorsement are over 10 percentage points more likely to enter the state's public teaching workforce than candidates with an elementary endorsement. This likely reflects the high demand for special education teachers, both in Washington state (e.g., Theobald et al., 2020) and across the country (e.g., Mason-Williams et al., 2019). Thus, it may make sense for the state to consider other means of encouraging teacher candidates to acquire the skills during training that line up with school system needs. For instance, this might include differential pay for difficult-to-staff classrooms or better information about likely future job prospects.

Second, despite mounting evidence about the importance of cooperating teachers for future candidate *effectiveness* (e.g., Bastian et al., 2020; Goldhaber et al., 2020a, 2020b; Ronfeldt et al., 2018a), we find little evidence that characteristics of cooperating teachers (including their value added) are predictive of teacher candidates' future career paths (either the probability of workforce entry or attrition). These null results are estimated with considerable precision due to the large sample sizes, so we can rule out even relatively modest relationships between cooperating teacher characteristics and workforce entry and retention. This, of course, does not necessarily mean that cooperating teachers are not playing important roles in candidates' career paths, but perhaps that these roles are not proxied by the cooperating teacher characteristics we consider. Future research could explore this issue further by leveraging surveys of teacher candidates or new teachers (e.g., Bastian et al., 2018; Boyd et al., 2009; Matsko et al., 2020; Ronfeldt et al., 2020b) that ask about the role that cooperating teachers play in candidate career decisions.

Finally, we find that early-career teachers who are teaching in the same school type (elementary, middle, or high), and whose classrooms and schools have similar student demographics as their student teaching experience, are considerably less likely to leave the workforce than early-career teachers who do not experience these types of alignment between student teaching and their first job. This is important given that we also document substantial misalignment between student teaching placements and first teaching jobs; for example, less than half of first-year middle school teachers student taught in a middle school. Only about 3% of teachers host student teachers each year (Krieg et al., 2020b), implying both that there is tremendous scope for change in student teaching assignments and that trying to ensure better alignment between student teaching placements and first teaching jobs could be a low-cost strategy for improving teacher retention.

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Table 1. *Teacher Candidate and Cooperating Teacher Characteristics, by Hiring Outcome*

	Full Sample	Public teaching role	Public non-teaching role	Not observed hired
	N = 17,621	**N = 13,919**	**N = 151**	**N = 3,551**
Age	29.07	29.10**	32.22***	28.79
	(8.200)	(8.109)	(10.14)	(8.438)
Female	0.765	0.765	0.762	0.768
	(0.424)	(0.424)	(0.428)	(0.422)
STEM endorsement	0.157	0.169***	0.0397***	0.113
	(0.364)	(0.375)	(0.196)	(0.316)
Special education endorsement	0.132	0.153***	0.106***	0.0529
	(0.339)	(0.360)	(0.309)	(0.224)
ELL endorsement	0.0956	0.105***	0.113***	0.0586
	(0.294)	(0.306)	(0.317)	(0.235)
Elementary endorsement	0.583	0.595***	0.589	0.537
	(0.493)	(0.491)	(0.494)	(0.499)
Other endorsement	0.346	0.353***	0.517***	0.312
	(0.476)	(0.478)	(0.501)	(0.463)
No endorsements	0.0236	0.00697***	0.0464*	0.0876
	(0.152)	(0.0832)	(0.211)	(0.283)
Number of endorsements	1.314	1.375***	1.364***	1.073
	(0.589)	(0.591)	(0.638)	(0.511)
CT Experience	14.76	14.70*	14.45	15.00
	(8.760)	(8.715)	(8.685)	(8.936)
CT Female	0.775	0.780***	0.755	0.757
	(0.417)	(0.414)	(0.432)	(0.429)
CT Non-White	0.0894	0.0910	0.0596	0.0848
	(0.285)	(0.288)	(0.238)	(0.279)
CT Master's degree	0.785	0.788*	0.768	0.774
	(0.411)	(0.409)	(0.423)	(0.418)
CT Gender match	0.748	0.749	0.715	0.748
	(0.434)	(0.434)	(0.453)	(0.434)
CT Endorsement match	0.879	0.897**	0.854	0.809
	(0.326)	(0.304)	(0.354)	(0.393)
CT Institution match	0.234	0.232	0.199	0.243
	(0.424)	(0.422)	(0.400)	(0.429)
ST Standardized class % FRL	-0.100	-0.0887***	0.0555*	-0.155
	(0.977)	(0.978)	(1.128)	(0.965)
ST Standardized school stay ratio	0.139	0.129	0.213	0.173
	(0.838)	(0.838)	(0.866)	(0.836)
ST School number of new teachers hired in year after internship year	0.583	0.611	0.521	0.477
	(4.966)	(5.033)	(3.911)	(4.733)
ST Classroom Prior Performance Sample	**N = 6,610**	**N = 5,256**	**N = 41**	**N = 1,313**
ST Standardized average classroom prior performance	0.0284	0.0124***	-0.0965**	0.0970
	(0.607)	(0.617)	(0.742)	(0.556)
Race/Ethnicity Sample	**N = 8,506**	**N = 6,975**	**N = 64**	**N = 1,467**
White/non-White	0.141	0.141	0.172	0.142
	(0.348)	(0.348)	(0.380)	(0.349)
CT White/non-White match	0.808	0.809	0.766	0.808
	(0.394)	(0.393)	(0.427)	(0.394)
Value Added Sample (Leave Out)	**N = 2,699**	**N = 2,123**	**N = 20**	**N = 556**
CT Value Added (Leave Out)	0.00644	0.00628	0.00274	0.00720
	(0.116)	(0.116)	(0.120)	(0.114)
Value Added Sample (Pooled Year)	**N = 3,023**	**N = 2,392**	**N = 21**	**N = 610**
CT Value Added (Pooled Year)	0.00820	0.00777	-0.0161	0.0107
	(0.143)	(0.144)	(0.116)	(0.144)

Notes. Significance levels for two-sided t-test in columns 2 and 3 relative to last column. Standard deviations in parenthesis. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Table 2. *Teacher and Cooperating Teacher Characteristics for Hired Teachers, by Attrition Type*

	Full Sample	Attritted after 1 year	Attritted after 2 years	Stayed 2+ years
	N = 13,915	**N = 1,699**	**N = 1,184**	**N = 11,032**
Teacher attrition (within 2 years of hire)	0.207	1	1	0
	(0.405)	(0)	(0)	(0)
Teacher Age	29.15	30.13***	29.46**	28.96
	(8.152)	(9.137)	(8.339)	(7.958)
Teacher Female (male ref.)	0.765	0.736***	0.739***	0.772
	(0.424)	(0.441)	(0.439)	(0.419)
Teacher Graduate degree	0.351	0.347	0.351	0.352
	(0.477)	(0.476)	(0.478)	(0.478)
STEM endorsement	0.168	0.169	0.179	0.167
	(0.374)	(0.375)	(0.384)	(0.373)
Special education endorsement	0.152	0.129***	0.141	0.157
	(0.359)	(0.336)	(0.348)	(0.364)
ELL endorsement	0.105	0.0865***	0.0971	0.109
	(0.307)	(0.281)	(0.296)	(0.311)
Elementary endorsement	0.596	0.489***	0.476***	0.625
	(0.491)	(0.500)	(0.500)	(0.484)
Other endorsement	0.356	0.420***	0.424***	0.339
	(0.479)	(0.494)	(0.494)	(0.473)
No endorsements	0.00575	0.0141***	0.00591	0.00444
	(0.0756)	(0.118)	(0.0767)	(0.0665)
Number of endorsements	1.377	1.293***	1.318***	1.397
	(0.590)	(0.550)	(0.557)	(0.598)
Number of years until hire	1.825	2.053***	1.851	1.787
	(1.609)	(1.833)	(1.608)	(1.568)
CT Age	45.59	46.07**	45.67	45.51
	(10.30)	(10.27)	(10.33)	(10.30)
CT Experience	14.70	15.37***	14.84	14.58
	(8.717)	(8.942)	(8.707)	(8.679)
CT Female (male ref.)	0.779	0.721***	0.740***	0.793
	(0.415)	(0.449)	(0.439)	(0.405)
CT Non-White	0.0908	0.0800*	0.0896	0.0926
	(0.287)	(0.271)	(0.286)	(0.290)
CT Graduate degree	0.787	0.790	0.785	0.787
	(0.409)	(0.407)	(0.411)	(0.409)
CT Gender match	0.749	0.716***	0.721***	0.756
	(0.434)	(0.451)	(0.449)	(0.429)
CT Endorsement match	0.898	0.876***	0.899	0.901
	(0.303)	(0.329)	(0.301)	(0.299)
CT Institution match	0.231	0.230***	0.231	0.232
	(0.422)	(0.421)	(0.422)	(0.422)
ST Standardized class % FRL	-0.0885	-0.101	-0.174**	-0.0782
	(0.979)	(0.971)	(0.962)	(0.982)
ST Standardized school stay ratio	0.131	0.141	0.167	0.126
	(0.837)	(0.825)	(0.799)	(0.842)
ST Classroom Prior Performance Sample	**N = 5,220**	**N = 670**	**N = 491**	**N = 4,059**
ST Standardized average classroom prior performance	0.0113	0.0594**	0.0561**	-0.00207
	(0.618)	(0.585)	(0.652)	(0.618)
Race/Ethnicity Sample	**N = 13,723**	**N = 1,678**	**N = 1,169**	**N = 10,876**
Non-White	0.113	0.109	0.0992*	0.116
	(0.317)	(0.312)	(0.299)	(0.320)
CT White/non-White match	0.835	0.847	0.845	0.832
	(0.371)	(0.360)	(0.362)	(0.374)
CT Value Added Sample (Leave Out)	**N = 2,117**	**N = 247**	**N = 166**	**N = 1,704**
CT Value Added (Leave Out)	0.00564	0.00114	-0.000332	0.00688
	(0.116)	(0.107)	(0.110)	(0.118)
CT Value Added Sample (Pooled Year)	**N = 2,384**	**N =276**	**N = 192**	**N = 1,916**
CT Value Added (Pooled Year)	0.00715	-0.00545	0.00417	0.00927
	(0.143)	(0.142)	(0.137)	(0.144)

Notes. Significance levels for two-sided t-test in columns 2 and 3 relative to last column. Standard deviations in parenthesis. *$p < 0.05$; **$p < 0.01$; ***$p < .001$. STEM is science, technology, engineering, and mathematics. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Table 3. *School Alignment Summary Statistics, by Teacher Type*

	(1)	(2)	(3)	(4)	(5)
	All Teachers	Elementary Teachers	Middle School Teachers	High School Teachers	Other School Teachers
Same Grade	0.252 (0.434)	0.278 (0.448)	0.178*** (0.383)	0.263 (0.440)	0.164*** (0.371)
Same School Type	0.780 (0.414)	0.926 (0.262)	0.454*** (0.498)	0.779*** (0.415)	0.0847*** (0.279)
Same School	0.160 (0.367)	0.167 (0.373)	0.113*** (0.316)	0.197*** (0.398)	0.0621*** (0.242)
Same District	0.403 (0.491)	0.447 (0.497)	0.390*** (0.488)	0.330*** (0.471)	0.220*** (0.416)
Classroom % FRL Difference	5.993 (30.14)	5.282 (32.17)	8.212*** (28.09)	6.271 (26.34)	2.958 (28.50)
School % FRL Difference	2.945 (25.15)	3.351 (26.56)	5.053*** (24.39)	0.493** (21.82)	-1.828** (24.45)
Observations	7,583	4,167	1,489	1,725	177

Note. P-values calculated from t-tests relative to column 2. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. FRL is free or reduced-price lunch.

Table 4. *Marginal Effects Predicting Entry Into Public Teaching Role*

	(1)	(2)	(3)	(4)
Candidate Age	-0.001**	-0.001**	-0.002**	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Candidate Female (male ref.)	-0.014	-0.014	-0.008	-0.024
	(0.008)	(0.008)	(0.010)	(0.022)
Candidate Non-White	0.018	0.017	0.031	0.036
	(0.019)	(0.019)	(0.031)	(0.051)
Candidate STEM endorsement (ref. Elementary)	0.044***	0.044***	0.029	0.022
	(0.011)	(0.011)	(0.015)	(0.029)
Candidate SPED endorsement (ref. Elementary)	0.118***	0.118***	0.125**	0.27
	(0.022)	(0.022)	(0.042)	(0.145)
Candidate ELL endorsement (ref. not ELL)	0.016	0.015	0.014	0.006
	(0.017)	(0.017)	(0.026)	(0.041)
Candidate Other endorsement (ref. Elementary)	0.005	0.005	-0.003	0.002
	(0.008)	(0.008)	(0.013)	(0.026)
Candidate Multiple endorsements	0.056**	0.056**	0.035	0.057
	(0.019)	(0.019)	(0.033)	(0.047)
Candidate STEM * multiple endorsements (ref. Elementary * multiple)	0.049*	0.049*	0.070*	0.046
	(0.023)	(0.023)	(0.034)	(0.055)
Candidate SPED * multiple endorsements (ref. Elementary * multiple)	-0.024	-0.024	-0.051	-0.204
	(0.030)	(0.030)	(0.053)	(0.154)
Candidate Other * multiple endorsements (ref. Elementary * multiple)	0.060***	0.060**	0.046	0.037
	(0.018)	(0.018)	(0.028)	(0.047)
CT Experience	0	-0.001	-0.001	-0.001
	0.000	0.000	(0.001)	(0.001)
CT Female (male ref.)	0.016*	0.016*	0.011	0.053*
	(0.008)	(0.008)	(0.010)	(0.022)
CT Non-White	0.012	0.011	0.008	-0.028
	(0.011)	(0.011)	(0.018)	(0.029)
CT Master's degree	0.008	0.009	-0.001	0.009
	(0.007)	(0.007)	(0.012)	(0.021)
CT Gender match	0	0	0.002	-0.011
	(0.007)	(0.007)	(0.010)	(0.022)
CT Endorsement match	-0.003	-0.004	-0.024	-0.041
	(0.010)	(0.010)	(0.018)	(0.028)
CT Institution match	-0.002	-0.002	0.006	0.001
	(0.007)	(0.007)	(0.011)	(0.020)
CT White/non-White match	0.013	0.012	0	-0.014
	(0.018)	(0.018)	(0.028)	(0.045)
ST School Standardized % FRL	-0.002			
	(0.003)			
ST Standardized stay ratio	-0.004			
	(0.004)			
ST Number of new teachers hired in year after internship year	0			
	(0.001)			
ST Classroom Standardized % FRL		0.002	0	0.015
		(0.004)	(0.007)	(0.012)
ST Standardized average classroom prior performance			-0.007	0.021
			(0.011)	(0.026)
CT Value Added (Leave Out)				-0.034
				(0.070)
N	17,275	17,275	6,884	2,197

Notes. All models control for teaching roles prior to and concurrently with internship placement, the quarter of internship, internship year, and internship school characteristics (standardized percentage FRL students, stay ratio, and number of new teachers hired the next year). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

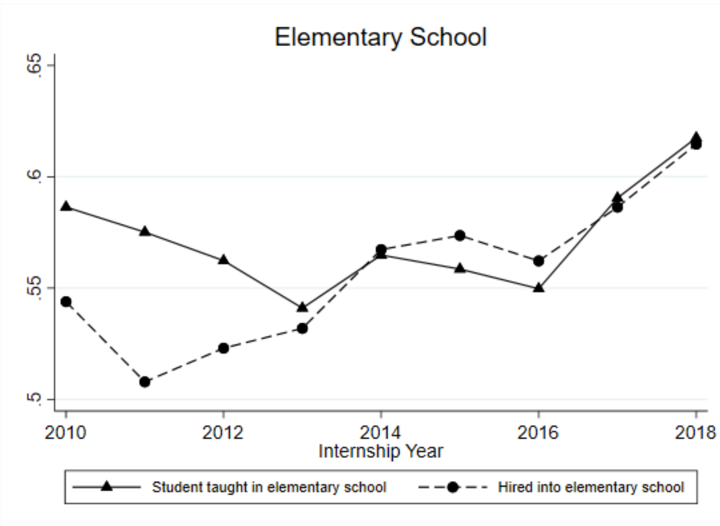
Table 5. *Discrete Time Hazard Models of Attrition Marginal Effects, Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)
Teacher Age	0.002*** (0.000)	0.002*** (0.000)	0.002*** (0.000)	0.002** (0.001)	0.002*** (0.001)
Teacher Female (male ref.)	0.007 (0.005)	0.008 (0.005)	0.004 (0.007)	0.034* (0.016)	0.029 (0.015)
Teacher Non-White	-0.003 (0.009)	-0.004 (0.009)	0.006 (0.014)	-0.002 (0.021)	-0.004 (0.020)
Teacher Graduate degree	-0.014** (0.005)	-0.013** (0.004)	-0.021** (0.007)	-0.013 (0.012)	-0.015 (0.011)
Teacher STEM endorsement	0.024** (0.009)	0.025** (0.009)	0.043** (0.016)	0.021 (0.024)	0.022 (0.023)
Teacher SPED endorsement	0.021 (0.011)	0.022 (0.011)	0.042 (0.024)	0.052 (0.041)	0.05 (0.034)
Teacher ELL endorsement	0.021* (0.009)	0.020* (0.009)	0.037* (0.016)	-0.003 (0.025)	-0.004 (0.022)
Teacher Other endorsement	0.052*** (0.007)	0.053*** (0.007)	0.075*** (0.015)	0.015 (0.024)	0.02 (0.023)
Teacher Multiple endorsements	-0.025* (0.011)	-0.025* (0.011)	-0.012 (0.021)	-0.004 (0.028)	0.002 (0.026)
Teacher STEM * multiple endorsements	-0.012 (0.012)	-0.012 (0.012)	-0.024 (0.021)	-0.016 (0.033)	-0.014 (0.031)
Teacher SPED * multiple endorsements	-0.029* (0.015)	-0.030* (0.015)	-0.044 (0.029)	-0.086 (0.049)	-0.075 (0.041)
Teacher Other * multiple endorsements	-0.039*** (0.010)	-0.040*** (0.010)	-0.046* (0.018)	-0.032 (0.029)	-0.027 (0.027)
Number of years until hired	0.006*** (0.001)	0.006*** (0.001)	0.009** (0.003)	0.009* (0.004)	0.008* (0.004)
CT Age	0 (0.000)	0 (0.000)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)
CT Experience	0.001 (0.000)	0.001 (0.000)	0.001* (0.001)	0.001 (0.001)	0.001 (0.001)
CT Female (male ref.)	-0.012* (0.005)	-0.012* (0.005)	-0.016* (0.007)	0.004 (0.016)	0.009 (0.015)
CT Non-White	-0.003 (0.009)	-0.004 (0.009)	0.01 (0.014)	0.015 (0.021)	0.006 (0.020)
CT Graduate degree	0 (0.005)	0 (0.005)	0 (0.009)	0.017 (0.015)	0.01 (0.014)
CT Gender match	-0.004 (0.005)	-0.004 (0.005)	-0.002 (0.007)	-0.037* (0.016)	-0.031* (0.015)
CT Endorsement match	0.001 (0.007)	0.001 (0.007)	0.017 (0.013)	0.009 (0.018)	0 (0.017)
CT Institution match	-0.002 (0.005)	-0.003 (0.005)	-0.005 (0.008)	-0.012 (0.014)	-0.016 (0.013)
CT White/non-White match	0 (0.009)	-0.001 (0.009)	0.004 (0.014)	-0.002 (0.020)	-0.008 (0.019)
ST Standardized school % FRL	-0.002 (0.003)				
ST Standardized school stay ratio	-0.002 (0.003)				
ST Standardized class % FRL		0.001 (0.003)	-0.006 (0.005)	0.01 (0.008)	0.01 (0.007)
ST Standardized average class prior performance			0.006 (0.008)	0.021 (0.017)	0.026 (0.014)
Grade match	-0.008 (0.009)	-0.009 (0.009)	-0.004 (0.012)	-0.023 (0.020)	-0.021 (0.019)
School type match	-0.043*** (0.009)	-0.043*** (0.009)	-0.042*** (0.011)	-0.028 (0.018)	-0.031 (0.017)
School match	-0.016 (0.013)	-0.016 (0.013)	-0.028 (0.018)	0.005 (0.029)	-0.009 (0.028)
District match	-0.006 (0.009)	-0.006 (0.009)	-0.005 (0.011)	-0.029 (0.019)	-0.028 (0.018)
CT Value Added (Leave Out)				-0.005 (0.048)	
CT Value Added (Pooled Year)					-0.042 (0.038)
N	25,181	25,181	9,824	3,159	3,577

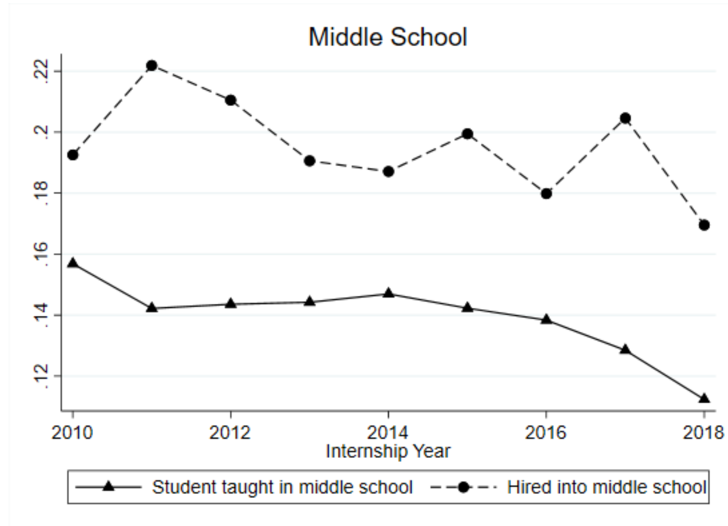
Notes. All models control for teaching roles prior to and concurrently with ST placement, the quarter of internship, inservice school characteristics, and school year. The models also control for those with limited certificates and those with no endorsements. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Figure 1. *Student Teaching and Inservice School Type Comparisons*

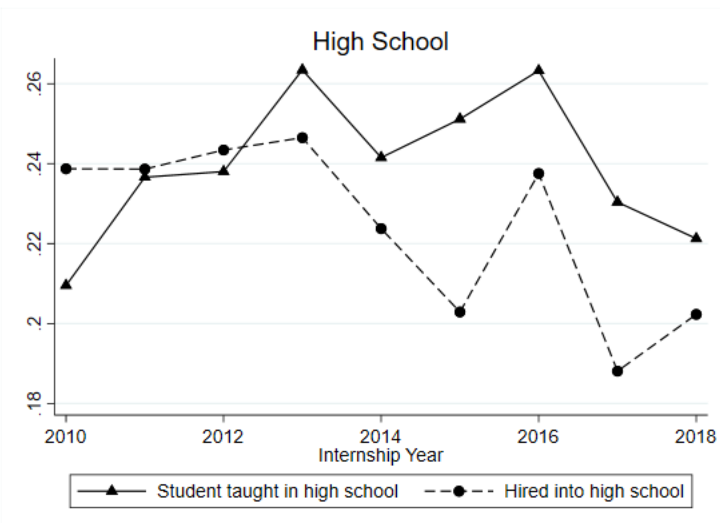
Panel A: Elementary School



Panel B: Middle School



Panel C: High School



Panel D: Other School

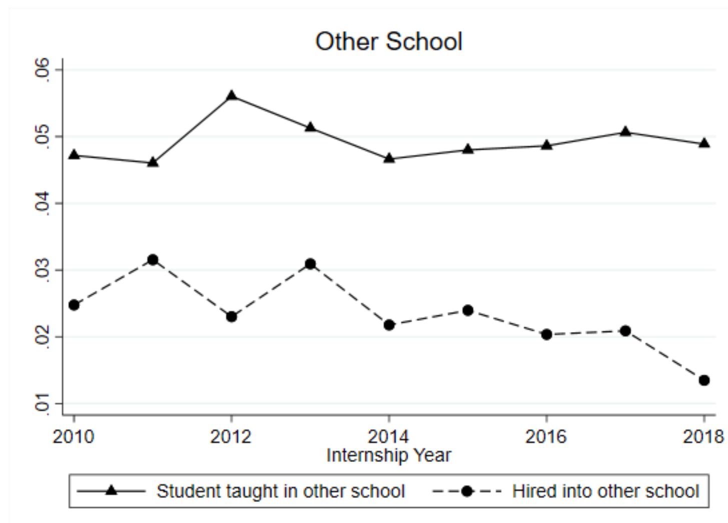


Figure 2. *Hiring Rates in Washington State, by Internship Year Over Time*

Figure 3. *Cumulative Hiring Rates, by Internship Cohort*

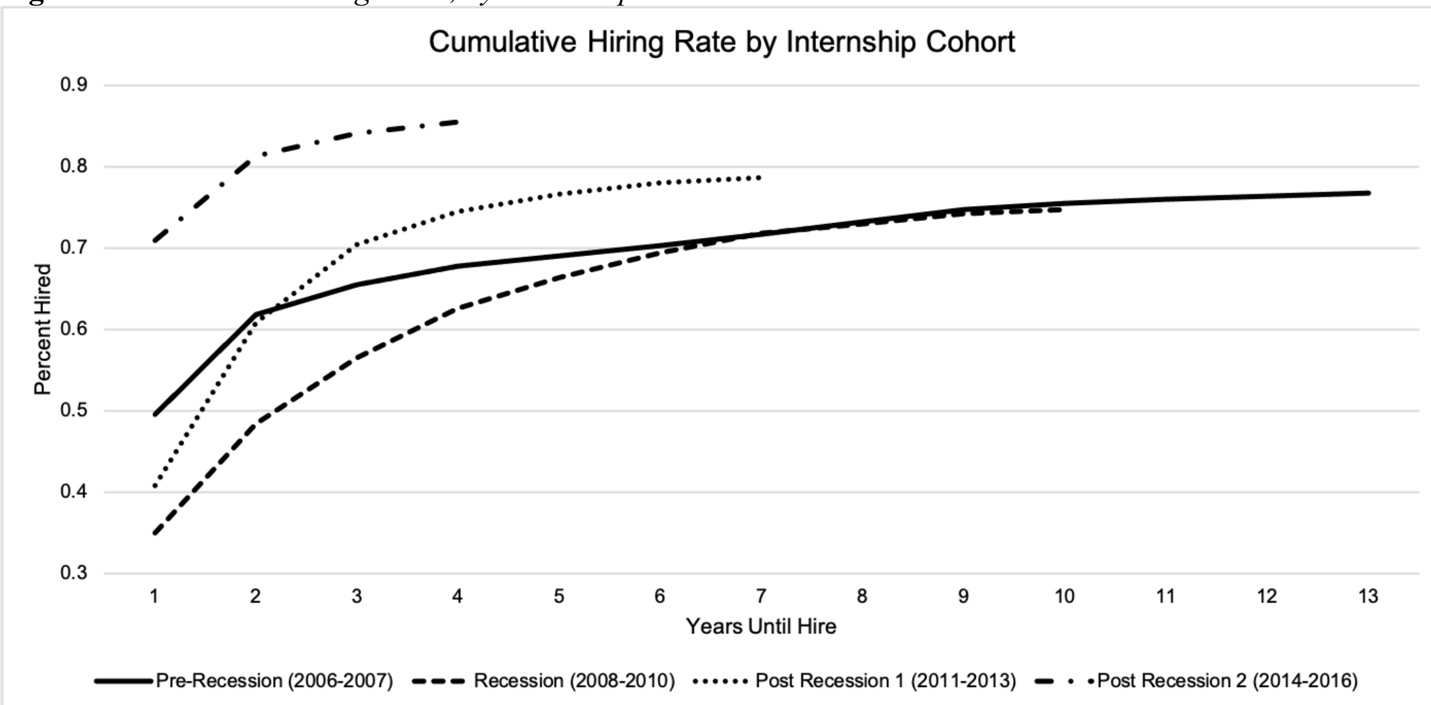


Figure 4. *1- and 3-Year Hiring Rates, by Endorsement Category Over Time*

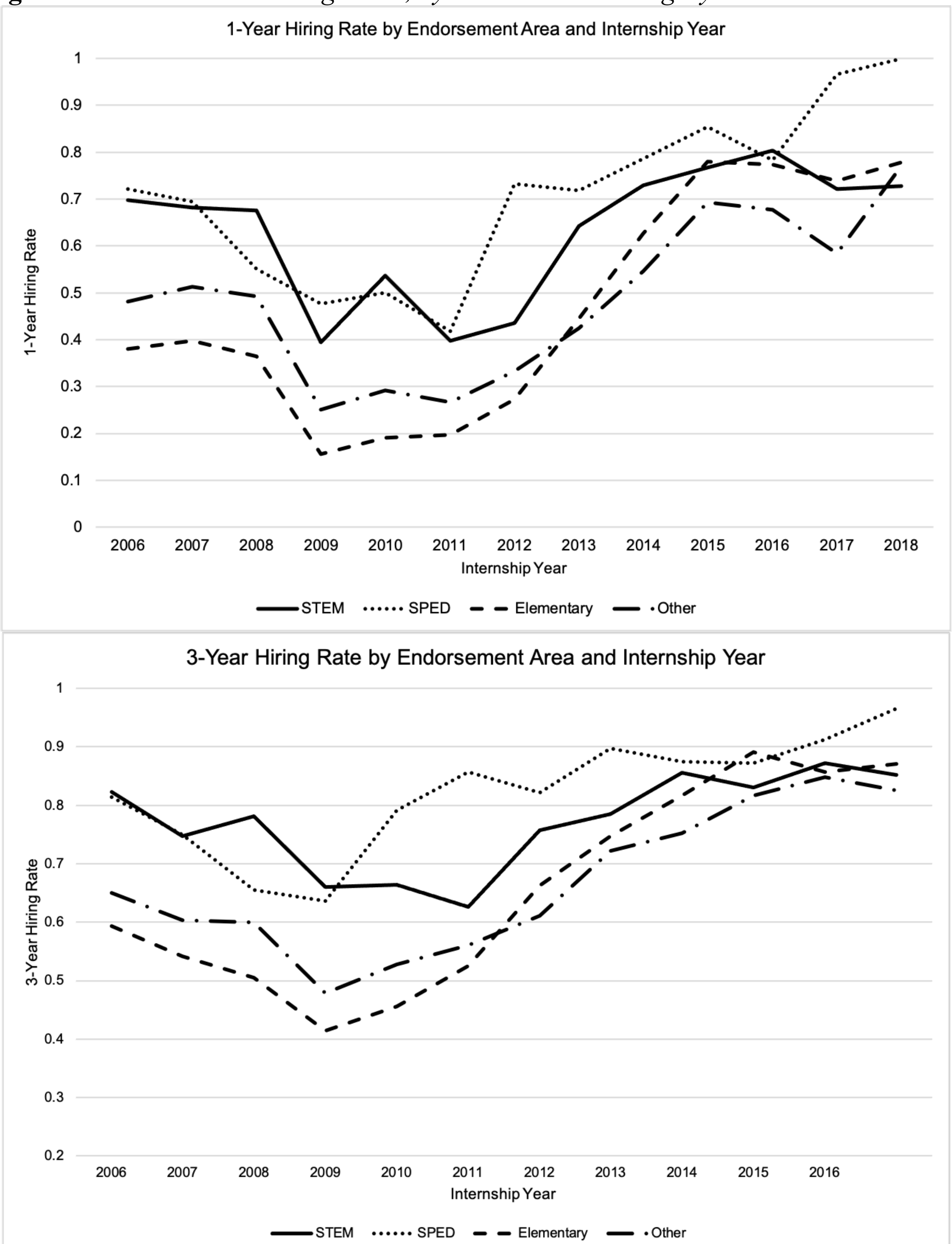


Figure 5. *Predicted Probabilities of Hire as In-State Public School Teacher, by Endorsement Area*

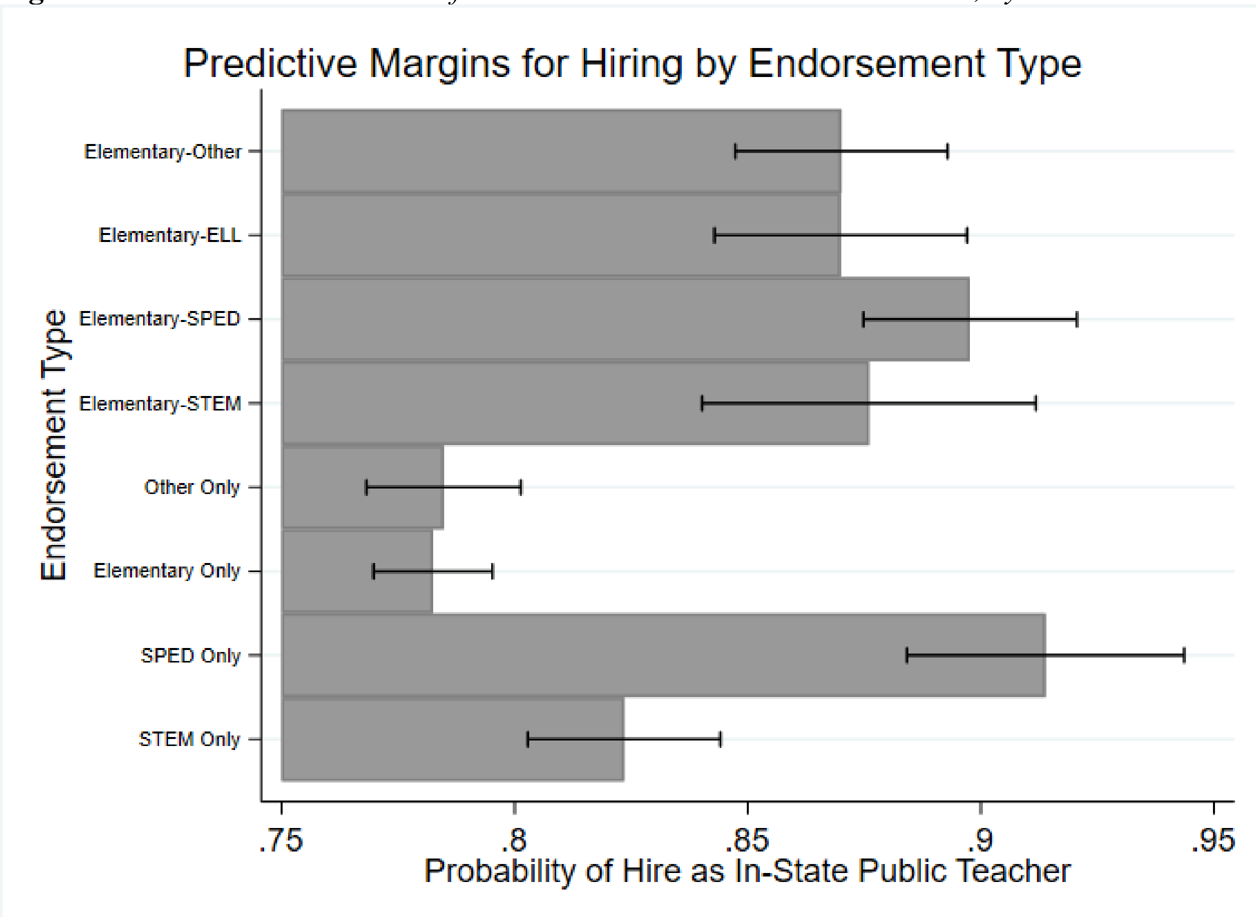


Figure 6. *Probability of Attrition Based on School Type Match Between Current and Internship School Type*

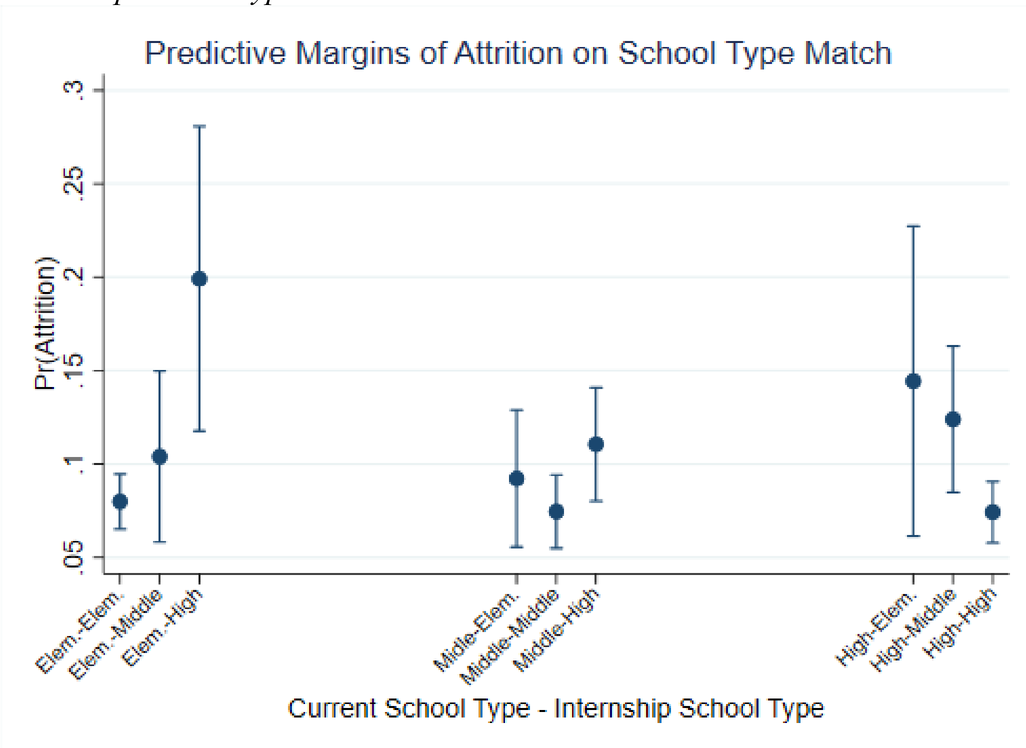
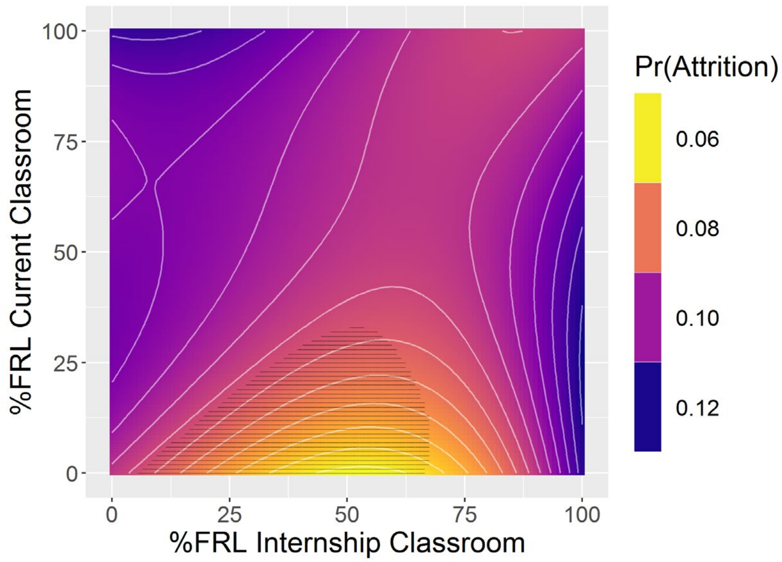
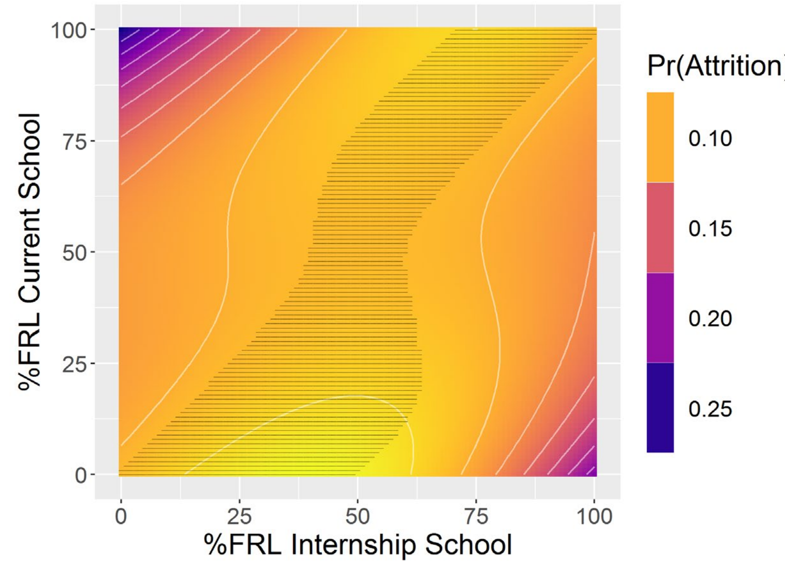


Figure 7. *Predicted Attrition From the Workforce by % FRL in Student Teaching and First Job Placements*

Panel A: Classroom Level



Panel B: School Level



Notes. + indicates regions statistically significantly greater than zero; - indicates regions statistically significantly less than zero.

Appendix Table 1. *Teacher Candidate Characteristics and Test Scores, by Hiring Outcome*

	Full Sample	Public teaching role	Public non-teaching role	Not observed hired
Teaching role prior to internship	0.0443	0.0537***	0.119***	0.00422
	(0.206)	(0.225)	(0.325)	(0.0649)
Teaching role concurrent with internship	0.0528	0.0630***	0.0662***	0.0124
	(0.224)	(0.243)	(0.250)	(0.111)
Non-teaching role prior to internship	0.0151	0.0167***	0.159***	0.00253
	(0.122)	(0.128)	(0.367)	(0.0503)
Non-teaching role concurrent with internship	0.0116	0.0116***	0.185***	0.00451
	(0.107)	(0.107)	(0.390)	(0.0670)
Internship Quarter	**N = 14,218**	**N = 11,353**	**N = 127**	**N = 2,738**
Fall (N = 3355)	0.236	0.234	0.370	0.239
	(0.425)	(0.423)	(0.485)	(0.427)
Winter (N = 3169)	0.223	0.223	0.157	0.224
	(0.416)	(0.417)	(0.366)	(0.417)
Spring (N = 7193)	0.506	0.508	0.465	0.501
	(0.500)	(0.500)	(0.501)	(0.500)
Summer (N = 328)	0.0231	0.0230	0.00787	0.0241
	(0.150)	(0.150)	(0.0887)	(0.153)
WEST-B sample	**N = 15,841**	**N = 12,856**	**N = 132**	**N = 2,853**
WEST-B score (first attempt)	0.0145	0.0186	-0.114	0.00193
	(0.993)	(0.989)	(1.073)	(1.006)
Failed any WEST-B (first attempt)	0.131	0.130	0.159	0.138
	(0.338)	(0.336)	(0.367)	(0.345)
WEST-E sample	**N = 10,585**	**N = 8,783**	**N = 89**	**N = 1,713**
WEST-E score (first attempt)	0.0146	0.0156	-0.159*	0.0188
	(0.927)	(0.928)	(1.032)	(0.920)
Failed any WEST-E (first attempt)	0.954	0.953	0.944	0.961
	(0.209)	(0.212)	(0.232)	(0.194)

Notes. Significance levels for two-sided t-test relative to last column. Standard deviations in parenthesis. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Appendix Table 2. *Marginal Effects Predicting Entry Into Public Teaching Role for WEST-B and WEST-E Sample*

	(1)	(2)
Candidate Age	-0.008*	-0.011**
	(0.004)	(0.004)
Candidate Female (male ref.)	-0.099	-0.083
	(0.075)	(0.075)
Candidate Non-White	0.137	0.103
	(0.178)	(0.180)
Candidate STEM endorsement (ref. Elementary)	0.214*	0.280**
	(0.105)	(0.107)
Candidate SPED endorsement (ref. Elementary)	0.836***	0.964***
	(0.194)	(0.195)
Candidate ELL endorsement (ref. not ELL)	0.211	0.232
	(0.148)	(0.151)
Candidate Other endorsement (ref. Elementary)	0.088	0.180*
	(0.081)	(0.084)
Candidate Multiple endorsements	0.373*	0.344
	(0.175)	(0.179)
Candidate STEM * multiple endorsements (ref. Elementary * multiple)	0.601**	0.540*
	(0.223)	(0.226)
Candidate SPED * multiple endorsements (ref. Elementary * multiple)	-0.24	-0.323
	(0.263)	(0.267)
Candidate Other * multiple endorsements (ref. Elementary * multiple)	0.24	0.246
	(0.165)	(0.168)
CT Experience	-0.007*	-0.008*
	(0.003)	(0.003)
CT Female (male ref.)	0.1	0.099
	(0.076)	(0.077)
CT Non-White	0.078	0.102
	(0.109)	(0.111)
CT Master's degree	-0.009	-0.01
	(0.071)	(0.071)
CT Gender match	-0.083	-0.093
	(0.073)	(0.073)
CT Endorsement match	-0.171	-0.165
	(0.103)	(0.104)
CT Institution match	0.029	-0.036
	(0.068)	(0.071)
CT White/non-White match	0.031	0.043
	(0.164)	(0.166)
Standardized WEST-B score (1st attempt)	-0.023	-0.005
	(0.048)	(0.049)
Failed any WEST-B (1st attempt)	-0.042	-0.021
	(0.118)	(0.119)
Standardized WEST-E score (1st attempt)	-0.051	-0.06
	(0.041)	(0.041)
Failed any WEST-E (1st attempt)	-0.065	-0.088
	(0.159)	(0.161)
ST Classroom Standardized % FRL	0.004	-0.013
	(0.033)	(0.034)
Institution FE		X
N	10,433	10,433

Notes. All models control for teaching roles prior to and concurrently with internship placement, the quarter of internship, internship year, and internship school characteristics (standardized percent FRL students, stay ratio, and the number of new teachers hired the next year). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch. FE is fixed effect.

Appendix Table 3. *Marginal Effects Predicting Entry Into Public Teaching Role With Institution FEs*

	(1)	(2)	(3)	(4)
Candidate Age	-0.001***	-0.001***	-0.002***	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)
Candidate Female (male ref.)	-0.012	-0.012	-0.007	-0.024
	(0.008)	(0.008)	(0.010)	(0.021)
Candidate Non-White	0.01	0.009	0.028	0.036
	(0.019)	(0.019)	(0.031)	(0.051)
Candidate STEM endorsement (ref. Elementary)	0.057***	0.057***	0.037*	0.03
	(0.011)	(0.011)	(0.015)	(0.030)
Candidate SPED endorsement (ref. Elementary)	0.135***	0.137***	0.128**	0.271
	(0.022)	(0.022)	(0.042)	(0.143)
Candidate ELL endorsement (ref. not ELL)	0.022	0.021	0.014	0.003
	(0.017)	(0.017)	(0.027)	(0.042)
Candidate Other endorsement (ref. Elementary)	0.019*	0.020*	0.006	0.005
	(0.008)	(0.008)	(0.013)	(0.027)
Candidate Multiple endorsements	0.045*	0.044*	0.03	0.059
	(0.020)	(0.020)	(0.033)	(0.048)
Candidate STEM * multiple endorsements (ref. Elementary * multiple)	0.04	0.039	0.062	0.033
	(0.023)	(0.023)	(0.034)	(0.056)
Candidate SPED * multiple endorsements (ref. Elementary * multiple)	-0.035	-0.036	-0.058	-0.225
	(0.030)	(0.030)	(0.053)	(0.153)
Candidate Other * multiple endorsements (ref. Elementary * multiple)	0.058**	0.057**	0.046	0.033
	(0.018)	(0.018)	(0.028)	(0.047)
CT Experience	-0.001	-0.001	-0.001	-0.001
	0.000	0.000	(0.001)	(0.001)
CT Female (male ref.)	0.017*	0.017*	0.01	0.054*
	(0.008)	(0.008)	(0.010)	(0.022)
CT Non-White	0.014	0.013	0.007	-0.029
	(0.011)	(0.011)	(0.017)	(0.029)
CT Master's degree	0.008	0.008	0.001	0.015
	(0.007)	(0.007)	(0.012)	(0.021)
CT Gender match	-0.002	-0.001	0	-0.009
	(0.007)	(0.007)	(0.010)	(0.021)
CT Endorsement match	-0.002	-0.002	-0.02	-0.038
	(0.010)	(0.010)	(0.017)	(0.028)
CT Institution match	-0.006	-0.007	-0.003	0
	(0.007)	(0.007)	(0.011)	(0.020)
CT White/non-White match	0.012	0.012	0.005	-0.012
	(0.017)	(0.017)	(0.028)	(0.045)
ST School Standardized % FRL	-0.005			
	(0.003)			
ST Standardized stay ratio	-0.004			
	(0.004)			
ST Number of new teachers hired in year after internship year	0			
	(0.001)			
ST Classroom Standardized % FRL		-0.001	-0.003	0.014
		(0.004)	(0.007)	(0.012)
ST Standardized average classroom prior performance			-0.007	0.023
			(0.011)	(0.026)
CT Value Added (Leave Out)				-0.033
				(0.070)
Institution FE	X	X	X	X
N	17,275	17,275	6,884	2,197

Notes. All models control for teaching roles prior to and concurrently with internship placement, the quarter of internship, internship year, and internship school characteristics (standardized percent FRL students, stay ratio, and the number of new teachers hired the next year). $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch. FE is fixed effect.

Appendix Table 4. *Discrete Time Hazard Models of Attrition Marginal Effects With Fixed Effects, Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Teacher Age	0.002***	0.001***	0.002***	0.002***	0.002***	0.001***	0.002***	0.002***	0.002***	0.002***	0.002***	0.002**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Teacher Female (male ref.)	0.007	0.007	0.006	0.006	0.007	0.007	0.006	0.005	0.004	0.005	-0.003	-0.005
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.008)	(0.012)	(0.012)
Teacher Non-White	-0.003	-0.001	-0.003	-0.004	-0.005	-0.002	-0.004	-0.005	0.004	0.008	-0.007	-0.011
	(0.009)	(0.009)	(0.012)	(0.012)	(0.009)	(0.009)	(0.012)	(0.012)	(0.014)	(0.015)	(0.022)	(0.023)
Teacher Graduate degree	-0.014**	-0.015**	-0.020***	-0.021**	-0.014**	-0.015**	-0.020***	-0.021**	-0.021*	-0.019*	-0.031**	-0.034*
	(0.005)	(0.005)	(0.006)	(0.007)	(0.005)	(0.005)	(0.005)	(0.007)	(0.008)	(0.008)	(0.012)	(0.013)
Teacher STEM endorsement	0.022*	0.025**	0.050***	0.048***	0.023*	0.025**	0.051***	0.049***	0.039*	0.047**	0.100***	0.095***
	(0.009)	(0.009)	(0.012)	(0.012)	(0.009)	(0.009)	(0.011)	(0.012)	(0.016)	(0.016)	(0.028)	(0.028)
Teacher SPED endorsement	0.015	0.02	0.030*	0.025	0.016	0.019	0.030*	0.024	0.033	0.041	0.096*	0.094*
	(0.011)	(0.011)	(0.014)	(0.015)	(0.011)	(0.011)	(0.014)	(0.015)	(0.025)	(0.026)	(0.041)	(0.041)
Teacher ELL endorsement	0.018	0.018	0.013	0.01	0.017	0.018	0.011	0.009	0.032	0.032	0.052	0.052
	(0.009)	(0.010)	(0.012)	(0.012)	(0.009)	(0.010)	(0.012)	(0.012)	(0.017)	(0.017)	(0.029)	(0.030)
Teacher Other endorsement	0.050***	0.051***	0.079***	0.077***	0.051***	0.051***	0.080***	0.078***	0.071***	0.074***	0.129***	0.125***
	(0.007)	(0.007)	(0.009)	(0.009)	(0.007)	(0.007)	(0.006)	(0.009)	(0.015)	(0.015)	(0.026)	(0.027)
Teacher Multiple endorsements	-0.022*	-0.021	-0.021	-0.02	-0.023*	-0.022	-0.021	-0.02	-0.009	-0.01	-0.026	-0.029
	(0.011)	(0.011)	(0.014)	(0.014)	(0.011)	(0.011)	(0.014)	(0.014)	(0.021)	(0.022)	(0.038)	(0.038)
Teacher STEM * multiple endorsements	-0.013	-0.011	-0.031*	-0.033*	-0.013	-0.011	-0.032*	-0.034*	-0.024	-0.024	-0.052	-0.043
	(0.013)	(0.013)	(0.016)	(0.016)	(0.012)	(0.013)	(0.016)	(0.016)	(0.021)	(0.022)	(0.036)	(0.037)
Teacher SPED * multiple endorsements	-0.028	-0.027	-0.040*	-0.040*	-0.029	-0.027	-0.040*	-0.040*	-0.038	-0.041	-0.059	-0.053
	(0.015)	(0.015)	(0.019)	(0.019)	(0.015)	(0.015)	(0.019)	(0.019)	(0.029)	(0.030)	(0.049)	(0.049)
Teacher Other * multiple endorsements	-0.039***	-0.041***	-0.065***	-0.064***	-0.040***	-0.041***	-0.066***	-0.065***	-0.045*	-0.048**	-0.077*	-0.076*
	(0.010)	(0.010)	(0.013)	(0.013)	(0.010)	(0.010)	(0.012)	(0.013)	(0.018)	(0.019)	(0.032)	(0.031)
Number of years until hired	0.006***	0.006***	0.008***	0.007***	0.006***	0.005***	0.008***	0.007***	0.009***	0.009**	0.013**	0.013**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.005)	(0.005)
CT Age	0	0	0	0	0	0	0	0	-0.001	-0.001	-0.001	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
CT Experience	0.001	0	0.001	0.001	0.001	0	0.001	0.001	0.001	0.001	0.002	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)
CT Female (male ref.)	-0.012*	-0.012*	-0.012	-0.012	-0.012*	-0.012*	-0.012	-0.012	-0.016*	-0.018*	-0.013	-0.014
	(0.005)	(0.005)	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.008)	(0.012)	(0.012)
CT Non-White	-0.003	0	0.008	0.009	-0.004	-0.001	0.007	0.008	0.009	0.011	0.005	0.004
	(0.009)	(0.009)	(0.012)	(0.012)	(0.009)	(0.009)	(0.012)	(0.012)	(0.014)	(0.014)	(0.022)	(0.022)
CT Graduate degree	0	-0.002	0	0	0.001	-0.002	0	0	0	-0.001	0.007	0.005
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.009)	(0.009)	(0.014)	(0.014)
CT Gender match	-0.004	-0.005	-0.006	-0.006	-0.004	-0.005	-0.006	-0.006	-0.002	-0.002	-0.004	-0.004
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.007)	(0.008)	(0.012)	(0.012)
CT Endorsement match	0	-0.001	-0.007	-0.007	0	-0.001	-0.006	-0.007	0.016	0.008	-0.004	-0.005
	(0.007)	(0.007)	(0.009)	(0.009)	(0.007)	(0.007)	(0.009)	(0.009)	(0.013)	(0.013)	(0.020)	(0.020)
CT Institution match	-0.003	-0.007	-0.005	-0.005	-0.003	-0.007	-0.006	-0.006	-0.008	-0.01	-0.017	-0.02
	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.006)	(0.008)	(0.009)	(0.014)	(0.014)
CT White/non-White match	0	-0.002	-0.001	-0.001	0	-0.002	-0.002	-0.001	0.003	-0.003	-0.017	-0.018
	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)	(0.011)	(0.011)	(0.014)	(0.014)	(0.021)	(0.022)
ST Standardized School % FRL	-0.002	-0.001	-0.003	-0.003								
	(0.003)	(0.003)	(0.003)	(0.003)								
ST Standardized stay ratio	-0.002	-0.003	-0.005	-0.005								
	(0.003)	(0.003)	(0.003)	(0.003)								
ST Standardized Class % FRL					0.001	0.003	0.004	0.004	-0.006	-0.002	-0.006	-0.006
					(0.003)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.008)	(0.008)
ST Standardized average classroom prior performance									0.006	0.011	0.019	0.02
									(0.008)	(0.008)	(0.013)	(0.013)
Grade match	-0.008	-0.008	0.001	0.002	-0.008	-0.009	0.001	0.001	-0.004	-0.004	0.001	0.001
	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)	(0.011)	(0.011)	(0.012)	(0.012)	(0.018)	(0.018)
School type match	-0.044***	-0.043***	-0.054***	-0.055***	-0.044***	-0.043***	-0.054***	-0.055***	-0.043***	-0.042***	-0.069***	-0.068***
	(0.009)	(0.009)	(0.011)	(0.010)	(0.009)	(0.009)	(0.009)	(0.010)	(0.011)	(0.011)	(0.016)	(0.016)
School match	-0.016	-0.013	-0.009	-0.009	-0.016	-0.013	-0.01	-0.009	-0.027	-0.021	-0.001	-0.001
	(0.013)	(0.013)	(0.016)	(0.016)	(0.013)	(0.013)	(0.016)	(0.016)	(0.018)	(0.018)	(0.026)	(0.026)
District match	-0.005	-0.009	-0.014	-0.013	-0.005	-0.009	-0.013	-0.012	-0.004	-0.015	-0.025	-0.023
	(0.009)	(0.009)	(0.011)	(0.011)	(0.009)	(0.009)	(0.011)	(0.011)	(0.011)	(0.012)	(0.018)	(0.018)
Institution FE	X			X	X			X	X			X
District FE		X				X				X		
School FE			X	X			X	X			X	X
N	25,181	24,975	20,302	20,302	25,181	24,975	20,302	20,302	9,824	9,441	6,162	6,162

Notes. All models control for teaching roles prior to and concurrently with internship placement, the quarter of internship, internship year, and internship school characteristics (standardized percent FRL students, stay ratio, and the number of new teachers hired the next year). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch. FE is fixed effect.

Appendix Table 5. *Discrete Time Hazard Models of Attrition Marginal Effects With Fixed Effects and Value Added, Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)	(6)
Teacher Age	0.002**	0.002**	0.002**	0.002**	0.003***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Teacher Female (male ref.)	0.033*	0.031	0.029	0.028	0.024	0.023
	(0.016)	(0.018)	(0.018)	(0.015)	(0.017)	(0.017)
Teacher Non-White	-0.002	0.007	0.008	-0.004	0.009	0.009
	(0.021)	(0.024)	(0.024)	(0.020)	(0.022)	(0.022)
Teacher Graduate degree	-0.006	-0.026	-0.017	-0.009	-0.026*	-0.018
	(0.014)	(0.015)	(0.016)	(0.013)	(0.013)	(0.015)
Teacher STEM endorsement	0.017	0.011	0.008	0.018	0.018	0.016
	(0.024)	(0.027)	(0.027)	(0.023)	(0.025)	(0.026)
Teacher SPED endorsement	0.051	0.065	0.066	0.048	0.061	0.061
	(0.042)	(0.043)	(0.045)	(0.035)	(0.038)	(0.039)
Teacher ELL endorsement	-0.003	-0.001	0.002	-0.005	0	0.002
	(0.026)	(0.030)	(0.030)	(0.023)	(0.026)	(0.027)
Teacher Other endorsement	0.013	-0.004	-0.007	0.019	0.006	0.006
	(0.025)	(0.027)	(0.028)	(0.024)	(0.026)	(0.026)
Teacher Multiple endorsements	-0.002	-0.003	-0.003	0.006	0.002	0.003
	(0.029)	(0.033)	(0.034)	(0.026)	(0.030)	(0.030)
Teacher STEM * multiple endorsements	-0.014	-0.01	-0.008	-0.013	-0.011	-0.011
	(0.033)	(0.037)	(0.038)	(0.031)	(0.035)	(0.035)
Teacher SPED * multiple endorsements	-0.084	-0.095	-0.093	-0.075	-0.085	-0.084
	(0.050)	(0.052)	(0.054)	(0.041)	(0.046)	(0.047)
Teacher Other * multiple endorsements	-0.029	-0.019	-0.013	-0.026	-0.015	-0.012
	(0.029)	(0.034)	(0.034)	(0.027)	(0.032)	(0.032)
Number of years until hired	0.010*	0.012*	0.013*	0.009*	0.011*	0.011*
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
CT Age	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CT Experience	0.001	0.001	0.001	0.001	0.001	0
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
CT Female (male ref.)	0.001	-0.006	-0.008	0.008	0	-0.001
	(0.016)	(0.017)	(0.018)	(0.015)	(0.017)	(0.017)
CT Non-White	0.014	0.011	0.013	0.006	0.003	0.006
	(0.021)	(0.023)	(0.024)	(0.021)	(0.023)	(0.023)
CT Graduate degree	0.015	0.019	0.016	0.009	0.011	0.008
	(0.015)	(0.017)	(0.017)	(0.014)	(0.015)	(0.015)
CT Gender match	-0.035*	-0.038*	-0.038*	-0.030*	-0.031	-0.03
	(0.016)	(0.018)	(0.018)	(0.015)	(0.017)	(0.017)
CT Endorsement match	0.011	-0.006	-0.002	0.001	-0.011	-0.009
	(0.018)	(0.020)	(0.020)	(0.017)	(0.019)	(0.019)
CT Institution match	-0.015	-0.017	-0.019	-0.018	-0.024	-0.025
	(0.014)	(0.016)	(0.016)	(0.014)	(0.015)	(0.016)
CT White/non-White match	-0.002	0.001	0	-0.008	-0.007	-0.007
	(0.020)	(0.022)	(0.022)	(0.020)	(0.021)	(0.021)
ST Standardized Class % FRL	0.01	0.015	0.015	0.011	0.017*	0.017*
	(0.008)	(0.009)	(0.010)	(0.007)	(0.008)	(0.008)
ST Standardized average classroom prior performance	0.022	0.028	0.029	0.027	0.036*	0.037*
	(0.017)	(0.019)	(0.020)	(0.014)	(0.015)	(0.016)
Grade match	-0.022	-0.016	-0.013	-0.02	-0.015	-0.013
	(0.020)	(0.022)	(0.022)	(0.019)	(0.021)	(0.021)
School type match	-0.029	-0.023	-0.023	-0.031	-0.024	-0.024
	(0.018)	(0.020)	(0.020)	(0.017)	(0.019)	(0.019)
School match	0.007	-0.005	-0.003	-0.008	-0.021	-0.019
	(0.029)	(0.030)	(0.030)	(0.028)	(0.030)	(0.030)
District match	-0.03	-0.029	-0.031	-0.029	-0.027	-0.029
	(0.020)	(0.022)	(0.022)	(0.018)	(0.021)	(0.021)
CT Value Added (Leave Out)	-0.002	0.005	0.003			
	(0.049)	(0.056)	(0.057)			
CT Value Added (Pooled Year)				-0.042	-0.044	-0.042
				(0.039)	(0.042)	(0.043)
Institution FE	X		X	X		X
District FE		X	X		X	X
N	3,159	2,822	2,822	3,577	3,213	3,213

Notes. All models control for teaching roles prior to and concurrently with internship placement, the quarter of internship, internship year, and internship school characteristics (standardized percent FRL students, stay ratio, and the number of new teachers hired the next year). *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch. FE is fixed effect.

Appendix Table 6. *Discrete Time Hazard Models of District Attrition Marginal Effects, Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)
Teacher Age	0	0	0	0.001	0
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Teacher Female (male ref.)	0.002	-0.001	0.002	0.006	0.002
	(0.005)	(0.005)	(0.007)	(0.015)	(0.014)
Teacher Non-White	-0.002	-0.002	0	0.036	0.025
	(0.009)	(0.008)	(0.014)	(0.021)	(0.020)
Teacher Graduate degree	-0.005	-0.006	-0.016*	-0.030*	-0.027*
	(0.004)	(0.004)	(0.007)	(0.013)	(0.012)
Teacher STEM endorsement	0.025**	0.022*	0.007	0.016	0.016
	(0.009)	(0.009)	(0.015)	(0.024)	(0.022)
Teacher SPED endorsement	0.013	0.014	-0.022	-1.049***	-0.13
	(0.011)	(0.010)	(0.023)	(0.070)	(0.070)
Teacher ELL endorsement	0.002	0.004	-0.002	-0.002	-0.015
	(0.008)	(0.008)	(0.015)	(0.022)	(0.020)
Teacher Other endorsement	0.037***	0.036***	0.032*	0.014	0.021
	(0.007)	(0.007)	(0.013)	(0.024)	(0.021)
Teacher Multiple endorsements	0.001	0.004	0.016	0.038	0.046*
	(0.009)	(0.009)	(0.018)	(0.025)	(0.023)
Teacher STEM * multiple endorsements	-0.023*	-0.024*	-0.006	-0.035	-0.04
	(0.012)	(0.012)	(0.019)	(0.031)	(0.028)
Teacher SPED * multiple endorsements	-0.001	-0.005	0.024	1.033***	0.104
	(0.013)	(0.013)	(0.025)	(0.072)	(0.073)
Teacher Other * multiple endorsements	-0.024*	-0.025**	-0.032*	-0.034	-0.042
	(0.009)	(0.009)	(0.016)	(0.029)	(0.026)
Number of years until hired	-0.006***	-0.005**	-0.009**	-0.005	-0.006
	(0.002)	(0.002)	(0.003)	(0.005)	(0.005)
CT Age	0	0	-0.001	-0.001	-0.001
	0.000	0.000	0.000	(0.001)	(0.001)
CT Experience	0	0	0.001	0	0
	0.000	0.000	(0.001)	(0.001)	(0.001)
CT Female (male ref.)	0	-0.001	0.001	-0.015	-0.004
	(0.005)	(0.005)	(0.007)	(0.014)	(0.014)
CT Non-White	-0.012	-0.015	-0.023	-0.019	-0.017
	(0.008)	(0.008)	(0.014)	(0.021)	(0.020)
CT Graduate degree	-0.004	-0.005	-0.009	-0.019	-0.015
	(0.004)	(0.004)	(0.008)	(0.013)	(0.012)
CT Gender match	0.007	0.007	0.004	0.019	0.016
	(0.005)	(0.005)	(0.007)	(0.015)	(0.014)
CT Endorsement match	-0.005	-0.006	-0.016	-0.025	-0.022
	(0.006)	(0.006)	(0.011)	(0.016)	(0.015)
CT Institution match	0	0.001	0.001	0.021	0.019
	(0.004)	(0.004)	(0.007)	(0.012)	(0.011)
CT White/non-White match	-0.002	-0.003	-0.006	0.014	0.013
	(0.008)	(0.008)	(0.014)	(0.020)	(0.019)
ST Standardized school % FRL	-0.002				
	(0.002)				
ST Standardized school stay ratio	0.003				
	(0.002)				
ST Standardized class % FRL		0	-0.006	-0.006	-0.002
		(0.002)	(0.004)	(0.008)	(0.006)
ST Standardized average class prior performance			-0.015*	-0.025	-0.018
			(0.007)	(0.016)	(0.012)
Grade match	0.002	0.002	0.008	0.011	0.02
	(0.007)	(0.007)	(0.010)	(0.017)	(0.016)
School type match	-0.018*	-0.019*	-0.025*	0.003	-0.007
	(0.008)	(0.008)	(0.010)	(0.019)	(0.017)
School match	0.012	0.009	-0.005	-0.046	-0.053
	(0.013)	(0.013)	(0.017)	(0.035)	(0.034)
District match	-0.060***	-0.060***	-0.047***	-0.054**	-0.056**
	(0.009)	(0.009)	(0.011)	(0.019)	(0.018)
CT Value Added (Leave Out)				-0.017	
				(0.048)	
CT Value Added (Pooled Year)					0.008
					(0.036)
N	20,932	20,932	8,280	2,688	3,077

Notes. All models control for teaching roles prior to and concurrently with ST placement, the quarter of internship, inservice school characteristics, and school year. The models also control for those with limited certificates and those with no endorsements. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Appendix Table 7. *Discrete Time Hazard Models of School Attrition Marginal Effects, Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)
Teacher Age	0.001**	0.001**	0.001	0.001	0
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Teacher Female (male ref.)	0.006	0.005	0.003	-0.005	-0.013
	(0.006)	(0.006)	(0.007)	(0.015)	(0.014)
Teacher Non-White	0.003	0.001	-0.013	-0.026	-0.022
	(0.009)	(0.009)	(0.016)	(0.027)	(0.023)
Teacher Graduate degree	-0.003	-0.003	0.003	0.009	0.006
	(0.005)	(0.005)	(0.007)	(0.012)	(0.011)
Teacher STEM endorsement	-0.030**	-0.031**	-0.026	0.01	0.002
	(0.010)	(0.010)	(0.014)	(0.026)	(0.025)
Teacher SPED endorsement	0.02	0.016	0.034	0.055	0.066*
	(0.011)	(0.011)	(0.018)	(0.037)	(0.033)
Teacher ELL endorsement	0.006	0.004	0.007	0.015	0.013
	(0.009)	(0.010)	(0.014)	(0.025)	(0.022)
Teacher Other endorsement	-0.008	-0.008	-0.007	-0.004	-0.005
	(0.008)	(0.008)	(0.013)	(0.026)	(0.025)
Teacher Multiple endorsements	-0.005	-0.005	0.015	-0.001	-0.001
	(0.010)	(0.010)	(0.017)	(0.026)	(0.023)
Teacher STEM * multiple endorsements	0.022	0.024	0.01	-0.032	-0.021
	(0.013)	(0.013)	(0.019)	(0.031)	(0.030)
Teacher SPED * multiple endorsements	-0.009	-0.008	-0.036	-0.041	-0.051
	(0.014)	(0.014)	(0.022)	(0.043)	(0.038)
Teacher Other * multiple endorsements	0.003	0.001	-0.012	-0.005	-0.001
	(0.011)	(0.011)	(0.016)	(0.031)	(0.029)
Number of years until hired	-0.001	0	0	-0.007	-0.005
	(0.002)	(0.002)	(0.003)	(0.006)	(0.005)
CT Age	0	0	-0.001*	-0.001	-0.001
	0.000	0.000	0.000	(0.001)	(0.001)
CT Experience	0.001	0.001	0.001	0.001	0.001
	0.000	0.000	(0.001)	(0.001)	(0.001)
CT Female (male ref.)	0.002	0.001	0.005	-0.012	-0.014
	(0.006)	(0.006)	(0.008)	(0.014)	(0.013)
CT Non-White	-0.001	-0.004	-0.028	-0.059*	-0.042
	(0.009)	(0.009)	(0.016)	(0.027)	(0.023)
CT Graduate degree	0.001	0.002	-0.001	-0.025	-0.013
	(0.005)	(0.005)	(0.008)	(0.014)	(0.013)
CT Gender match	-0.002	-0.002	0.002	0.001	0.011
	(0.006)	(0.006)	(0.007)	(0.014)	(0.014)
CT Endorsement match	-0.001	0	0.002	0.027	0.023
	(0.007)	(0.007)	(0.012)	(0.019)	(0.018)
CT Institution match	-0.004	-0.004	-0.003	0.018	0.017
	(0.005)	(0.005)	(0.008)	(0.013)	(0.013)
CT White/non-White match	-0.002	-0.004	-0.03	-0.048	-0.039
	(0.009)	(0.009)	(0.016)	(0.026)	(0.023)
ST Standardized school % FRL	-0.002				
	(0.002)				
ST Standardized school stay ratio	0.003				
	(0.003)				
ST Standardized class % FRL		0.002	0.002	0.01	0.015*
		(0.003)	(0.004)	(0.008)	(0.007)
ST Standardized average class prior performance			0.001	0.012	0.028*
			(0.007)	(0.017)	(0.013)
Grade match	-0.018	-0.018	-0.014	0.009	-0.001
	(0.010)	(0.010)	(0.011)	(0.017)	(0.017)
School type match	-0.023*	-0.022*	-0.011	-0.034	-0.031
	(0.010)	(0.010)	(0.010)	(0.018)	(0.017)
School match	-0.043***	-0.048***	-0.046**	-0.069*	-0.074**
	(0.012)	(0.012)	(0.015)	(0.027)	(0.026)
District match	0.045***	0.046***	0.039***	0.027	0.032*
	(0.008)	(0.008)	(0.010)	(0.016)	(0.015)
CT Value Added (Leave Out)				0.017	
				(0.047)	
CT Value Added (Pooled Year)					-0.035
					(0.038)
N	19,770	19,770	7,634	2,520	2,860

Notes. All models control for teaching roles prior to and concurrently with ST placement, the quarter of internship, inservice school characteristics, and school year. The models also control for those with limited certificates and those with no endorsements. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Appendix Table 8. *Discrete Time Hazard Models of Attrition Marginal Effects, not Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)
Teacher Age	0 (0.000)	0 (0.000)	0 (0.000)	0 (0.000)	0 (0.000)
Teacher Female (male ref.)	0.010*** (0.003)	0.010*** (0.003)	0.010* (0.005)	0.024* (0.010)	0.023* (0.009)
Teacher Non-White	-0.003 (0.005)	-0.005 (0.005)	0.007 (0.009)	-0.012 (0.014)	-0.01 (0.013)
Teacher Graduate degree	-0.005 (0.002)	-0.004 (0.002)	-0.009 (0.005)	-0.001 (0.007)	0.003 (0.007)
Teacher STEM endorsement	0.011* (0.005)	0.012* (0.005)	0.026* (0.010)	0.021 (0.016)	0.02 (0.015)
Teacher SPED endorsement	0.008 (0.006)	0.008 (0.006)	0.025 (0.015)	0.024 (0.031)	0.017 (0.025)
Teacher ELL endorsement	0.018*** (0.005)	0.016** (0.005)	0.031** (0.010)	-0.006 (0.016)	-0.01 (0.015)
Teacher Other endorsement	0.028*** (0.004)	0.029*** (0.004)	0.046*** (0.009)	0.01 (0.015)	0.011 (0.014)
Teacher Multiple endorsements	-0.017** (0.006)	-0.018** (0.006)	-0.008 (0.013)	0.004 (0.018)	0.015 (0.016)
Teacher STEM * multiple endorsements	-0.004 (0.007)	-0.004 (0.007)	-0.012 (0.013)	-0.024 (0.021)	-0.029 (0.020)
Teacher SPED * multiple endorsements	-0.008 (0.008)	-0.009 (0.008)	-0.013 (0.018)	-0.04 (0.035)	-0.026 (0.028)
Teacher Other * multiple endorsements	-0.017** (0.006)	-0.018** (0.006)	-0.030** (0.011)	-0.023 (0.019)	-0.029 (0.017)
Number of years until hired	0.002 (0.001)	0.001 (0.001)	0.005** (0.002)	0.005 (0.003)	0.005 (0.003)
CT Age	0 (0.000)	0 (0.000)	0 (0.000)	0 (0.000)	0 (0.000)
CT Experience	0 (0.000)	0 (0.000)	0.001 (0.000)	0 (0.001)	0 (0.001)
CT Female (male ref.)	-0.005 (0.003)	-0.006 (0.003)	-0.011* (0.005)	-0.008 (0.010)	-0.002 (0.009)
CT Non-White	-0.002 (0.005)	-0.003 (0.005)	0.012 (0.009)	0.008 (0.014)	0.009 (0.013)
CT Graduate degree	0 (0.003)	0 (0.003)	0.001 (0.006)	0.008 (0.009)	0.005 (0.009)
CT Gender match	0.001 (0.003)	0.001 (0.003)	0.004 (0.005)	-0.01 (0.010)	-0.01 (0.009)
CT Endorsement match	0.001 (0.004)	0.002 (0.004)	0.017* (0.008)	0.018 (0.012)	0.011 (0.011)
CT Institution match	-0.003 (0.003)	-0.004 (0.003)	-0.009 (0.005)	-0.009 (0.008)	-0.013 (0.008)
CT White/non-White match	0.001 (0.005)	0.001 (0.005)	0.007 (0.009)	-0.012 (0.014)	-0.011 (0.013)
ST Standardized school % FRL	-0.003 (0.001)				
ST Standardized school stay ratio	-0.001 (0.001)				
ST Standardized class % FRL		-0.001 (0.002)	-0.003 (0.003)	0.006 (0.005)	0.005 (0.004)
ST Standardized average class prior performance			0.007 (0.005)	0.019 (0.011)	0.015 (0.009)
Grade match	-0.008 (0.008)	-0.008 (0.008)	-0.004 (0.010)	-0.022 (0.018)	-0.021 (0.017)
School type match	-0.042*** (0.007)	-0.042*** (0.007)	-0.038*** (0.009)	-0.022 (0.014)	-0.024 (0.014)
School match	-0.009 (0.011)	-0.01 (0.011)	-0.022 (0.015)	0.003 (0.025)	-0.009 (0.025)
District match	-0.007 (0.007)	-0.006 (0.007)	-0.006 (0.010)	-0.021 (0.017)	-0.02 (0.016)
CT Value Added (Leave Out)				-0.01 (0.030)	
CT Value Added (Pooled Year)					-0.028 (0.024)
N	63,773	63,773	20,430	6,770	7,641

Notes. All models control for teaching roles prior to and concurrently with ST placement, the quarter of internship, inservice school characteristics, and school year. The models also control for those with limited certificates and those with no endorsements. $*p < 0.05$; $**p < 0.01$; $***p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.

Appendix Table 9. *Discrete Time Hazard Models of Attrition Marginal Effects, Conditional on Changing Schools and Limited to First 2 Years in the Workforce*

	(1)	(2)	(3)	(4)	(5)
Teacher Age	0.002**	0.002**	0.003*	0.004	0.005*
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
Teacher Female (male ref.)	0.005	0.008	-0.006	0.069	0.07
	(0.016)	(0.016)	(0.022)	(0.049)	(0.046)
Teacher Non-White	-0.002	-0.006	0.031	0.004	-0.005
	(0.029)	(0.029)	(0.045)	(0.072)	(0.068)
Teacher Graduate degree	-0.017	-0.015	-0.026	-0.032	-0.036
	(0.014)	(0.014)	(0.022)	(0.039)	(0.037)
Teacher STEM endorsement	0.058*	0.062*	0.100*	-0.026	-0.002
	(0.027)	(0.027)	(0.045)	(0.074)	(0.072)
Teacher SPED endorsement	0.009	0.016	0.058	0.206	0.164
	(0.033)	(0.034)	(0.068)	(0.160)	(0.119)
Teacher ELL endorsement	0.042	0.039	0.084	0.017	0.035
	(0.028)	(0.028)	(0.046)	(0.079)	(0.072)
Teacher Other endorsement	0.086***	0.088***	0.114**	0.006	0.017
	(0.021)	(0.021)	(0.039)	(0.078)	(0.072)
Teacher Multiple endorsements	-0.061	-0.067*	-0.084	-0.112	-0.107
	(0.032)	(0.032)	(0.058)	(0.092)	(0.083)
Teacher STEM * multiple endorsements	-0.018	-0.021	-0.033	0.105	0.1
	(0.038)	(0.038)	(0.060)	(0.108)	(0.098)
Teacher SPED * multiple endorsements	-0.05	-0.051	-0.052	-0.242	-0.163
	(0.044)	(0.044)	(0.081)	(0.181)	(0.137)
Teacher Other * multiple endorsements	-0.066*	-0.063*	-0.022	0	0.018
	(0.031)	(0.031)	(0.051)	(0.097)	(0.088)
Number of years until hired	0.022***	0.021***	0.032***	0.042**	0.040**
	(0.005)	(0.005)	(0.009)	(0.016)	(0.015)
CT Age	0.001	0	0	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)
CT Experience	0	0	0	0.002	0.001
	(0.001)	(0.001)	(0.002)	(0.003)	(0.003)
CT Female (male ref.)	-0.035*	-0.034*	-0.051*	0.009	0.024
	(0.016)	(0.016)	(0.022)	(0.049)	(0.046)
CT Non-White	0.009	0.014	0.084	0.109	0.07
	(0.029)	(0.029)	(0.045)	(0.075)	(0.071)
CT Graduate degree	0.003	0	0.015	0.088	0.067
	(0.015)	(0.015)	(0.025)	(0.046)	(0.043)
CT Gender match	-0.015	-0.015	-0.016	-0.128**	-0.125**
	(0.015)	(0.015)	(0.021)	(0.048)	(0.045)
CT Endorsement match	0.012	0.012	0.061	0.052	0.033
	(0.021)	(0.021)	(0.037)	(0.057)	(0.055)
CT Institution match	-0.011	-0.015	-0.019	-0.099*	-0.109**
	(0.015)	(0.015)	(0.024)	(0.044)	(0.041)
CT White/non-White match	0.016	0.019	0.059	0.042	0.011
	(0.029)	(0.029)	(0.045)	(0.070)	(0.066)
ST Standardized school % FRL	0.001				
	(0.007)				
ST Standardized school stay ratio	-0.015				
	(0.008)				
ST Standardized class % FRL		0.003	-0.006	0.029	0.014
		(0.009)	(0.014)	(0.027)	(0.023)
ST Standardized average class prior performance			0.03	0.099	0.077
			(0.021)	(0.054)	(0.044)
Grade match	0.005	0.002	0.002	-0.06	-0.07
	(0.029)	(0.029)	(0.036)	(0.067)	(0.063)
School type match	-0.063*	-0.059*	-0.058	-0.042	-0.049
	(0.028)	(0.028)	(0.032)	(0.060)	(0.056)
School match	0.033	0.042	0.038	0.162	0.157
	(0.042)	(0.042)	(0.054)	(0.097)	(0.096)
District match	-0.012	-0.011	-0.019	-0.051	-0.06
	(0.027)	(0.027)	(0.033)	(0.061)	(0.057)
CT Value Added (Leave Out)				0.039	
				(0.158)	
CT Value Added (Pooled Year)					-0.072
					(0.123)
N	6,387	6,387	2,528	758	862

Notes. All models control for teaching roles prior to and concurrently with ST placement, the quarter of internship, inservice school characteristics, and school year. The models also control for those with limited certificates and those with no endorsement. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. STEM is science, technology, engineering, and mathematics. SPED is special education. ELL is English language learner. CT is cooperating teacher. ST is student teaching. FRL is free or reduced-price lunch.