The Relationship Between Pandemic-Era Teacher Licensure Waivers and Teacher Demographics, Retention, and Effectiveness in New Jersey

Ben Backes
Dan Goldhaber

June 2023

WORKING PAPER No. 286-0623

CALDER
National Center for Analysis of
Longitudinal Data in Education Research

AIR®

The Relationship Between Pandemic-Era Teacher Licensure Waivers and Teacher Demographics, Retention, and Effectiveness in New Jersey

Ben Backes
American Institutes for Research / CALDER

Dan Goldhaber
American Institutes for Research / CALDER
University of Washington

Contents

Acknowledgments

This work was supported by a grant from the Joyce Foundation to the American Institutes for Research and supported by the Center for Analysis of Longitudinal Data in Education Research (CALDER), which is funded by a consortium of foundations. For more information about CALDER funders, see www.caldercenter.org/about-calder. We are grateful to the New Jersey Department of Education, and especially Elizabeth Fernandez-Vina, for assistance with obtaining and using the data. We thank Roddy Theobald for helpful comments.

CALDER • American Institutes for Research
1400 Crystal Drive 10th Floor, Arlington, VA 22202
202-403-5796 • www.caldercenter.org

The Relationship Between Pandemic-Era Teacher Licensure Waivers and Teacher Demographics, Retention, and Effectiveness in New Jersey

Ben Backes and Dan Goldhaber

CALDER Working Paper No. 286-0623
June 2023

Abstract

The onset of the pandemic in spring 2020 substantially disrupted routes into teaching and offered a unique opportunity to study this process with different requirements for initial entry into the classroom. We examine the impacts of the Temporary Certificate of Eligibility (Temporary CE), which allowed teacher candidates in New Jersey to enter the workforce before completing assessment and performance requirements. Relative to the novice teacher workforce before the pandemic, Temporary CE teachers were substantially more diverse without any significant effects on teacher performance or student test scores. However, Temporary CE holders were less likely to remain in the same school or in the New Jersey teaching workforce between 2020–21 and 2021–22. Although Temporary CE holders disproportionately entered through alternate routes into teaching, these patterns hold for both traditional- and alternate-route entrants.

1. Introduction

Teachers are arguably the most important educational input for student outcomes, and teacher licensing systems are the primary way that state education agencies can shape their states' public teaching workforce. Through licensure requirements, states aim to ensure that teacher candidates have sufficient pedagogical preparation and basic skills in reading, writing, math, and their chosen specialization. State decisions about what is required for licensure therefore have significant implications for who is eligible to enter the teacher workforce (Goldhaber & Hansen, 2010; Larson et al., 2020).

The onset of the pandemic in spring 2020 substantially disrupted these routes into teaching and offers a unique opportunity to study this process with different requirements for initial entry into the classroom. Testing centers shutting down during the onset of the pandemic meant that teacher candidates were no longer able to take required licensure exams. As a result, states were forced to modify licensure requirements for teachers seeking to enter the profession. The great majority of states modified licensure requirements during the pandemic (DeArmond et al., 2023). For many, this entailed the granting of provisional licenses that could be obtained without passing licensure tests, but that were of limited duration.[1] This was the case in New Jersey, the site of this study. Specifically, the New Jersey Department of Education (NJDOE) created a Temporary Certificate of Eligibility (Temporary CE) that allowed candidates to enter the workforce and defer assessment and performance requirements to the following year, at which time the Temporary CE expired. Candidates who held a Temporary CE and had enrolled in or completed a preparation program, and had completed at least 50 preservice hours, could obtain a Temporary Provisional Certificate to work as a teacher in a New Jersey school. For a

[1] See DeArmond et al. (2023) for more information on the types of licensure waivers enacted by states.

limited time, candidates could thus become a teacher in New Jersey without first passing licensure exams.

The process by which teacher candidates are certified to teach is an area of active policy and research interest. Preservice assessments such as the edTPA, as well as basic skills and subject matter tests such as the widely used Praxis series, are intended to ensure teachers arrive in the classroom with the necessary skills and knowledge to teach. Indeed, there is evidence that Praxis tests provide a signal about how a teacher will do in the classroom, at least in math (Goldhaber & Hansen, 2010). However, at least two potential drawbacks exist to using tests as screens. First, these represent additional hurdles in terms of time and money that candidates must clear before entering the classroom as licensed teachers. These tests may discourage some potential high-quality teachers from ever pursuing teaching (Angrist & Guryan, 2004). Second, a growing body of evidence finds that students of color benefit from having teachers of the same race (e.g., Dee, 2005; Gershenson et al., 2018; Goldhaber & Hansen, 2010), and that licensure tests tend to disproportionately screen out Black and Hispanic teacher candidates, creating a "diversity gap" between students and teachers that is an increasing policy concern (National Academies of Sciences, Engineering, and Medicine, 2020).[2]

New Jersey is an ideal location to study the impacts of waiving licensure test requirements for two reasons. First, because of the large portion of teachers in the state who enter the teaching workforce without completing a traditional teacher preparation program, observing short-term changes to the composition of first-year teachers is plausible because these teacher candidates do not go through the several-year process of entering and completing a traditional

[2] For example, Cowan et al. (2020) find that the percentage of teacher candidates who pass both subsections of the required Communication and Literacy Skills test on the first attempt is 77% for White candidates, 54% for Hispanic candidates, and about 50% for Black candidates.

program. In the 3 years before the pandemic, more than 20% of newly certified teachers carried an alternate-route CE rather than the traditional Certificate of Eligibility with Advanced Standing (CEAS) certificate granted to graduates of educator preparation programs. Consequently, through its influence on both traditional and alternate-route programs, NJDOE has a direct policy lever to shape a substantial share of the novice teacher workforce through requirements in this pathway.

Second, New Jersey, like many states, is wrestling with a mismatch between the demographics of its teachers and its students. NJDOE has set a goal for all New Jersey public school students to have access to high-quality novice teachers who reflect the race/ethnicity of the overall student population in the state (NJDOE, 2020). But meeting this goal will entail dramatic changes to early parts of the teacher pipeline. In 2019–20, New Jersey's teacher workforce consisted of 15% teachers of color, despite the majority of its students being students of color (56%).[3] In addition, there were nearly 40,000 students of color in schools with a 100% White teacher workforce and about one-fifth of schools with a 100% White workforce; students in these schools, regardless of race, never encounter an educator of color. The alternate CE pathway offers the most promising avenue to help the state meet its diversity goals, as it is disproportionately the route chosen by teachers of color, with 81% of recent novice CEAS completers being White, compared to 68% of CE completers. Thus, this policy offers an opportunity to assess the extent to which easing requirements on these CE entrants who disproportionately constituted the Temporary CE novice teacher workforce, in particular, was associated with changes in the demographic makeup of who becomes a teacher.

[3] https://www.njspotlight.com/2019/02/19-02-15-analysis-enrollment-stats-show-lack-of-diversity-in-front-of-nj-classrooms/

In this paper, we seek to learn from the experiment necessitated by the pandemic to understand the degree to which licensure tests influence who enters the New Jersey public school teacher labor market, their impact on student achievement, and their retention. Specifically, we compare how the composition, retention, and performance of Temporary CE entrants differs from entrants with other licenses. This policy experiment has tremendous practical relevance. For one, it gives states direct evidence about how the policies crafted around the pandemic response affected the composition of the teaching workforce and student learning. More broadly, the study contributes to the evidence of the costs and benefits of licensure testing that would have policy relevance across the country. At least 40 states include the Praxis tests studied here as part of their teacher licensure process.[4]

Although the work is meant to inform how the temporary pause on licensure testing requirements affected the composition of the novice teacher workforce, the simultaneous nature of the policy change and the onset of the pandemic means that there were a number of changes to the labor market, schools, and society happening concurrently. It is thus extremely difficult to isolate the causal impact any singular policy change brought about by the pandemic (Bacher-Hicks & Goodman, 2021). For example, unprecedented job losses in other sectors of the economy could have led individuals to consider teaching at a higher rate in 2020 than in other years, and the relaxation of entry requirements made the transition easier. If this were the case, any observed changes to the composition of the first-year teacher labor force may overstate the actual persistent changes that would occur in a hypothetical world where the Praxis requirement was eliminated in the long term under routine conditions. Nonetheless, even given the caveats

[4] ETS FAQ: https://www.ets.org/praxis/faq_test_takers/

described here, NJDOE is keenly interested in how the first-year teacher workforce in 2020–21 and 2021–22 differed from other years.

As described in further detail below, our findings are as follows. First, we find that Temporary CE holders disproportionately came from alternate routes into teaching, a finding that should not come as a surprise given that these prospective teachers do not need to go through the multiyear process of enrolling in and completing a traditional teacher preparation program. Second, among first-year teachers who did not enter with a Temporary CE, the racial composition, retention, and summative performance ratings of traditional and alternate-route teachers were similar in the pandemic years as they had been in prior years. Third, Temporary CE holders were much more diverse than the existing teacher workforce. In New Jersey, 84% of veteran teachers are White, including 77% of first-year teachers. For teachers from alternate routes before the pandemic, this figure was 65%. For Temporary CE holders, only 45% of candidates from traditional programs and 55% from alternate programs were white. Fourth, Temporary CE holders were less likely to be retained in their school or in the state following their first year of teaching (i.e., from the 2020–21 to 2021–22 school years). Fifth, Temporary CE teachers were rated lower in teacher observations (teacher practice score) and overall performance ratings in 2021–22, the first post-pandemic year in which observations resumed. However, Temporary CE teachers were about as effective as other novice teachers as measured by gains in their students' math and English language arts (ELA) test scores.

2. Background and Prior Literature

2.1 New Jersey Context

Before being hired as a teacher in New Jersey, an individual must obtain a certificate of eligibility. There are two primary routes. The CEAS is the credential for individuals who have completed a traditional teacher preparation program, whereas the CE is for individuals who have

not. The CEAS and CE both allow individuals to seek out and accept employment in New Jersey public schools. To meet the basic skills requirement for the CE and CEAS, candidates must meet qualifying scores on Praxis Core Reading, Writing, and Mathematics; individuals with top-third percentile scores in the SAT, ACT, or GRE also meet the requirement and are exempted from Praxis Core. Candidates also must pass the Praxis Subject Assessment(s) required for their area(s) of certification. After an individual has met eligibility requirements, they can seek a teaching position and obtain a Provisional Certificate, a two-year certificate that an employing school district requests for newly hired teachers with a CE or CEAS.

NJDOE's response to the pandemic entailed deferring the basic skills and subject assessment requirements and granting a Temporary CE. A Temporary CE and completion of 50 hours of preservice training, along with an offer of employment from a New Jersey school, allowed an individual to obtain a Temporary Provisional Certificate and teach in a New Jersey classroom. The Temporary CE and Temporary Provisional Certificate expired the following summer; the individual then was required to pursue a CE or CEAS. As shown in Table 1, the majority of Temporary CE teachers linked to students for this analysis were hired by New Jersey public schools through alternate routes.

As an example of an alternate route in New Jersey, the most frequent preparation site for Temporary CE holders as found in the Staffing file described below is the program offered by the Rutgers Graduate School of Education (GSE): the Rutgers Alternate Route Program. To obtain a CE from Rutgers GSE, one must hold a bachelor's degree, a credit minimum depending on subject, and pass the Praxis core and subject tests. After an individual obtains a CE, NJDOE requires them to complete 50 hours of preprofessional experience, including at least 15 hours of coursework, 20 hours of clinical experience, and 15 additional hours that may include additional

coursework and clinical experience. The Rutgers course is delivered online and contains learning modules such as New Jersey Professional Teaching Standards, Lesson Planning, and Survey of Instructional and Engagement Strategies. As of spring 2023, the cost of the 50-hour program is $295; the goal of the program is to "provide the prospective teacher with an overview of the teaching profession, featuring classroom management, lesson planning, and job search strategies."[5] After completing this course, prospective teachers can obtain a provisional license and a teaching position.[6] To complete the Rutgers Alternate Route Program, teachers then can enroll in the full 350-hour program once they have obtained a teaching position. Completion of the program allows alternate-route teachers the opportunity to then fulfill the same requirements for all New Jersey teachers to obtain a standard teaching license: two years of teaching (one under a mentor teacher) and two years of effective performance ratings over a three-year period.

The pandemic, which led to the certification flexibility granted by the state, also disrupted New Jersey education in other ways. First, statewide testing was canceled for the 2019–20 and 2020–21 school years (i.e., spring 2020 and spring 2021).[7] Second, budget concerns caused by shortfalls in revenue forced teacher layoffs across the state in spring 2020. However, many districts conducted hiring before fall 2020, providing an opportunity for new teachers to be hired, obtain a Temporary Provisional Certificate, and be observed in public schools.

[5] For more information, please visit https://njalternateroute.rutgers.edu/50-hour-online-pre-service-course.
[6] As of spring 2023, the combined Praxis core test cost $150 (https://praxisexam.org/praxis/test-fees/), and most Praxis subject tests cost between $120 and $146 (https://praxisexam.org/praxis-ii/).
[7] We describe how we handle the missing years of testing in Section 4 below.

2.2 Prior Evidence

Nearly every state requires passing a subject-matter exam prior to initial certification to teach.[8] These requirements are by far the most popular method states use to ensure prospective teachers meet some level of minimum competency before entering the classroom. By contrast, about half of states require a knowledge of teaching exam or a performance assessment. However, researchers have long questioned the extent to which high-stakes certification testing actually "raises the bar" for teaching (Angrist & Guryan, 2004; Goodman et al., 2008; Podgursky, 2005). In particular, stringent licensing requirements may discourage potential high-quality teachers as well as teachers from underrepresented minority groups (Cowan et al., 2020; Goodman et al., 2008). Debates over the wisdom of requiring licensure tests have thus spanned decades (NCTAF, 1996; Darling-Hammond, 2001; Ballou & Podgursky, 1998).

This paper falls within the conceptual framework developed by Angrist and Guryan (2008), which describes licensure testing as a screen on potential teachers (see also Larsen et al., 2020). Under this framework, licensure testing imposes a cost borne by teachers, and an individual's likelihood of pursuing teaching depends in part on the likelihood of passing the test and the individual's outside wage options. Thus, the theoretical effect of licensure requirements on the overall quality of the teaching workforce is ambiguous, which is consistent with the mixed empirical evidence on the impact of licensure requirements. For example, whereas Angrist and Guryan (2008) saw no relationship between state testing requirements and teacher quality, Larsen et al. (2020) found that states adopting more stringent certification requirements (primarily measured by coursework requirements) experienced increases in teacher quality.

[8] NCES SER data table 3.1: https://nces.ed.gov/programs/statereform/tab3_1.asp

In addition, the evidence on the extent to which licensure test scores even serve as an effective screen at the individual teacher level is somewhat mixed. Goldhaber and Hansen (2010) found that scoring above the cut point on Praxis subject tests in North Carolina was predictive of value added in math, but not reading, and not for Black math teachers. On the other hand, Cowan et al. (2020) found that the Massachusetts-specific licensure scores predicted future performance for both White teachers and teachers of color. Thus, it appears likely that the screening function of licensure scores depends on the specific exam, subject, and population tested. Because the Praxis series is by far the most widespread of these tests, the proposed study has the potential to inform other states as they consider the role of testing in the licensure process.

Consistent with the conceptual framework laid out earlier, a long-standing, well-documented concern exists that these requirements disproportionately screen out teachers of color and thus have a deterrence effect (Baker, 2001; Campbell-Whatley, 2003; Wakefield, 2006, Watras, 2003). Cowan et al. (2020) found that in Massachusetts, teachers of color are less likely to pass these tests and less likely to retake tests upon failing on the initial try. Goldhaber and Hansen (2010) argued that because Black teachers are disproportionately likely to be screened out in math by licensure testing, this has negative implications on the achievement of Black students since Black students benefit from being taught by same-race teachers.

One of the contributions of this paper is to investigate how the pandemic affected teacher turnover in New Jersey. There is a large amount of literature on the costs associated with teacher turnover. Hiring and training replacements takes time and money (Barnes et al., 2007; DeFeo et al., 2017). In addition, schools with higher turnover rates also tend to have higher portions of inexperienced teachers or teachers with provisional licenses (Sorensen & Ladd, 2020), and the

negative effects of teacher turnover on achievement in math and ELA is especially strong in schools with more low-income and more Black students (Ronfeldt et al., 2013).

To our knowledge, there is only a single paper that examines how pandemic licensure waivers affected the demographics and retention of new teachers in a state. Bacher-Hicks et al. (2023) examined the impact of licensure waivers in Massachusetts, finding that the share of teachers of color among new hires with an emergency license was two to three times higher than on traditional licenses (30% compared to 10%–15%). In addition, Bacher-Hicks et al. (2023) found that newly hired teachers with licensure waivers had similar turnover rates as those with traditional licenses; however, they also found a large general increase in teacher turnover between the 2020–21 and 2021–22 school years. This general increase also was found in other states (Bastian & Fuller, 2023; Camp et al., 2022; CERRA, 2022; Goldhaber & Theobald, 2022).

3. Methods

3.1 Data

We use administrative data collected by NJDOE covering all public schools in New Jersey from 2015–16 through 2021–22 for this study. For the analysis using test scores, we construct a tested sample consisting of students linked to their classroom teachers in tested grades and subjects: Grades 3–8 in math, Grades 3–10 in ELA, and end-of-course Algebra I, Geometry, and Algebra II. We standardize teacher tests to be mean zero within year, grade, and subject. No test scores are available for 2019–20 or 2020–21. As detailed below, for prior scores in 2021–22, we use students' scores from 2018–19 and include robustness checks where we estimate test score impacts using a 2021–22 sample only. The paper also uses several sources of linked data provided by NJDOE. Information on teachers comes from staff files (years of experience, gender, race/ethnicity, traditional or alternate route program, and credential type), evaluation files (teacher practice score, summative rating, and student growth objective rating),

certification files (certification name and issue date), and certification scores (Praxis core and subject test scores).

Teacher certification test scores are provided by ETS to NJDOE; we have scores from 2013 and later. Teachers who took certification exams before 2013, did not take an ETS exam, or had no certification results sent to NJDOE are unobserved in our data. However, we observe scores for more than 95% of Temporary CE teachers. We discard tests taken more than 9 months after an individual's initial Praxis sitting to ensure meaningful comparisons across cohorts, as we observe older (i.e., non-Temporary CE) cohorts for a much longer time period. In addition, we construct the average Praxis scores of all first-time attempts. For the latter, we standardize each Praxis test to be mean zero, standard deviation one in each test type by year cell after restricting the sample to individuals taking a given test for the first time.

In the evaluation files, NJDOE provides teacher practice score (based on classroom observations), a student growth objectives (SGO) rating, and summative performance rating. All three are on 1-to-4-point scales. The practice score typically covers domains such as planning, environment, instruction, and professionalism. The SGO rating is based on how many of a teacher's students met their goal for student growth. Finally, the summative rating consists of the other two ratings plus, for math and ELA teachers, a student growth percentile rating.[9] Because of the pandemic, there are no evaluation ratings from the 2019–20 or 2020–21 school years.

Using the teacher files, we construct two additional variables key for the analyses. The first is an indicator for a Temporary CE teacher, which is provided in the certification file. Because this paper intends to examine how the relaxation of entry requirements affects the

[9] For more information, including the weights on each component, please visit https://www.nj.gov/education/broadcasts/2022/aug/3/NotificationofEducatorEvaluationRubricWeightsfor2022-2023andBacktoSchoolKeyDateReminders.pdf

composition of novice teachers, we only flag a teacher as a Temporary CE teacher if they had not already earned a CE or CEAS before earning a Temporary CE.[10] The second is an indicator for whether a teacher entered the teaching profession through an alternate route. For this indicator, we use a combination of certification and staff files. For non-Temporary CE holders, we classify a teacher as having entered through an alternative route if they are labeled as such in the staff file or if their initial certification was a CE (rather than CEAS).[11] For Temporary CE holders, we follow the same procedure. However, an extra step is needed because many Temporary CE holders neither have route type in the staff file nor have earned a CE or CEAS in the certification file. Among Temporary CE holders with missing teacher route information in the Staff file who later earned a CE or CEAS, 95% later earned a CE. We thus assign Temporary CE holders with unknown entry route to alternate route. We plot the share of first-year teachers by race and entry type in Figure 1. As discussed above, non-White teachers disproportionately enter through alternate routes. In addition, the racial composition of first-year teachers remained similar after the onset of the pandemic.

Summary statistics for certification scores by teacher race and entry type are presented in Table 1. In contrast to the remainder of the tables presented in the paper, which restrict the sample to teachers who can be linked to students, the sample in Table 1 consists of teachers present in both the certification file and the staff file (the latter needed for teacher race). Consistent with the literature on certification scores, prospective teachers of color tend to score lower on certification exams (Cowan et al., 2020; Goodman et al., 2008). Among candidates

[10] This happens for existing teachers adding another certification type during the pandemic: for example, an elementary teacher with a standard certificate for Grades K–6 adding on a license for Teacher of Bilingual/Bicultural Education or for Teacher of Students with Disabilities.
[11] Combining these two data sources is necessary due to missing pathway information for some teachers in the staff files.

without a Temporary CE, the Black–White (19 percentage points) and Hispanic–White (13 percentage points) gaps in initial pass rates are consistent with the 16 percentage point national gap reported by the National Council on Teacher Quality (NCTQ, 2022). Unsurprisingly, individuals of all racial/ethnic backgrounds who earned a Temporary CE scored substantially lower on Praxis tests, were much less likely to pass tests the first time they took them, and had to take each test more times. Finally, among prospective teachers present in both the certification and staff files, Temporary CE holders are less likely to be found in the student–teacher links. As discussed below, the basic patterns present in Table 1 continue to hold after making this sample restriction. Thus, the existence of the Temporary CE during the pandemic appears to have opened the door for an initial year of teaching to many teachers of color who otherwise would not have been eligible due to not passing the required exams.

We count the number of first-year teachers by route (traditional or alternate; Temporary CE or not) who can be linked to students in Table 2. Three notable patterns surfaced. First, as noted above, alternate-route entrants constitute a meaningful share—roughly 15-25% depending on the year—of the novice teacher workforce in New Jersey. Second, the bulk (over 70% in each year) of Temporary CE holders entered through these alternate-route programs. And third, most teachers who entered the workforce in the pandemic years did so on a non-pandemic license: a CE or CEAS. Thus, most new teachers were still able to fulfill licensure requirements during the pandemic.

3.2 Summary Statistics

Summary statistics for teachers who can be linked to students are shown in Table 3, with Panel A showing teacher characteristics and pathway experiences. The first two columns compare veteran (not in their first year of teaching) to novice (in their first year) teachers.

Veteran teachers tend to be White, female, and have higher performance ratings than their novice counterparts. The next two columns show traditional versus alternate-route novice teachers before the pandemic. Alternate-route teachers tend to be more likely Hispanic, Black, and male, and somewhat less likely to remain in the teacher workforce after the first year (88% versus 84%).

The final four columns show teachers whose first year of teaching was during the two pandemic years. There are several notable patterns. First, as might be expected given the patterns around Praxis scores discussed in Table 1, the share of Black and Hispanic teachers was much higher for Temporary CE holders than other teachers. Black teachers constituted 21% of traditional-route Temporary CE holders and 19% of alternate-route Temporary CE holders, compared to 7% of novice teachers statewide. For Hispanic teachers, the corresponding numbers are 30% of traditional-route Temporary CE holders and 20% of alternate-route Temporary CE holders, compared to 11% of novice teachers statewide. Second, although retention of non-Temporary CE holders during the pandemic was very similar to before the pandemic (Columns 3 and 4 versus 5 and 6), retention for Temporary CE holders was much lower (Columns 7 and 8); however, we caution that this is based on a sample of only 105 Temporary CE teachers whose retention we can observe between 2020–21 and 2021–22. Third, as noted in Table 1, the percentage of Temporary CE teachers who did not pass a Praxis test was much higher than non-Temporary CE teachers during the pandemic. For example, among traditional-route Temporary CE teachers, we observe Praxis scores for 94% of first-year teachers. Of teachers who took a Praxis test, 74% of these traditional-route Temporary CE teachers failed a Praxis test (0.70/0.94), compared to 44% of traditional-route non-Temporary CE teachers during the pandemic (0.39/0.89). Relative to traditional-route teachers before the pandemic, traditional-route

Temporary CE teachers score 0.62 standard deviations lower on their Praxis tests (Column 3 versus Column 7).[12] Thus, for traditional-route teachers especially, Temporary CE holders are disproportionately a selected sample of teachers who encountered difficulty passing licensure exams.

Panel B shows characteristics of students taught by teachers. Temporary CE teachers teach classes with more Black students and students who are eligible for free- or reduced-price lunch (FRL) and who have lower prior achievement. In their first year of teaching, Temporary CE holders were disproportionately employed in schools that had experienced lower prior achievement during the pre-pandemic era. However, despite their lower starting point, these schools are estimated to have a higher school value-added.[13]

4. Empirical Strategy

Each research question is a variant of the same high-level question: the extent to which Temporary CE teachers were observably different than novice teachers who entered with a CE or CEAS. Thus, each research question has a similar estimation strategy in that we obtain estimates for Temporary CE holders relative to those teachers holding other license types.

For estimating retention in the teaching workforce, we estimate a regression of the following form:

$$Retained_{jt} = \beta_0 + \beta_1 X_{jt} + \beta_2 TCE_j + \varepsilon_{jt} \text{ , (1)}$$

[12] Praxis data being missing for 90% of veteran teachers and 19% of novice teachers (Table 1, columns 1 and 2) makes it difficult to estimate the relationship between Praxis scores and teacher performance in New Jersey with any degree of confidence. Prior evidence from other settings suggests that a one-standard deviation increase in licensure test performance raises student achievement by about 0.005 to 0.015 standard deviations (Clotfelter et al. 2007, 2010; Cowan et al., 2020).

[13] Pre-pandemic school value-added is estimated by retaining a sample of the 2017–2019 school years and estimating the standard test score regression (Eq. 3) while replacing the teacher information with a school fixed effect. We then call the estimate of the school fixed effect school value-added.

where the model predicts the likelihood of retention as a function of the characteristics of the teacher's students (X_{jt}). Research (e.g., Hanushek et al., 2005) suggests that attrition is higher in schools serving more disadvantaged students. The vector of controls thus contains the percentage of students who are White, Black, or Hispanic; those who are FRL-eligible; those classified as English language learners; and special education status of a teacher's students; as discussed below, we also explore models that include school fixed effects. The primary object of interest is β_2, which estimates the likelihood of Temporary CE holders remaining in the workforce after their first year relative to other novice teachers.[14]

To account for school effects in teacher retention outcome models, we estimate models where we add school fixed effects to Eq. (1) and thus compare Temporary CE holders to other teachers within the same school rather than to all teachers in the state. These specifications ensure comparisons in similar school settings. However, this approach is potentially problematic because school fixed effects could absorb true differences in underlying disposition for retention across schools. We thus explore models with and without school fixed effects. When estimating Eq. (1) and subsequent regressions, we cluster standard errors at the school level.

One complication in the interpretation of Eq. (1) is that Temporary CE holders constitute a mix of two types of teachers: those who would have obtained a traditional-route CEAS license in the absence of the pandemic and those who would have obtained an alternate-route CE. However, as discussed above, if the modified licensure requirements were to affect the composition of the incoming teacher workforce, we might expect it to have the greatest short-term impacts on those entering through alternate routes; that is, those who otherwise would have

[14] Results are similar when using a logistic regression model. We prefer the specification in Eq. (1) as it is more straightforward to add school fixed effects.

obtained a CE. We thus estimate an alternative version of Eq. (1), breaking down Temporary CE holders by type:

$$Retained_{jt} = \beta_0 + \beta_1 X_{jt} + \beta_2 CE_j + \beta_3 T\_CE\_TRAD_j + \beta_4 T\_CE\_ALT_j + \epsilon_{jt}, \quad (2)$$

where CE_j denotes teachers who entered with a CE, $T\_CE\_TRAD_j$ teachers with a Temporary CE from traditional route programs who would have been eligible to obtain a CEAS in a typical year, and $T\_CE\_ALT_j$ teachers with a Temporary CE who would have attempted to obtain a CE in a typical year, with CEAS holders representing the excluded group. We are interested in two comparisons. First, a test of $\beta_3 = 0$, which is a test of the null hypothesis of equality among candidates entering with a Temporary CE from traditional route programs and those who entered with a CEAS from a traditional route program, and a comparison of β_2 and β_4, which measures the difference between Temporary CE holders from alternate routes and CE holders. These comparisons are meant to inform how the retention rate of first-year Temporary CE holders differed for the traditional and alternate routes. As discussed earlier, we might expect any changes in the retention rates of the teacher workforce to be more pronounced for teachers who would have obtained a CE in the absence of the pandemic because these individuals may be closer to the margin of deciding whether to teach or not (in contrast to those who already were in traditional teacher preparation programs).

When estimating the teacher performance ratings of Temporary CE teachers relative to other novice teachers, we again estimate versions of Eq. (1) and Eq. (2), replacing retention on the left side with each of the three categories. Because Temporary CE teachers have zero or one year of experience when receiving performance evaluations in 2022—the evaluations given after the onset of the pandemic—we restrict the sample to teachers with zero or one year of experience. As with retention, we include models that control for the characteristics of teachers'

students in order to account for potential biases associated with teaching in different classroom contexts (Cohen and Goldhaber, 2016).

For estimating the effectiveness (used interchangeably with value added) of teachers who enter with a Temporary CE as measured by their ability to raise the test scores of their students in math and ELA, we follow a similar approach as similar studies of teacher pipelines such as Teach For America, UTeach, and the New York City Teaching Fellows Program (Backes et al., 2018; Backes & Hansen, 2018; Boyd et al., 2006; Kane et al., 2008). We estimate the following equation:

$$y_{ijst} = \beta_0 + \beta_1 y_{ist-1} + \beta_2 X_{it} + \beta_3 TEMP\_CE_j + \beta_4 T_{jt} + \varepsilon_{ist} \text{ , (3)}$$

where y_{ijst} indicates the score in a given subject for student *i* in school *s* taught by teacher *j* in year *t*, y_{ist-1} a vector of cubic functions of prior year test scores in math and reading, TCE_j indicators for whether student *i* was taught by a teacher holding a Temporary CE in the tested subject, respectively, X_{it} contains a vector of student *i*'s characteristics, including race, gender, eligibility for FRL, special education status, English language learner status, and T_{jt} a vector of controls for teacher characteristics, which in most models consists solely of experience and an indicator for alternate route.

The coefficient of interest, β_3, represents the average differential effectiveness at raising student test scores of Temporary CE holders relative to other teachers in the state, controlling for years of experience and alternate route. Both experimental work and nonexperimental tests suggest that controlling for prior test scores as in Eq. (3) is sufficient for estimating teacher effects with little bias (Bacher-Hicks et al., 2014; Chetty et al., 2014; Kane et al., 2013; Kane & Staiger, 2008). For secondary teachers, we explore alternative specifications of Eq. (3) that attempt to account for the potential that students with unobserved attributes correlated with test

achievement are tracked into schools or classes (Jackson, 2014) by estimating additional models that include school-track effects. In these models, the effects of Temporary CE holders relative to CEAS holders are identified based on comparisons within the same school-track, where a track is defined to be all students within the same school who take the same set of courses in the same year.

One of the challenges associated with the impacts of the pandemic is the lack of statewide testing in 2019–20 and 2020-21, which means that y_{ijst} is missing in the 2019–20 and 2020-21 school years and that y_{ist-1} is missing in the 2020–21 and 2021-22 school years. For the former case, we exclude 2019–20 and 2020–21 from analyses where test scores are needed for an outcome; that is, we drop all observations where the outcome of interest on the left-hand side would be measured in 2019–20 or 2020–21. For the latter case, we cannot exclude observations in which 2019–20 or 2020–21 is the lagged observation (i.e., 2020–21 or 2021–22 outcomes) because we would then lose the first-year teacher cohorts of interest.

We thus experiment with two different ways to circumvent the issue of missing prior-year scores in the primary year of interest to assess robustness: first, with an alternative version of Eq. (4) where lagged scores y_{ist-1} are replaced with test scores from the final year before the pandemic, 2018–19; and second, estimating results using 2021–22 data only (and thrice-lagged prior controls) to ensure that our results aren't driven by a different relationship between prior scores and outcome in the post-pandemic year. Although these approaches allow us to estimate Eq. (3) in samples that include Temporary CE teachers, the lack of once- or twice-lagged test scores presents two main drawbacks. First, there is a potential concern due to the distance between current and prior score. In particular, the need to use thrice-lags in 2021–22 opens the door to biases if a student's experience in years *t-2* and *t-1* is correlated with Temporary CE

exposure in year *t* in a way that is not accounted for in *t-3*. And second, we do not observe any prior scores for students in Grade 5 and below in 2021–22.

5. Results

5.1 Retention of Novice Teachers

Results for teacher retention are shown in Table 4; Panel A for retention as teachers in the New Jersey public school workforce and Panel B for retention in individual schools.[15] Columns 1 and 2 show results for all Temporary CE holders relative to other first-year teachers. Temporary CE holders are both much less likely to be retained in the teacher workforce after the first year and much less likely to be retained in the same school. These results are not driven by Temporary CE holders disproportionately entering through alternate routes: route type is controlled for in the regressions in Columns 1 and 2. We estimate that teachers from alternate pathways are somewhat less likely to remain in the workforce after the first year, though retention in the same school is similar. In Columns 3 through 6, we disaggregate Temporary CE holders by traditional or alternate route. Because there are fewer traditional-route Temporary CE entrants, estimates are imprecise, but the point estimates are *suggestive* of the largest negative impacts on attrition coming through alternate-route Temporary CE holders. This is the case whether or not we control for school fixed effects or the characteristics of students taught.

5.2 Performance Ratings of Early-Career Teachers

We turn to differences in teacher performance ratings in Table 5. Recall that performance ratings are only available in 2017–19 and 2022. Thus, Temporary CE teachers' only performance rating came in 2022, when they were in their first or second year of teaching, so we display performance rating results for a sample of first- and second-year teachers in 2017–19 and 2022.

[15] Results for retention in the same school district are very similar to retention in the state.

Beginning with Panel A, alternate-route teachers tend to receive lower teacher practice scores. However, controlling for route type, Temporary CE teachers receive similar practice scores to other novice teachers (Columns 1 and 2). There are also minimal differences across route types within Temporary CE teachers.

Teacher SGO scores, in contrast, are lower for both alternate-route and Temporary CE holders (Panel B, Column 1). The addition of school fixed effects diminishes these relationships, suggesting that Temporary CE holders disproportionately sort into schools whose early-career teachers tend to have lower SGO scores. Disaggregating the Temporary CE group, we see large negative raw SGO scores for both traditional and alternate-route Temporary CE holders (Column 3), but this relationship again attenuates with school fixed effects (Column 4). When we control for the characteristics of teachers' students in Column 5, the raw coefficient from Column 3 is again attenuated, adding support for the idea that some of the difference in SGO scores are driven by classroom context rather than teacher effectiveness.

Finally, we examine teacher summative performance ratings in Panel C of Table 5. Because these ratings are an average of teacher practice score (Panel A) and teacher SGO score (Panel B) for teachers not teaching math or ELA in specific grades, it is not a surprise that the results in Panel C fall between Panel A and Panel B. In particular, Temporary CE teachers tend to have lower summative ratings, but much of this difference is explained by school and classroom context. When including school fixed effects and controls for the demographics of teachers' students, we estimate that both traditional and alternate-route Temporary CE holders have lower performance ratings by 0.05 points. This is about one-sixth of a standard deviation in teacher summative performance rating (the standard deviation is 0.311).

5.3 Teacher Effectiveness in Math and ELA

Results for impacts on student achievement are shown in Table 6. Recall that because of the pandemic, we do not have test scores from 2019–20 or 2020–21. Thus, to include prior scores, we can only use students from Grade 6 and up in 2021–22 (by using their Grade 3 scores from 2018–19). In addition, this sample has only 58 Temporary CE holders, meaning that it is not practical to disaggregate results by traditional or alternate route. With these caveats in mind, for both math and ELA, we estimate positive effects on student achievement (Column 1) that attenuate when adding school fixed effects. This pattern appears to be driven by teacher-school sorting, where Temporary CE holders appear to sort into schools that raise the test scores of their students beyond what would be predicted by prior test scores (see Table 2). In other words, the types of schools the Temporary CE teachers are hired by (at least in math and ELA) have very low starting points for student achievement, but given this starting point, raise test scores beyond what is expected. Our pooled estimates on math and ELA scores with school fixed effects find an increase of 0.038 standard deviations (Column 2). When adding school-track fixed effects, this becomes 0.013. Although somewhat imprecise, we can rule out large negative impacts on student test scores in math and ELA due to the relaxation of entry requirements.

The imprecision of the results is an important caveat. Recall from the discussion of Tables 1 and 3 that the average Praxis scores of Temporary CE entrants were substantially lower than other first-year teachers. In particular, in the Temporary CE sample that appears in test score regressions, average scores were 0.48 standard deviations lower for Temporary CE teachers relative to other teachers with Praxis scores. Using 0.01 as the relationship between Praxis scores and student test scores (Clotfelter et al. 2007, 2010; Cowan et al., 2020), we would expect the impact of Temporary CE teachers on student test scores operating through licensure

scores alone to be in the ballpark of 0.005. Given the standard errors in Table 5, this effect is undetectable in addition to being of small practical importance.

6. Discussion

In some ways, the results of this paper are not surprising. Consistent with the theory in Section 2.2, teachers entering with a Temporary CE primarily entered through alternate routes into the profession and were substantially more diverse than the existing teacher workforce in the state. These teachers were disproportionately likely to have attempted and failed a Praxis core and, especially, Praxis subject test. For the one cohort for which we can observe retention, these teachers remained in the profession at a lower rate. However, for Temporary CE teachers teaching math or ELA in 2021–22, the year testing resumed after the pandemic, Temporary CE teachers were at least as effective – and in some models, more so – as other novice teachers in the state as measured by student test score gains. Finally, in 2021–22, Temporary CE holders received lower performance ratings than other early-career teachers in the state, though this is partially—but not fully—attributable to school and classroom context.

Was the temporary availability of the Temporary CE a net benefit for students in New Jersey? It depends on how one weighs the costs and benefits. As discussed in Section 2.2, teacher turnover imposes real costs on schools and students. However, this cost appears to have been offset by at least two benefits. One, lowering the barrier to entry may have allowed more people to try out teaching than they would have otherwise. It is possible that the teachers who remain after the first year will have subsequent retention rates comparable to other teachers in the state. Second, in contrast to the existing teacher workforce in the state, the demographic makeup of teachers entering on Temporary CEs was much closer to that of the state's student body. The lower barrier to entry and increase in diversity does not appear to have come at a cost in terms of student learning, at least for the teachers for whom we can measure this (nearly 60).

References

Angrist, J. D., & Guryan, J. (2004). Teacher testing, teacher education, and teacher characteristics. *American Economic Review*, *94*(2), 241–246.

Angrist, J. D., & Guryan, J. (2008). Does teacher testing raise teacher quality? Evidence from state certification requirements. *Economics of Education Review*, *27*(5), 483–503.

Bacher-Hicks, A., Chi, O. L., & Orellana, A. (2023). Two years later: How COVID-19 has shaped the teacher workforce. *Educational Researcher*, *52*(4), 219-229.

Bacher-Hicks, A., & Goodman, J. (2021). The Covid-19 pandemic is a lousy natural experiment for studying the effects of online learning: Focus, instead, on measuring the overall effects of the pandemic itself. *Education Next*, *21*(4), 38-43.

Bacher-Hicks, A., Kane, T. J., & Staiger, D. O. (2014). *Validating teacher effect estimates using changes in teacher assignments in Los Angeles* (No. w20657). National Bureau of Economic Research.

Backes, B., Goldhaber, D., Cade, W., Sullivan, K., & Dodson, M. (2018). Can UTeach? Assessing the relative effectiveness of STEM teachers. *Economics of Education Review*, *64*, 184-198.

Backes, B., & Hansen, M. (2018). The impact of Teach For America on non-test academic outcomes. *Education Finance and Policy*, *13*(2), 168-193.

Baker, R. S. (2001). The paradoxes of desegregation: Race, class and education, 1935–1975. *American Journal of Education, 109,* 320–343.

Ballou, D., & Podgursky, M. (1998). Teacher recruitment and retention in public and private schools. *Journal of Policy Analysis and Management: The Journal of the Association for Public Policy Analysis and Management*, *17*(3), 393-417.

Barnes, G., Crowe, E., & Schaefer, B. (2007). The cost of teacher turnover in five school districts: A pilot study. *National Commission on Teaching and America's Future*.

Bastian, K. & Fuller, S. (2023). *Educator attrition and hiring in North Carolina Public Schools during the COVID-19 pandemic.* Education Policy Initiative at Carolina.

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

Camp, A., Zamarro, G., & McGee, J. (2022). *Changes in teachers' mobility and attrition in Arkansas during the first two years of the COVID-19 pandemic.* University of Arkansas.

Campbell-Whatley, G. D. (2003). Recruiting and retaining of culturally and linguistically diverse groups in special education: Defining the problem. *Teacher Education and Special Education*, *26*(4), 255–263.

CERRA (2022). South Carolina annual educator supply and demand data tables, 2022-23. https://www.cerra.org/uploads/1/7/6/8/17684955/supply___demand_data_tables_2022-23.pdf

Chetty, R., Friedman, J. N., & Rockoff, J. E. (2014). Measuring the impacts of teachers I: Evaluating bias in teacher value-added estimates. *American Economic Review*, *104*(9), 2593–2632.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2007). Teacher credentials and student achievement: Longitudinal analysis with student fixed effects. *Economics of Education Review, 26*(6), 673–682.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2010). Teacher credentials and student achievement in high school: A cross-subject analysis with student fixed effects. *Journal of Human Resources, 45*(3), 655–681. https://doi.org/10.3368/jhr.45.3.655

Cohen, J., & Goldhaber, D. (2016). Building a more complete understanding of teacher evaluation using classroom observations. *Educational Researcher*, *45*(6), 378–387.

Cowan, J., Goldhaber, D., Jin, Z., & Theobald, R. (2020). *Teacher licensure tests: Barrier or predictive tool?* (Working Paper No. 245-1020). National Center for Analysis of Longitudinal Data in Education Research (CALDER).

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

DeArmond, M. Goldhaber, D., & Payne, S. (2023). COVID's Under-the-Radar Experiment with Teacher Licensure. *CALDER Policy Brief No. 33*.

Dee, T. S. (2005). A teacher like me: Does race, ethnicity, or gender matter? *American Economic Review*, *95*(2), 158–165.

DeFeo, D. J., Tran, T., Hirshberg, D., Cope, D., & Cravez, P. (2017). The cost of teacher turnover in Alaska.

Gershenson, S., Hart, C., Hyman, J., Lindsay, C., & Papageorge, N. W. (2018). *The long-run impacts of same-race teachers* (No. w25254). National Bureau of Economic Research.

Goldhaber, D., & Hansen, M. (2010). Race, gender, and teacher testing: How informative a tool is teacher licensure testing? *American Educational Research Journal*, *47*(1), 218–251.

Goldhaber, D., & Theobald, R. (2022). Teacher attrition and mobility in the pandemic. Educational Evaluation and Policy Analysis.

Goodman, G., Arbona, C., & Dominguez de Rameriz, R. (2008). High-stakes, minimum-competency exams: How competent are they for evaluating teacher competence? *Journal of Teacher Education*, *59*(1), 24–39.

Hanushek, E. A., Kain, J., O'Brien, D., & Rivkin, S. G. (2005). The market for teacher quality.

Jackson, C. K. (2014). Teacher quality at the high school level: The importance of accounting for tracks. *Journal of Labor Economics*, *32*(4), 645–684.

Kane, T. J., McCaffrey, D. F., Miller, T., & Staiger, D. O. (2013). *Have we identified effective teachers? Validating measures of effective teaching using random assignment* (MET Project). Bill & Melinda Gates Foundation.

Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review*, *27*(6), 615–631.

Kane, T. J., & Staiger, D. O. (2008). *Estimating teacher impacts on student achievement: An experimental evaluation* (No. w14607). National Bureau of Economic Research.

Larsen, B., Ju, Z., Kapor, A., & Yu, C. (2020). *The effect of occupational licensing stringency on the teacher quality distribution* (No. w28158). National Bureau of Economic Research.

National Academies of Sciences, Engineering, and Medicine. (2020). *Changing expectations for the K–12 teachers: Policies, preservice education, professional development, and the workplace*. National Academies Press. https://doi.org/10.17226/25603.

National Commission on Teaching & America's Future (NCTAF). (1996). *What Matters Most: Teaching for America's Future: Report of the National Commission on Teaching & America's Future*. The Commission.

National Council on Teacher Quality. (2022). *Digging deeper: Which types of institutions achieve excellence and equity for aspiring teachers of color?* https://www.nctq.org/publications/Digging-Deeper:-Which-types-of-institutions-achieve-excellence-and-equity-for-aspiring-teachers-of-color

New Jersey Department of Education. (2020). *Diversifying the teacher workforce*. Office of Recruitment, Preparation and Instruction.

Podgursky, M. (2005). Teacher licensing in US public schools: The case for simplicity and flexibility. *Peabody Journal of Education*, *80*(3), 15–43.

Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How teacher turnover harms student achievement. *American Educational Research Journal*, *50*(1), 4-36.

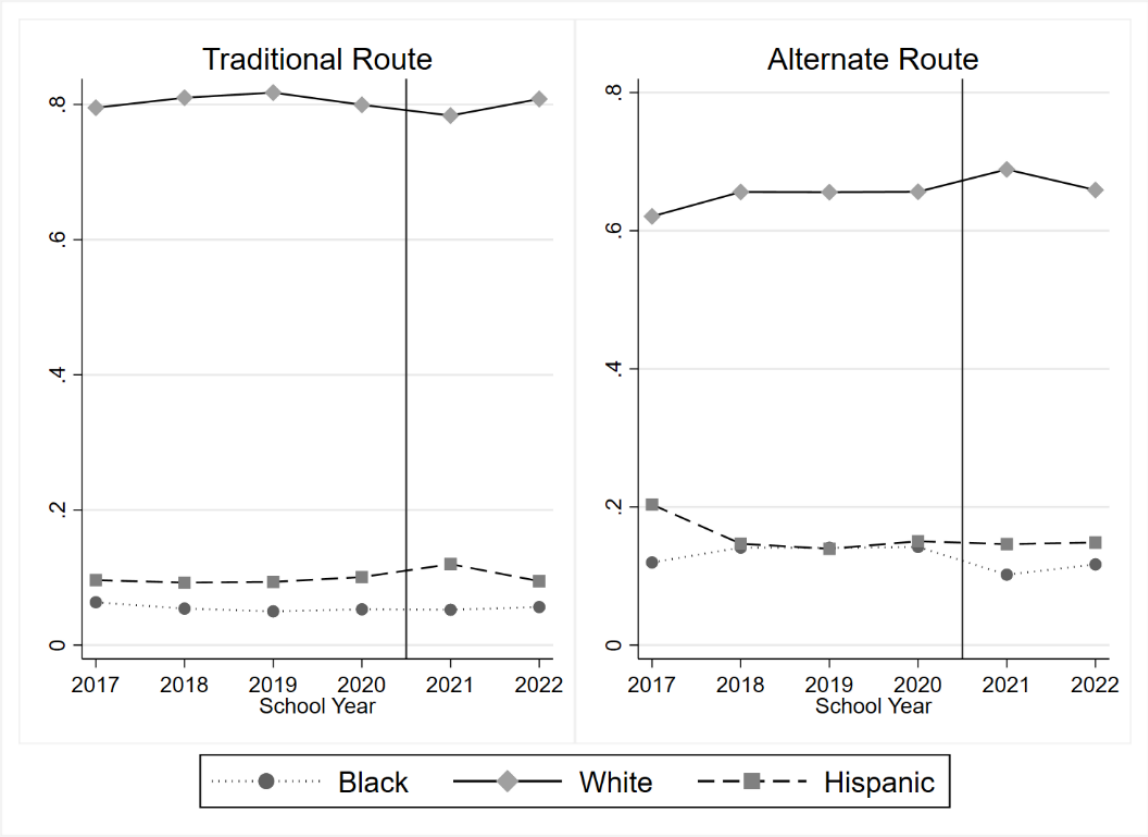
Sorensen, L. C., & Ladd, H. F. (2020). The hidden costs of teacher turnover. *AERA Open*, *6*(1), 2332858420905812.

Wakefield, D. (2006). Taking hope out of teaching. *Phi Delta Kappan*, *88*(1), 79–82.

Watras, J. (2003). Can teacher qualifying exams improve education? *Educational Foundations*, *17*(2), 71–85.

Figures and Tables

Figure 1. Share of First-Year Teachers by Race and Entry Route



Notes: Horizontal axis denotes spring of a given school year; e.g. 2020 for the 2019-2020 school year. Vertical line between 2020 and 2021 indicates onset of the pandemic.

Table 1. Certification Test by Prospective Teacher Race and Certification Type

	(1) White	(2) Black	(3) Hispanic	(4) White	(5) Black	(6) Hispanic
	Non Temp CE			Temp CE		
Mean standardized Praxis score	0.12	-0.42	-0.24	-0.25	-1.11	-0.98
	(0.81)	(0.91)	(0.90)	(1.00)	(0.81)	(0.98)
Pct. first-time tests passed	0.76	0.57	0.63	0.68	0.34	0.40
	(0.34)	(0.41)	(0.40)	(0.37)	(0.35)	(0.38)
Ever fail a Praxis test	0.42	0.63	0.57	0.57	0.89	0.82
	(0.49)	(0.48)	(0.50)	(0.50)	(0.31)	(0.39)
Pct. initial failures retaken	0.70	0.56	0.64	0.57	0.51	0.46
	(0.43)	(0.47)	(0.45)	(0.44)	(0.45)	(0.45)
Tests taken within 9 mo. of initial test	2.97	3.04	2.90	3.62	3.52	3.30
	(1.78)	(1.95)	(1.79)	(1.88)	(2.09)	(1.76)
Avg. times taking each test	1.27	1.34	1.37	1.29	1.47	1.46
	(0.58)	(0.63)	(0.69)	(0.56)	(0.65)	(0.75)
Present in student-teacher links	0.84	0.81	0.84	0.71	0.56	0.65
	(0.37)	(0.40)	(0.37)	(0.45)	(0.50)	(0.48)
Prospective Teachers	22746	2476	3510	188	122	122

Notes: sample consists of individuals present in state staffing file listed as having a teaching (as opposed to administrative) role, including those not linked to students in administrative data.

Table 2. Number of First-Year Teachers by Entry Route

	Alternate Route (CE)		Traditional Route (CEAS)	
Year	CE	Temp CE	CEAS	Temp CE
2016	285		1593	
2017	500		2545	
2018	534		2419	
2019	672		2478	
2020	832		2665	
2021	514	72	2015	33
2022	715	104	2457	20

Notes: Counts of unique teachers in their first year of teaching who are present in linked student-teacher data.

Table 3. Teacher Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Novice (1st year)					
			Pre-pandemic		Pandemic era (2021 and 2022)			
	Veteran	Novice					**Temp CE**	
			Trad.	Alt.	Trad.	Alt.	Trad.	Alt.
Panel A: Teacher information (no student weights)								
Tch Hispanic	0.07	0.11	0.10	0.16	0.10	0.14	0.30	0.20
Tch Black	0.07	0.07	0.06	0.14	0.05	0.10	0.21	0.19
Tch White	0.84	0.77	0.80	0.65	0.80	0.69	0.45	0.55
Tch Female	0.76	0.76	0.79	0.64	0.80	0.65	0.76	0.71
Retention in school	0.87	0.73	0.74	0.73	0.74	0.73	0.64	0.67
Retention in district	0.89	0.77	0.78	0.76	0.77	0.76	0.67	0.68
Retention in state	0.91	0.87	0.88	0.84	0.88	0.82	0.73	0.73
Average Praxis scores (s.d.'s)	0.08	0.10	0.12	0.11	0.06	0.18	-0.50	-0.26
Failed any Praxis test	0.04	0.36	0.35	0.37	0.39	0.34	0.70	0.57
In Praxis sample	0.10	0.81	0.77	0.80	0.89	0.85	0.94	0.96
Teacher Practice Score	3.41	3.14	3.13	3.11	3.17	3.13	3.20	3.11
Teacher SGO Score	3.71	3.59	3.61	3.57	3.58	3.49	3.17	3.29
Summative Performance Rating	3.44	3.20	3.20	3.18	3.23	3.19	3.19	3.14
Panel B: Student-weighted								
Stu Female	0.49	0.49	0.49	0.48	0.49	0.49	0.50	0.50
Stu Hispanic	0.26	0.30	0.29	0.34	0.29	0.33	0.39	0.36
Stu Black	0.16	0.19	0.18	0.24	0.18	0.22	0.34	0.25
Stu White	0.46	0.39	0.41	0.33	0.40	0.33	0.20	0.29
Stu FRL	0.33	0.39	0.39	0.49	0.33	0.40	0.58	0.50
Stu LEP	0.11	0.12	0.12	0.13	0.13	0.14	0.17	0.17
Stu Spec Ed	0.15	0.14	0.15	0.14	0.13	0.12	0.12	0.12
Secondary STEM	0.16	0.18	0.18	0.22	0.15	0.18	0.19	0.21
Pre-pandemic sch test	0.02	-0.02	-0.00	-0.11	0.02	-0.05	-0.26	-0.07
Pre-pandemic sch VA	-0.00	0.00	0.01	-0.03	0.02	-0.02	0.04	0.03
Stu Prior math	-0.01	-0.07	-0.04	-0.13	-0.12	-0.10	-0.38	-0.18
	(0.57)	(0.58)	(0.55)	(0.57)	(0.68)	(0.63)	(0.62)	(0.79)
Stu Prior ELA	-0.02	-0.08	-0.05	-0.16	-0.13	-0.11	-0.27	-0.26
	(0.59)	(0.59)	(0.55)	(0.63)	(0.64)	(0.60)	(0.46)	(0.79)
Grade	6.79	6.49	6.33	7.48	6.06	7.26	5.82	6.41
	(3.24)	(3.15)	(3.12)	(3.01)	(3.17)	(3.13)	(2.29)	(2.82)
Teachers	712057	20483	11708	2845	4472	1229	53	176
Unique tch (retention sample)	0	17187	11700	2823	2015	514	33	72
Unique tch (test sample)*	52596	4109	2954	484	1367	332	14	44

Notes: Observations teacher-year level unless otherwise noted. Retention outcomes exclude 2021-22 school year because 2022-23 has not yet been observed. Neither test scores nor performance ratings are observed in 2019-20 or 2020-21. Novice teacher: first year of teaching. *Pandemic era counts for test score regressions show teachers with 0 or 1 year of experience in 2022 (because there were no tests in 2020 or 2021). Praxis scores standardized in entire test-taking sample; Table 3 shows teachers who enter workforce and are linked to students.

Table 4. Teacher Retention Between Years 1 and 2 by Route

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Retained in State						
Temp CE	-0.15***	-0.12**				
	(0.04)	(0.04)				
Alt. Pathway	-0.04***	-0.02**				
	(0.01)	(0.01)				
Trad. route			-0.12	-0.14	-0.12	-0.14
Temp CE			(0.07)	(0.08)	(0.07)	(0.08)
Alt route			-0.20***	-0.14**	-0.19***	-0.15**
Temp CE			(0.05)	(0.05)	(0.05)	(0.05)
Alt route			-0.04***	-0.02**	-0.03***	-0.02**
Non-Temp CE			(0.01)	(0.01)	(0.01)	(0.01)
Panel B: Retained in School						
Temp CE	-0.11***	-0.10**				
	(0.04)	(0.05)				
Alt. Pathway	-0.00	-0.02*				
	(0.01)	(0.01)				
Trad. route			-0.08	-0.10	-0.09	-0.12
Temp CE			(0.07)	(0.08)	(0.07)	(0.09)
Alt route			-0.13**	-0.12**	-0.12**	-0.13**
Temp CE			(0.05)	(0.06)	(0.05)	(0.06)
Alt route			-0.00	-0.02*	-0.00	-0.02**
Non-Temp CE			(0.01)	(0.01)	(0.01)	(0.01)
Observations	17187	17187	17187	17187	16730	16730
Stu controls					X	X
School FE		X		X		X

Notes: Regression of teacher retention on pathway explanatory variables. The omitted group represents non Temporary CE teachers in columns 1 and 2 and traditional-route non Temporary CE teachers in columns 3-6. Results are for retention between a teacher's first and second year of teaching. Student controls include demographics of students taught: average race (Black, Hispanic, and white), gender, FRL, LEP, and special education. Results are similar but much less precise when restricting to post-pandemic period only. Results for retention in district similar to retention in state.

Table 5. Teacher Performance Ratings Teachers in First or Second Year of Teaching

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Teacher Practice Score						
Temp CE	-0.03	-0.02				
	(0.03)	(0.03)				
Alt. Route	-0.06***	-0.03***				
	(0.01)	(0.01)				
Trad. route			-0.14**	-0.06	-0.09*	-0.05
Temp CE			(0.05)	(0.05)	(0.05)	(0.05)
Alt. route			-0.07	-0.04	-0.05	-0.04
Temp CE			(0.04)	(0.03)	(0.04)	(0.03)
Alt. route			-0.06***	-0.03***	-0.03***	-0.03***
Non-Temp CE			(0.01)	(0.01)	(0.01)	(0.01)
Panel B: Teacher SGO Score						
Temp CE	-0.20**	-0.12				
	(0.06)	(0.06)				
Alt. Route	-0.08***	0.00				
	(0.01)	(0.01)				
Trad. route			-0.22*	-0.10	-0.12	-0.05
Temp CE			(0.10)	(0.11)	(0.09)	(0.11)
Alt. route			-0.28***	-0.12	-0.21**	-0.10
Temp CE			(0.07)	(0.07)	(0.07)	(0.07)
Alt. route			-0.08***	0.00	-0.04***	0.00
Non-Temp CE			(0.01)	(0.01)	(0.01)	(0.01)
Panel C: Teacher Summative Rating						
Temp CE	-0.06**	-0.04				
	(0.03)	(0.03)				
Alt. Route	-0.06***	-0.02***				
	(0.01)	(0.00)				
Trad. route			-0.15***	-0.07*	-0.10**	-0.05
Temp CE			(0.05)	(0.04)	(0.04)	(0.04)
Alt. route			-0.10***	-0.05*	-0.07**	-0.05
Temp CE			(0.04)	(0.03)	(0.03)	(0.03)
Alt. route			-0.06***	-0.02***	-0.03***	-0.02***
Non-Temp CE			(0.01)	(0.00)	(0.01)	(0.01)
Observations	29763	29763	29763	29763	29761	29761
Stu controls					X	X
School FE		X		X		X

Notes: Regression of teacher performance measure on pathway explanatory variables. The omitted group represents non-Temporary CE teachers in Columns 1 and 2 and traditional-route non Temporary CE teachers in Columns 3–6. Results are for teacher performance in a teacher's first and second year of teaching. Student controls include demographics of students taught: average race (Black, Hispanic, and white), gender, FRL, LEP, and special education. Results do not include 2019–20 or 2020–21 as teacher evaluation was suspended due to the pandemic.

Table 6. Student Test Score Impacts by Route

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Math						
Temp CE	0.116**	0.037	-0.015	0.102*	-0.022	-0.037
	(0.057)	(0.061)	(0.043)	(0.055)	(0.050)	(0.054)
Alt. Route	0.001	-0.003	-0.007	-0.010	-0.009	-0.009
	(0.006)	(0.005)	(0.004)	(0.013)	(0.010)	(0.009)
Panel B: ELA						
Temp CE	0.106**	0.029	0.054	0.085	-0.002	0.041
	(0.050)	(0.034)	(0.060)	(0.060)	(0.037)	(0.070)
Alt. Route	0.001	-0.004	-0.003	0.005	-0.002	0.000
	(0.004)	(0.003)	(0.004)	(0.010)	(0.007)	(0.007)
Panel C: Stacked						
Temp CE	0.111***	0.038	0.013	0.096**	-0.001	0.005
	(0.039)	(0.038)	(0.038)	(0.040)	(0.033)	(0.044)
Alt. Route	0.001	-0.004	-0.004	-0.004	-0.010	-0.008
	(0.004)	(0.003)	(0.003)	(0.009)	(0.007)	(0.007)
Observations	5950102	5950102	5946100	913499	913499	913499
School FE		X			X	
School-track FE			X			X
2022 only				X	X	X

Notes: Regression of student test score in a given subject on a cubic function of prior test scores, student race, gender, FRL, LEP, and special education, and grade- and school-level averages of each, along with teacher experience. Results do not include test scores in 2019–20 or 2020–21 as standardized testing was suspended due to the pandemic