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Career Sequences and Unequal Sorting of Subject Area Teachers along the Path to the Principalship

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The path to becoming a school principal is characterized by a variety of trajectories that reflect the diverse experiences and backgrounds of aspiring leaders. While ideally the road to the principalship would result in a proportional and representative body of principals, research has shown this is rarely the case. To gain a better understanding of where sorting mechanisms may occur along the principal pipeline, this paper longitudinally analyzes the full, start-to-finish career trajectories of over 1.6 million educators in Texas for 30 years. Using social sequence analysis and discrete-time hazard modeling, we find that (1) emergent principals tend to stay in their first teaching position longer than other educators and most often take a direct pathway towards the principalship; (2) proportionally, more principals emerge from elementary, ELA, Social Studies, or STEM fields, while fewer come from Special Education; (3) holding other features constant, male and Black educators are more likely to become a principal while female and Hispanic educators are less likely; and (4) educators are more likely to first become principals when transitioning to a smaller school with more Black and/or Hispanic students. While the pipeline does result in a balanced principal market in some areas, increasing efforts to encourage a more diverse content area representation as well as representation for Hispanic educators in Texas will be particularly important.

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Career Sequences and Unequal Sorting of Subject Area Teachers along the Path to the Principalship

Andrew Pendola[1a]

Abstract: The path to becoming a school principal is characterized by a variety of trajectories that reflect the diverse experiences and backgrounds of aspiring leaders. While ideally the road to the principalship would result in a proportional and representative body of principals, research has shown this is rarely the case. To gain a better understanding of where sorting mechanisms may occur along the principal pipeline, this paper longitudinally analyzes the full, start-to-finish career trajectories of over 1.6 million educators in Texas for 30 years. Using social sequence analysis and discrete-time hazard modeling, we find that (1) emergent principals tend to stay in their first teaching position longer than other educators and most often take a direct pathway towards the principalship; (2) proportionally, more principals emerge from elementary, ELA, Social Studies, or STEM fields, while fewer come from Special Education; (3) holding other features constant, male and Black educators are more likely to become a principal while female and Hispanic educators are less likely; and (4) educators are more likely to first become principals when transitioning to a smaller school with more Black and/or Hispanic students. While the pipeline does result in a balanced principal market in some areas, increasing efforts to encourage a more diverse content area representation as well as representation for Hispanic educators in Texas will be particularly important.

Keywords: Leadership emergence, career pathways, recruitment and hiring, career steps, career changes, principal sorting, principal labor market

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Introduction

Research has clearly documented the large effect school principals have on both student and teacher success, including aspects such as student achievement, teacher well-being, quality instruction, and organizational health (Coelli & Green, 2012; Liebowitz & Porter, 2019). Understanding how educators transition to become principals is therefore a key factor in ensuring quality teachers have sufficient opportunities to become school leaders (Davis et al., 2017) in order to support a talented, diverse, and representative principal labor pool (Gates et al., 2019).

While there is research addressing why educators become principals (Bass, 2006; Browne-Ferrigno, 2003; Hancock et al., 2006), as well as trends in hiring and selection (Lee & Mao, 2020), our understanding of the career trajectories of school leaders is more limited. As noted by Papa & Baxter, "There are not enough studies providing systematic, policy-relevant information about the career choices of school leaders and prospective school leaders on which to base some important policy decisions" (2005, p. 217). Given research on how social and structural aspects of the education system may lead to unequal and uneven opportunities for aspiring leaders (Bailes & Guthery, 2020; Fuller et al., 2019; Myung et al., 2011), it is important to gain a better understanding of the overall career trajectories of school principals to identify and address systematic inequalities that impact the principal labor pool.

Landmark research has addressed certain aspects of career trajectories to the principalship, including the likelihood of becoming a principal after certification (Davis et al., 2017), the impact of race and gender (Bailes & Guthery, 2020; Fuller et al., 2019), and the type of schools new principals move towards (Béteille et al., 2011). However, broad-scale quantitative research has yet to trace the full career trajectories or sequence of position changes that lead to

the principalship. As noted by Gates et al., (2004, p. 25), "very little is known about how, when, and why the transition occurs."

In order to build upon this body of research, we aim to map the common career trajectories to the principalship, by modeling the entire career path of all educators in Texas over a 33-year time window from 1990-2023. We ask two broad research questions: *What are the main career paths of emergent principals?*; and, *What conditions increase the likelihood of pathing towards the principalship?* To address these questions, we map the main career trajectories using social sequence analysis (SSA) and examine heterogeneity by gender, race, subject area, and school amenities using discrete-time hazard modeling. We include 1.6 million educators compromising 2.9 million position change observations in our data. By following the sequential position changes made by educators who both start and finish their careers in education, we can add to prior literature by (1) analyzing differences in career transition patterns based on subject area and position, (2) modeling multiple position transitions, and (3) identifying factors along one's career trajectory that associate with placement as a principal. By presenting a birds-eye, longitudinal view of career sorting along the principal pipeline, we hope to better inform school districts and policymakers on the contours of the principal pipeline and account for inequities in both representation (e.g., race, gender) and specialization (e.g., mathematics, arts). Our aim is to facilitate a better understanding of which educators are likely to make the transition to the principalship for improved recruitment, selection, retention, and equitable development efforts (Stevenson, 2006).

We begin with a review of the literature on principal career paths, followed by an explanation of our methodology, including variables, data, and analysis techniques used in our

study. Next, we present our findings and address how they fit into the larger body of knowledge in the discussion section. We conclude with implications for policy and future research.

Pathing to the Principalship

While there is much research into the factors that define principal hiring and selection (see: Lee & Mao, 2020) as well as principal turnover (see: Rangel, 2018), less research has focused on what factors define the career trajectory from one's initial position in education to the principalship (Bastian & Henry, 2015; Hancock et al., 2006). This small field deals with a complex issue, given that career trajectories are made at the intersection between the psychological dimension of traits and preferences for choosing a leadership position (e.g., Browne-Ferrigno, 2003), and the structural dimension of placement opportunities and barriers present to move into a leadership position (e.g., Farley-Ripple et al., 2012). These career trajectories—sometimes referred to as career paths (Ringel et al., 2004) or, in a more formalized manner, as pipelines (Gates et al., 2019; Myung et al., 2011)—are only beginning to be understood.

Choice Factors

Earlier research on the type of preferences and traits behind patterns of promotion has focused on what has made the position worth pursuing as part of job choice theory (Behling et al., 1968; Young et al., 1989). In general, the initial intent to pursue the principalship stems from a balance of one's understanding of the job's attributes (e.g., salary, workload) and its desirability (e.g., ability to make a difference, positive impact). Here, research has shown that it is mainly individuals who find the principalship desirable in terms of its ability to make change who actively develop intentions to pursue the job (Black et al., 2014; Hancock et al., 2006), while most others require strong benefit incentives, such as salary, to offset the perceived drawbacks

associated with the position (Howley et al., 2005; Pounder & Merrill, 2001). These drawbacks mainly include workload and time requirements, but also include dilemmas and stressors of the position, including student behavior problems, paperwork, political aspects, ethical dilemmas, and personnel issues (Bass, 2006; Farley-Ripple et al., 2010; Howley et al., 2005). Notably, research has shown that one of the main catalysts for principal emergence stems from the basic components of expectancy theory (Vroom, 1964). Here, the perceived likelihood of actually receiving a job offer has shown to be the most significant predictor of interest in pursuing the position (Pounder & Merrill, 2001). Research suggests that the desire to enter the principalship often remains reserved until—or is only seriously developed after—being 'tapped' (informally recruited) by someone in a leadership position (Browne-Ferrigno, 2003; Farley-Ripple et al., 2010; Myung et al., 2011).

While leadership support and the realistic opportunity to be placed as a principal have shown to be the most common catalysts for pursuing a principal position (Farley-Ripple et al., 2012), the mechanism of tapping or supporting potential candidates is also somewhat problematic in terms of the shaping the principalship labor market in an equitable manner. For example, research has shown that principals are more likely to actively tap teachers who are male, match their own race, or match the racial composition of the school (Bartanen & Grissom, 2019; Myung et al., 2011). Similarly, multiple studies on superintendents' perspectives on hiring principal candidates have shown biases that disadvantage female and minoritized educators (Kruse & Krumm, 2016; Palmer & Mullooly, 2015; Young et al., 2011; Young & Young, 2010). Following expectancy theory, this unequal support for a realistic opportunity to become a principal has shown to have a considerable impact on who decides to pursue the position in the first place and exerts a powerful force in shaping the principal labor market (McGee, 2010).

Opportunities and Barriers

Research on trends in hiring and placement has supported the notion that inequitable barriers exist along individuals' career trajectories. In a study on principal job applications and offers in Illinois, DeAngelis and O'Connor (2012) found that although certified nonwhite educators were more likely to apply for administrative positions, only 57% of nonwhite applicants received job offers, compared to 80% of White applicants. In a similar study in Texas, researchers found that Hispanic educators were 14% less likely to be hired as school principals than their White peers, ceteris paribus (Crawford & Fuller, 2017). Consistent with these findings, Davis et al. (2017) reported that White teachers in Texas have a significantly higher odds ratio of becoming principals compared to Black and Latin teachers, and male teachers had a 20% higher odds ratio when compared to female teachers. In addition, Bailes and Guthery (2020) found that Black assistant principals were less likely than their White counterparts to be promoted to principal, and that females were less likely to be promoted to a high school principal position.

Yet, to better explain the mechanisms that may be influencing *who* accedes to the principalship research needs to address *how* one accedes to the principalship, including the sequence of positions and patterns of promotion towards the job. Here, some research has focused on transition time, with research in North Carolina noting that it takes just over five years to transition from assistant principal to principal (Bastian & Henry, 2015), a finding echoed in Texas in terms of assistant principals (Bailes & Guthery, 2020) and educators with administrator certifications (Davis et al., 2017). However, Bailes and Guthery (2020) also noted that female and Black assistant principals take slightly longer than their white male counterparts to accede to the principalship (0.68 and 0.60 years to be placed, respectively). While these

differences do begin to sketch out a picture of how the pathway towards the principalship shapes the inequalities that may be present in the labor market, there is still much that is not known.

Research Questions

This study thereby aims to give a more complete picture of how the patterns of ascension may shape the principal labor market. To do so, we ask two main research questions: (1) *What are the career sequences of emergent principals?*; and (2) *What conditions increase the likelihood of pathing towards the principalship?* With these questions, we aim to build upon and extend prior studies in three ways. First, we aim to provide a broader sample. Prior studies have defined the pool of principal candidates based on those with leadership certification (e.g., Davis et al., 2017) or those in assistant principal positions (e.g., Bailes & Guthery, 2020; Fuller et al., 2019). While this gives insight into principal ascension, it only offers a sample of educators who are ostensibly already planning to enter the principalship, making observations of the differences between future principals and other career trajectories difficult. Second, prior studies have not systematically addressed how subject area specialization or starting position has played out in transitioning to the principalship. Beyond school locale or level (Gates et al., 2004; Papa et al., 2002; Ringel et al., 2004), research has yet to systematically ask what types of starting positions (e.g., science teacher, special education teacher, instructional aide) tend to lead to the principalship positions. This may be a major dimension of defining equitable leadership pathways in terms of content area representation (DeMatthews et al., 2020). Third, prior research has generally modeled promotion to the principalship as a single-step event, from either certification (Davis et al., 2017) or assistant principal position to the principalship (Bailes & Guthery, 2020; Fuller et al., 2019). However, there are undoubtedly multiple other pathways to the principalship, including the sequence of several position changes. Therefore, to add nuance

and a broader understanding of how patterns of ascension, we aim to map the full set of position changes educators take on their path to the principalship. Overall, our goal is to add to prior research and better understand how the trends and patterns of principal ascension shape the principal pool, so that major sorting mechanisms may be better identified to remove barriers and improve opportunities for a healthy, equitable principal market.

Method

Given the above research questions, we now will outline our methodological approach. We start with the data and measures used in the analysis, detail the analytic approach for each research question, and then briefly address the limitations of the research.

Data and Measures

This study employs over 30 years of individual-level longitudinal data from the Texas Education Agency's Public Education Information Management System (PEIMS) and the National Center for Educational Statistics (NCES) Common Core of Data. This includes the population of individuals in the Texas educational system from 1989-90 to 2022-23. Given the goal of understanding career trajectories in full, we restrict our observations to public school educators who both entered and exited the profession during this time window, so that the full start-to-finish career pathway in education is observed. Doing so gives us roughly 1.6 million unique educators with 11.8 million individual-year observations. For each observation, we have longitudinal, time-variant indicators of individual educator characteristics including gender, race/ethnicity, salary, and years in education. We also include position in the education system, including Elementary, English language arts and social studies (ELA/SS), science, technology, engineering or math (STEM), the arts, career and technical education (CTE), special educating (SE), physical education (PE), other subjects, athletics, business and human resources, and more.

For a full list of position categories, see Table 1 below.[1] The data also contains time-variant school conditions including school enrollment, student racial/ethnic composition, percentages of students identified for free and/or reduced meals (FARM) and limited English proficiency (LEP), within-year standardized student proficiency ratings, accountability scores, school level (elementary, secondary, all grades), and school locale (e.g., urban, rural). Within this dataset, we identified all educators who transitioned the principalship at some point in their careers. Notably, some covariates, such as the percentage of students achieving proficiency on the state exam and school accountability ratings were first collected in 1995, so statistics and models utilizing these variables were restricted to the period of 1995 to 2023. This gives us 34.2 thousand individuals and 605.9 thousand individual-year observations of principals.

Analytic approach

RQ1: What are the career sequences of emergent principals?

For our first research question, we begin with a descriptive comparison of those educators who became principals with those who did not in order to give a sense of the major trends towards the principalship. This comparison includes our main individual-level variables of gender, race/ethnicity, experience, salary, and position. Notably, it compares the number of years

[1] 'Position' is operationalized as a combination of the PEIMS `role` and `subject` variables. `Role` includes multiple (81) categories for positions in education, such as principal and teacher, but also includes job categories such as security, visual training therapist, interpreter, aide, custodian, etc. `Subject` includes the teaching position (87 in total), such as elementary, English Language Arts (ELA), social studies (SS), and science, but also includes positions such as agricultural science, dance, desktop publishing, and more. These variables also changed across years, so were hand-coded to match or include new categories so no information was lost. For purposes of this study, positions were then collapsed and combined into 15 items that differentiate between the principal, assistant principal, and major type of teacher. Teaching positions have been combined into the major groups of: Elementary, ELA & Social Studies (SS), Science, Technology, Engineering, and/or Mathematics (STEM), the Arts (e.g., dance, art, music), Career and Technical Education (CTE), Physical Education (PE), and Other (e.g., career development, desktop publishing, psychology, ROTC), and not-teaching positions (e.g., Athletics, Business & Human Resources, Operations, Library & Technology).

in the education system, the number of position changes, and how long individuals are in their first position.

Next, to start identifying career sequences, we identify the type and pattern of position changes that both non-principals and principals go through during their total career arc using techniques from social sequence analysis (SSA). Based on tools developed to identify patterns in genome sequencing, SSA can be used to classify discrete state changes and patterns over time for large numbers of groups (Cornwell, 2015). Using the `SQ-Ados` package in STATA (Brzinsky-Fay et al., 2006), we set the data to categorize each observed pattern of position changes (e.g., STEM teacher → assistant principal → principal) and extract the frequency of each pattern. Patterns are defined by each position change event for a given educator over their career arc, and do not account for the duration of a given position (e.g., 8 years as a STEM teacher → assistant principal is counted the same as 1 year as a STEM teacher → assistant principal). Position changes can also include horizontal moves, such as STEM teacher in School A → STEM teacher in School B.

With the data configured, we then employ three different approaches to help define career sequences. First, we create a sequence index plot, which plots the proportional composition of all educator positions during the 1st, 2nd, …k^{th} position change that individuals go through. We compare the proportional position composition between principals and non-principals to demonstrate how the overall distribution of positions change as educators move through their careers. Second, we construct an alluvial plot to demonstrate the proportional 'flow' of one position into another for those who became principals, given that sequence index plots do not follow individual pathways. Given the large number of potential pathways (117,838 unique sequences were taken in our data), we only present the flows from the first position to the

position immediately before the principalship, and then to the principalship. Third, we present the top 10 most frequent position sequences to the principalship to clearly identify which career sequences occur most often.

RQ2: What conditions increase the likelihood of pathing towards the principalship?

After examining the types of pathways that principals take, we next turn to our second research question. Here we model the individual risk of becoming a principal at a given time period, using discrete-time hazard (DTH) modeling with fixed effects (Singer & Willett, 2003). We run five main models, with transitioning to the principalship (i.e., changing positions from a non-principal to a principal position for the first time) as our dependent variable in each model. The models encompass 11.8 million educator-year observations, with 29,786 first-time principal transitions.

The first model estimates this transition with educator characteristics, including gender, race, age, experience, as well as the number of position changes an individual has gone through. We also incorporate squared regressors to account for the nonlinear, inverted U-shaped relationship of age, experience, and the number of position changes on transitioning to the principalship, similar to the approach used by Davis et al., (2016). In the second model, we add in school fixed effects, to account for unobserved heterogeneity within schools that may make transitioning to the principalship more or less of a risk, such as the political or policy climate. Our third model then adds in the position an educator started out in, such as teaching special education, instructional support, or athletics. This includes the 15 different teaching and non-teaching position categories outlined in Table 1 below. Our fourth model then includes school-level conditions of the arrival school (e.g., salary, % FARM, student proficiency, urban/rural) to see if particular conditions of a position increase the risk of transitioning to the principalship, as

noted by prior literature (e.g., Fuller et al., 2019). Finally, our fifth model replaces school conditions with a change score between the starting and current position, following research suggesting that the relative difference in school conditions is an improved measure of educator position change preferences than absolute conditions (Pendola & Fuller, 2021b).

Overall, our models take the basic form below, with ν representing the baseline hazard and γ representing school fixed effects. β_1, β_2, and β_3 represent vectors of the variables for principal characteristics, educator positions, and school conditions noted above, respectively. The change score Δ—which is only used in the fifth model—represents the difference score between the conditions of an individual's first school position (t_0) and the current period (t_k), which for principal transitions would be the difference between the starting position school and the school where they first became a principal (e.g., Δ salary = principal position salary t_k – STEM teacher salary t_0).

$$\text{Logit}\left[\frac{\text{p (principal transition)}}{1-\text{p(principal transition)}}\right] = \alpha + \beta_1 \text{ educator characteristics} + \beta_2 \text{ educator position} + \beta_3(\Delta) \text{ school conditions} + \nu + \gamma$$

Each model presented was chosen to balance fit and explanatory power, with robustness checks for alternative specifications (e.g., different predictor variable combinations including individual and/or district fixed effects, and multilevel model specifications). The models we present demonstrated the best balance of goodness-of-fit via Craig & Uhler's and McFadden's adjusted and r^2 (Singer & Willett, 2003), as well as lower Baysean information criterion (BIC) scores (Raftery, 1995). Alternative specifications were highly similar substantively but tended to have reduced model fit. Multicollinearity checks demonstrated an average variance inflation

(VIF) score of < 3. Some covariates were correlated (e.g., % LEP and % Hispanic; proficiency and accountability ratings), but did not bias results in any substantive way (O'Brien, 2007).[2]

Limitations

Before proceeding, it is important to note a few limitations regarding the interpretation of results. First, position changes and career trajectories are not always an expression of an individual's career preferences. Educators are sometimes moved involuntarily, pushed or pulled into positions based on availability or personal factors (e.g. spousal relocation), or are unable to secure a position they desire (Farley-Ripple et al., 2012). As a result, interpretations are to be taken as the observation of career patterns as they manifest, rather than as an indicator of who intends or desires to transition to the principalship. Relatedly, estimating transitions to the principalship based on individual and administrative data explains a relatively small proportion of overall variance. This is consistent with similar studies (Bailes & Guthery, 2020; Davis et al., 2017; Fuller et al., 2019), and suggests that, while we have attempted to include important

[2] A few additional technical notes on the data and model selection: (1) The main model specification was further confirmed with LASSO analysis of 66 model iterations to arrive at the current *k*-fold cross-validated model (λ 1.324). LASSO is a supervised machine learning method for model selection and prediction, with the goal of identifying the optimal balance of regressors that avoid overfitting while maximizing the explanation of variance (Hastie et al., 2015). (2) We restricted observations to educators who were above 0.5 full-time employment (FTE) in a single position and changed positions between or within public schools to model 'typical' transfer situations. (3) We report racial/ethnic categories as Asian, Black, Hispanic, Other, and White. TEA racial designations were recategorized in 2010-11 (Texas Education Agency, 2012, 2017), and as a result categories of American Indian, Alaska Native, Pacific Islander, and two or more races were collapsed into the 'other' category. These account for roughly 0.5% of educators. (4) The inclusion of squared regressors for age, experience, and position changes were confirmed with Box-Tidwell tests. (5) We note that school proficiency percentages and accountability ratings are correlated, but we treat them as distinct. Student proficiency was within-year standardized given Texas Assessment of Academic Skills was administered from 1991-2002 and was then replaced by the Texas Assessment of Knowledge Skills. School accountability ratings, given their changes over time, have been categorized on a 1-3 (low, proficient, high) ordered scale to map onto the Academic Excellence Indicator System (AEIS). AEIS accountability ratings include alternative assessments, information on school academic progress, gap closure, comparative performance, and completion rates. As a result, we treat this as a conceptually distinct measure from proficiency scores and note their inclusion did not result in elevated VIF scores (Texas Education Agency, 2017).

indicators, behaviors surrounding career transitions are largely driven by personal and contextual choices that are not available in our administrative data (Farley-Ripple et al., 2012). Second, we must recognize the limitations of generalizability given the unique policy, demographic, and institutional context of Texas. For example, Texas requires two years of classroom teaching experience and currently has 69 accredited leadership preparation programs across, some of which are alternative preparation programs offered mostly online (Texas Education Agency, 2024). This may alter who transitions to the principalship (or other positions) based on cost, location, and availability of leadership certification. Third, we only model first-time transitions to the principalship. Although there are many instances of second- and third-time transitions back into a principal position, the nature of these transitions are much different conceptually and practically (Farley-Ripple et al., 2012). Given our current research question, second- and third-time transitions are outside the scope of the current analysis but are an area for future research.

Results

RQ1: What are the career sequences of principals?

We begin by comparing educators who became principals to those who did not over the past 30 years, as shown in Table 1. To maintain focus, we only discuss the main trends here but note that there are many more worth consideration. Starting at the individual characteristics section in Table 1, we see that a vast majority of the education workforce tends to be female (82%) and White (62%). While this holds for those that become principals, compositionally more males end up becoming principals than non-principals (39% principals to 18% non-principals), while Black, Hispanic, and Asian principals stay roughly proportional to the non-principal workforce. Turning to the experience section of Table 1, we see that principals tend to stay in the profession of public education much longer than those who do not become principals, with non-

principals staying an average of just over 4 years, and having roughly 1.7 positions in their educational career, as opposed to those who do become principals and are in public education for nearly 11 years with an average of 3.3 positions before becoming a principal. Principals are also much stable in their first position much longer than non-principals, with an average of 5.5 years in their first education position, compared with just 2 for non-principals. Moving to starting position, we see that a plurality of Elementary teachers become principals, along with proportionally more English Language Arts and Social Studies teachers (ELA/SS). While many of the other starting position categories remain relatively similar between non-principal and principal educators, Arts and Special Education teachers are relatively less represented in the principalship.

[Table 1 Here]

Next, we compare the career pathways of principals with those that do not become principals using the abovementioned techniques from SSA. Figure 1 presents three sequence index plots, each showing the composition of positions at each transition of educators in Texas whose total career occurred between 1990 and 2023. In total, this covers 1.6 million educators and 2.9 million position changes, which includes 34,199 principals and 68,143 principal position changes. Each bar represents the proportion of the population in a given position during their 1^{st}, 2^{nd}, …k^{th} position change, demonstrating the overall composition of positions before becoming a principal. Notably, the number of individuals compromising the total decreases at each position change, given most principals only have 3 or 4 changes. For example, the 4^{th} principal change bar represents 13,324 principals, while the 10^{th} bar only represents 413.

[Figure 1 about here]

Starting with panel A for reference, we see that transitions into administration, student support, or the assistant principalship occur early and peak around the 4th position change. Content area teaching positions remain more or less stable, although there is a slight decrease in elementary teachers and an increase in both STEM and ELA/SS teachers over time. Moving to Panel B, which focuses on principals, we see the same trend expanded, with general decreases in content area teaching as individuals transfer to new administrative positions. Direct transfer to an assistant principal position is the most frequently observed, followed by transitions into student support or other administrative positions (e.g., curriculum director). Notably, there is a greater magnitude of reduction in elementary positions than in ELA/SS or STEM starting positions, showing that Elementary teachers move more directly towards administration, whereas other teaching positions may take a less direct path with more moves into other content areas or administrative positions.

To dive deeper into the specific career pathing of public-school principals, we now present Figure 2, which is an alluvial plot connecting the proportional transitions of educators showing their first position, last position before the principalship, and final principal position. In other words, while Figure 1 presents the total proportions, Figure 2 connects principal pathways. As noted above, given the large amount of transitions in the data, Figure 2 is a coarse simplification used to make visual sense of what is otherwise a complex set of pathways. Most principals have more than 3 positions, and the degrees of freedom at each transition increases exponentially. To aid in comprehensibility, we have simplified the prior-to-principal stage into 5 categories. With this in consideration, we see that for nearly every starting position, roughly 2/3rds eventually transfer to an assistant principal position, with a few then coming directly from

a teaching position, and others into an administrative position.[3] Most notably, this figure demonstrates that there is a rough proportionality in transitions without segmentation whereby certain starting positions have unique pathways.

[Figure 2 about here]

This leads us to next examine what exactly are the most common pathways to the principalship. Table 2 presents the results of the positional sequence analysis of career transitions leading to the principalship. We present the top 10 career transition sequences out of 117,838 observed sequences to the principalship, along with the percentage of principals that took the pathway. Comporting with Figures 1 and 2 above, we see that the most prevalent pathway is the elementary → assistant principal → principal sequence, making up over 23% of all principal pathway sequences. The most frequent sequences are shorter, being between 3 and 4 transitions, whereas longer sequences, containing 5+ transitions occur less often. Part of this is due to the complexity of longer sequences, whereby longer sequences are less likely to be repeated due to the growing number of combinations possible. As noted above, the mean number of positions educators have prior to the principalship is 3.4, while the mode is 2, demonstrating that while most pathways to the principalship are fairly direct, some individuals have as many as 17 position changes.

[Table 2 about here]

[3] Individuals who started in a non-teaching position (e.g., athletics) either transitioned to a teaching position or held less than 0.5 FTE teaching positions (e.g., 0.7 athletics director and 0.3 PE teacher) to gain the necessary two years of classroom teaching experience.

RQ2: What conditions increase the likelihood of pathing towards the principalship?

Considering the types of position changes individuals progress through towards the principalship, we now examine which factors are most associated with transitioning to the principalship, and differentiate from the pathways of those who do not become principals. We begin with Table 2, which presents the results of discrete-time-hazard models estimating the risk of becoming a principal. As noted above, we present compare several models: Model 1 estimates the risk of becoming a principal based solely on observed individual characteristics; Model 2 adds in school-level fixed effects; Model 3 adds in an individual's starting position (e.g., elementary teacher); Model 4 adds in the time-variant school conditions (e.g., enrollment, demographics) of the arrival school; and Model 5 includes the change between an individual's first position conditions (e.g., enrollment, demographics) and their current position conditions.

Given the large amount of information presented, we will focus on some main trends. To begin most broadly, we look at which model does the best job in statistically explaining transitioning to the principalship. First, we see that just including educator characteristics in Model 1 (e.g., gender, race, age) accounts for about 10% of model variance via McFadden's adjusted r^2, while the inclusion of school fixed effects in Model 2 increases model variance explanation to roughly 20%. The inclusion of each educator's starting position in Model 3 adds only a slight increase to model fit, and the addition of school position characteristics (e.g., salary, enrollment) increases the proportion of variance explained to roughly 24%. Finally, we see that modeling school conditions as change scores from the starting position to the current position does the best job in explaining transitioning to the principalship, bringing the r^2 up to nearly 30%, and also demonstrating the lowest BIC score across all models. Here, principal ascendance is best explained by the relation between starting and finishing positions.

We now turn to which characteristics and conditions are associated with significant differences in the likelihood of transitioning to the principalship, focusing on Model 5 given it has the best fit statistics, but note that in most instances, the magnitude and valence of each effect is similar across models. To start, we see that female educators have a lower risk (~70% lower risk ratio) of becoming principals at any given time period than male educators, as do Hispanic educators (~10% lower risk ratio) than White educators. Black educators have a roughly 12% greater risk ratio of becoming a principal in a given time period. Both years of experience and the number of positions educators move through increase the risk of becoming a principal. However, looking at the coefficients of the squared regressors for experience and position changes, we see these are curvilinear associations in an inverted U shape, showing that at low and high values, the overall positive association between experience and position changes on principal emergence is diminished. Turning to educators' starting position, we see that ELA/SS, as well as STEM teachers, have a roughly 70% higher risk ratio of becoming a principal at a given time than an elementary certified teacher (the reference category). Teachers certified in the arts, CTE, or in other areas are also more likely to become principals, although the effect size is smaller (23%, 44%, and 30% increase in risk ratio respectively). Interestingly, educators certified in Special Education are less likely to become a principal (46% lower risk ratio), as are those in athletics, library and technology, and student support.

Next, we look at the change in school conditions between the starting and current position in Model 5. We see that individuals staying in the same district as internal hires are slightly more likely to become principals, as are those that have a greater increase between their starting salary and current salary. These salary differentials are intuitive, and somewhat mechanical given principal salaries are generally higher that starting positions. However, looking

at Model 4, we also see that higher salaries are associated with an increased risk of becoming a principal, showing that a greater jump in salary from one year to another—or from starting to current position—increases the risk of becoming a principal.[4] Notably, we also see that those who become principals for the first time tend to move towards schools that are smaller and with higher percentages of Black and Hispanic students than their starting positions. They also tend to move to schools with lower achievement scores and are less likely to arrive at a school with a high accountability rating. Finally, we see no significant differences in the likelihood of becoming a principal based on school level (e.g., elementary, middle) or locale (e.g., urban, rural).

[table 3 about here]

Discussion & Implications

The aim of this research has been to gain a broader scope for understanding the pathways to the principalship. By diagnosing the longitudinal trends of the principal pipeline, our goal has been to identify sorting patterns in order to improve both the equity of opportunity for educators, as well as help ensure improved representational parity between school leaders and the broader teacher and student population. Most broadly, our results have demonstrated that (1) principals tend to stay in their first position longer than other educators, and most often take a direct pathway towards the principalship moving from teaching to assistant principal to principal; (2) proportionally, more principals emerge from elementary, ELA or Social Studies, or STEM fields,

[4] Further models, available upon request, show that a higher distance between the principal and the position immediately before the principalship is associated with a significantly higher risk of becoming a principal as well.

while fewer come from Special Education or the Arts; (3) holding other features constant, male and Black educators are more likely to become a principal while female and Hispanic educators are less likely; (4) educators are more likely to become principals when transitioning to a smaller school with more Black and/or Hispanic students, and are more likely to become a principal if the salary is higher and within the same district. Our results have both confirmed and added new layers to prior research, which we will address below.

To begin, our results show that principals tend to be more generally stable in their first education position and tend to make more in-district vertical (e.g., teacher → assistant principal) than horizontal moves (e.g., elementary teacher in school A → elementary teacher in school B). This suggests that teachers who are stable in their first position for longer periods are both more likely to be principals, but also tend to make a straight line to the principalship (teacher → assistant principal→ principal). Indeed, while most educators are not in the profession long enough to tell—at only 4 years on average—even when looking at a comparative sample of all individuals that have been in the public education system for 10+ years (analysis not shown here), we find that principals had overall fewer position changes (3.34) than non-principals (4.26). It should be again noted that our data is strictly observational and has no capacity to remark on the intentions or motives of emergent principals that compromise the trends observed. However, prior literature demonstrating that more stable and established teachers tend to be 'tapped' more often for the principalship (Farley-Ripple et al., 2012; Myung et al., 2011) and that some teachers develop a direct plan and position identity to pursue the principalship after a few years (Browne-Ferrigno, 2003; Davis et al., 2017) does help to provide a possible explanation for these trends. In the broadest terms, having experienced teachers and those who are ostensibly driven to become principals can be seen largely as a positive for quality school leadership,

suggesting some positives of current certification requirements and perhaps the characteristics of tapping, pushes, and pulls to move into leadership (Farley-Ripple et al., 2012).

Yet it is clear that the current system may introduce some inequalities into principal pathing as well. In line with prior research, even though the majority of teachers and principals are female, male educators have a greater likelihood of becoming principals (Davis et al., 2017; Fuller et al., 2018, 2019). On a positive note, even though the vast majority of public school teachers are White, our results show that Black teachers are slightly more likely (~20% greater risk ratio than White educators) to become principals. Black educators tend to become principals more quickly and directly than others as well, having shorter time-to-principalship (average 15 years) and fewer positions prior to the principalship (~4 on average). Indeed, as the proportion of Black students in Texas has hovered at just under 13%, Black educators are essentially proportionally represented at just over 14% of the principal population (O'Hara et al., 2022). However, while the proportion of Hispanic principals (22%) closely matches the proportion of Hispanic teachers (22%), the likelihood of becoming a principal is less than the likelihood of a White educator (roughly 11% lower risk ratio). Given that the Hispanic student population of Texas has shifted between 47-53% in the last 30 years, there is clearly a significant gap in proportional representation between principals and students. Overall, this suggests that, in Texas (1) focusing on recruiting Hispanic educators in general will be important to move towards proportional representation (Carver-Thomas, 2018); and (2) improving mechanisms of eliciting Hispanic and female principals from the educator pool will also be crucial (Davis et al., 2017; Fuller, Hollingworth, et al., 2016; Fuller et al., 2019).

Therefore, in line with prior recommendations, we recommend schools and districts carefully examine their hiring practices with particular attention to assumptions and biases

surrounding the concept of fit and qualification (Lee & Mao, 2020). Prior research has shown gatekeeping bias in principal hiring whereby Hispanic candidates may be unfairly viewed as less qualified than others in leadership positions (Young et al., 2011), may be less likely to be encouraged to apply (Fuller, Reynolds, et al., 2016), and often must wait longer to find a principal placement than others (Bailes & Guthery, 2020). Moreover, the literature has suggested that racial homophily plays a significant part in determining which teachers are encouraged to move into administration—i.e., principals are more likely to encourage teachers who look like them (Myung et al., 2011). This means that deliberate attempts to diversify the leadership pathway by being more inclusive and supportive are increasingly important—particularly for Hispanic students and teachers—to realize the benefits of representative leaders in terms of student achievement, teacher satisfaction, workplace support, and retention rates (Bailes & Guthery, 2020; Bartanen & Grissom, 2023; Edwards & Anderson, 2023; Grissom et al., 2021).

This inequity relates to subject area specialization as well. Teachers certified in ELA & Social Studies, STEM, Arts, and CTE were more likely to emerge as principals than elementary teachers, although former elementary teachers make up a plurality of principals (45%). While this can be seen as generally a positive in ensuring wide and relatively proportional content representation in the principalship, notably Special Education teachers were significantly less likely to emerge as principals, and have been proportionally underrepresented in the field. Research has often emphasized the importance of well-informed and supportive leadership for special education (DeMatthews et al., 2020; Goor et al., 1997; Talbott et al., 2016). Principals often only have a minimal understanding of special education law and processes and often require much more background in the field and/or specialized training to lead effectively (Crockett, 2018; Crockett et al., 2012), and so it comes of some concern that so few have Special

Education backgrounds. This is particularly relevant for Texas, which implemented the so-called 'special education cap' that led to a substantial decline in special education identification and support for special education (DeMatthews & Knight, 2019). Although it has been repealed, research has shown lasting effects of the cap, including increased leadership turnover (Mandel & Pendola, 2021). As noted before, our data cannot explain why Special Education teachers are not moving to the principalship. In this light, and given the shortage of research in this area, we hope to compel future research to investigate why special education teachers are less likely to become principals, as well as to note the importance of encouraging and supporting special education teachers to pursue leadership positions.

Another addition to our understanding of the career pathways of principals comes from our results in terms of school conditions. Comporting with prior research, we found that educators tended to be placed in positions when there was a higher salary jump (Pendola, 2022), in districts that they had been employed in before (Pendola & Fuller, 2021a, 2021b), and in schools with more Black and Hispanic students and schools with lower accountability ratings (Davis et al., 2017). However, we also found that they were more likely to find placement in schools with more Black, Hispanic, and LEP students with lower accountability ratings relative to their first position. This adds a dimension to research showing that historically underserved schools tend to have novice principals, by noting that these new principals do not necessarily come from similar background conditions (Grissom et al., 2019; Loeb et al., 2010; Papa, 2007). This phenomenon may partially be explained by the 'stepping stones' idea, where new leaders take their first positions in ostensibly more challenging contexts, but then move towards less historically underserved schools (Béteille et al., 2011).

Overall, our findings comport with several prior studies on principal pathways and hiring, showing that these trends are robust to both different samples and modeling techniques, and have persisted over time. Part of the contribution of this study has been to widen the temporal scope to show that aspects of the principal pipeline—such as reduced female and Hispanic placement and stepping-stone positions—are widely systematic and enduring. Yet this study has also sought to add to this body of literature, investigating what separates the emergence of a principal from other pathways in public education while viewing the entirety of an educator's career. Here, we see the main pattern, of a long period of stability in an initial teaching position, followed by a few transitions towards the principalship. This is not to say that circuitous pathways are not taken, but high-churn individuals tend not to become principals. Moreover, we also see that certain content areas are favored in terms of leadership emergence. This paints an overall picture of a leadership pipeline that has several positives for supporting well-functioning schools, yet still has some work to do.

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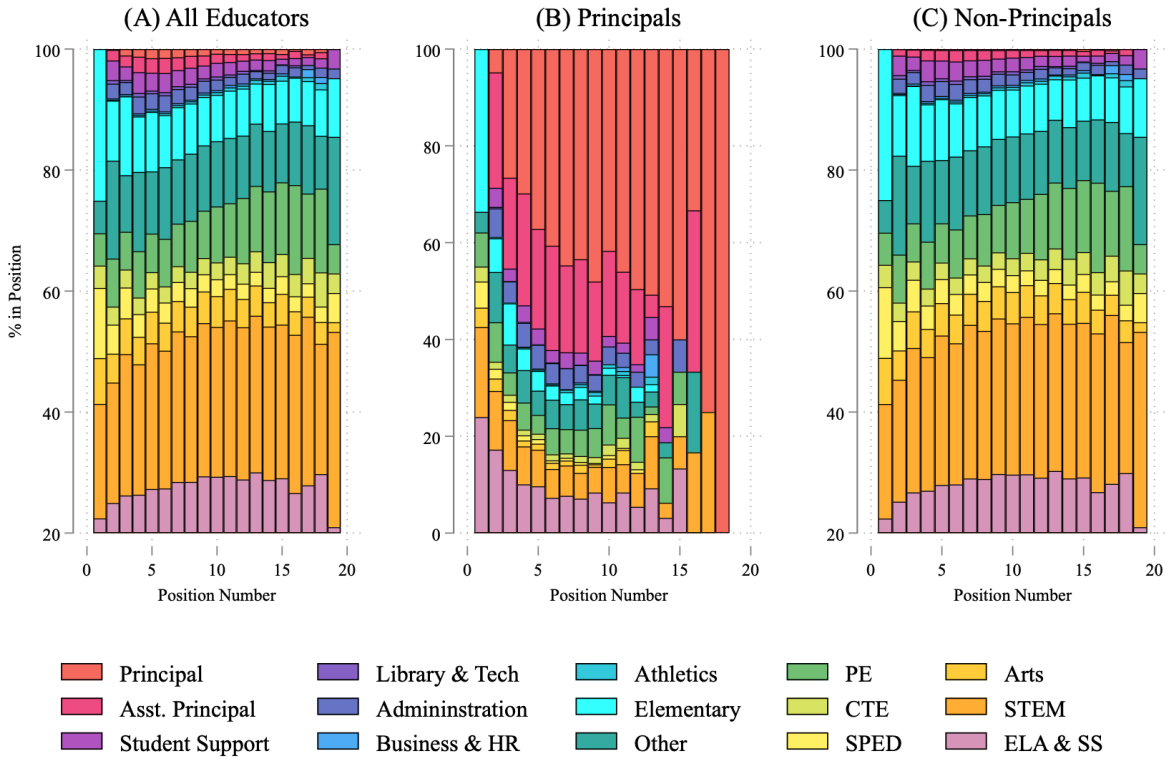
Figures

Figure 1

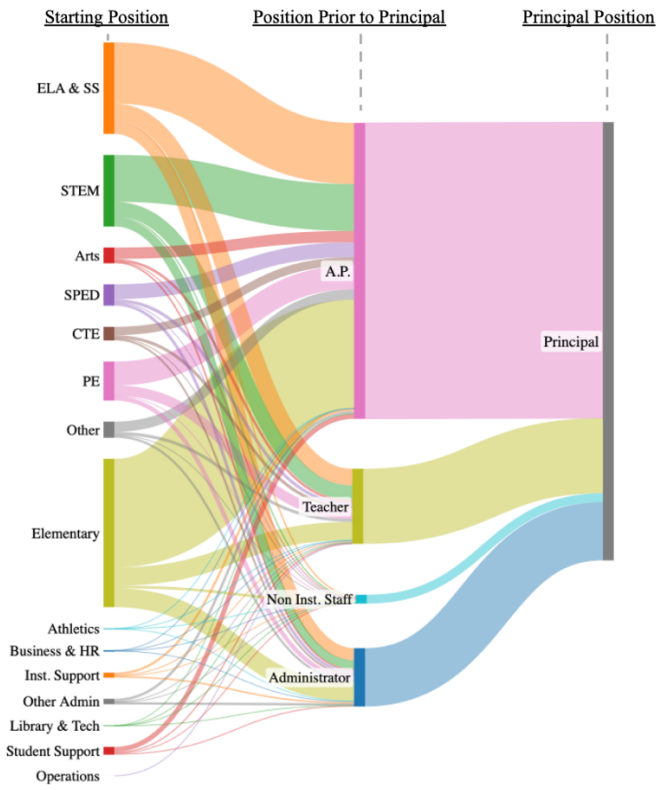
Position Changes for Educators and Principals in Texas, 1990-2023



Note: Each bar of this sequence index plot represents the proportion of the 1.6 million educators and 34 thousand principals in a given position based on the number of position changes that have occurred.

Figure 2

Position Transitions to the Principalship in Texas, 1990-2023



Note: Each flow line represents the proportion of the 34,199 individuals moving from one position to another towards the principalship. For clarity, the position prior to principal has been collapsed into five categories. A.P. stands for Assistant Principal. Multiple position changes may have occurred between the starting position and position prior to principal but are not shown here for clarity.

Tables

Table 1
Principal and Non-Principal Demographics and Positions in Texas, 1995-2023

	Non-Principals	Principals		Non-Principals	Principals
Individual Characteristics			*Starting Position*		
Female	81.88%	61.50%	Elementary Teacher	23.89%	45.34%
Male	18.12%	38.50%	ELA/S.S. Teacher	17.10%	19.19%
Asian	1.58%	0.79%	STEM Teacher	14.66%	14.92%
Black	12.46%	14.25%	Arts Teacher	6.49%	3.27%
Hispanic	21.79%	21.65%	Spec. Ed. Teacher	11.96%	4.26%
White	63.03%	62.45%	CTE Teacher	3.12%	2.51%
Other	0.50%	0.31%	Phys. Ed. Teacher	4.07%	5.61%
Salary (adj)	$61,233.52	$139,645.62	Other Subject Teacher	4.39%	3.31%
			Athletics	0.21%	0.12%
Experience			Business & HR	0.59%	0.12%
Years in Education System	4.33	10.61	Inst. Support	0.69%	0.21%
# Positions	1.74	3.34	Other Admin	5.76%	0.62%
Years in First Position	1.99	5.47	Library & Technology	0.54%	0.04%
Years as Principal	-	6.38	Student Support	5.69%	0.50%
			Non-Inst. Staff	0.26%	0.01%
# of Educators	1,632,605	34,199			
# of Observations	11,824,520	605,924			

Notes: Principals are individuals who were identified as being in a principal position at some point in their career. Non-principals are individuals who did not have a principal position in their career. Salary is adjusted to 2020 dollars and regionally adjusted for cost-of-living differences. # Positions represents the total number of positions for non-principals and the number of positions prior to becoming a principal for principals.

Table 2

Top 10 Most Frequent Position Sequences of Principals in Texas 1990-2023

		Position Order			
Sequence Rank	% With Sequence	1st	2nd	3rd	4th
1	23.07%	Elementary	Asst. Principal	Principal	
2	15.21%	ELA/SS	Asst. Principal	Principal	
3	12.20%	STEM	Asst. Principal	Principal	
4	5.51%	Elementary	ELA/SS	Asst. Principal	Principal
5	4.91%	Elementary	Admin	Asst. Principal	Principal
6	4.13%	PE	Asst. Principal	Principal	
7	3.41%	Elementary	Student Support	A.P.	Principal
8	3.30%	CTE	Asst. Principal	Principal	
9	3.18%	ELA/SS	Asst. Principal	Admin	Principal
10	2.88%	ELA/SS	Student Support	Asst. Principal	Principal

Note: This table presents the top 10 of 117,838 observed position sequences to the principalship. Each sequence terminates at the arrival of a principal position.

Table 3
Discrete Time Hazard of Risk of becoming Principal, 1995-2023

	1 Individual	2 w/ FE	3 w/ Role	4 w/School	5 w/Change
Individual Characteristics					
Female	0.419**	0.269**	0.271**	0.271**	0.289**
	(0.007)	(0.006)	(0.006)	(0.006)	(0.007)
Asian	0.640**	0.814*	0.812	0.871	0.951
	(0.061)	(0.082)	(0.088)	(0.099)	(0.112)
Black	0.913**	1.032	1.136**	1.189**	1.266**
	(0.023)	(0.033)	(0.039)	(0.043)	(0.050)
Hispanic	0.740**	0.752**	0.818**	0.851**	0.892**
	(0.015)	(0.021)	(0.024)	(0.026)	(0.029)
Other	0.890	0.989	1.079	1.026	0.997
	(0.132)	(0.156)	(0.180)	(0.186)	(0.188)
Age	0.685**	0.760**	0.740**	0.724**	0.759**
	(0.010)	(0.013)	(0.014)	(0.014)	(0.015)
Age Squared	0.742**	0.713**	0.757**	0.773**	0.760**
	(0.011)	(0.011)	(0.013)	(0.014)	(0.015)
Experience	3.084**	2.522**	1.930**	2.272**	1.951**
	(0.167)	(0.119)	(0.105)	(0.147)	(0.126)
Experience Sq	0.609**	0.777**	0.821**	0.788**	0.827**
	(0.062)	(0.043)	(0.045)	(0.052)	(0.054)
# Role Changes	2.407**	3.005**	2.587**	3.894**	3.155**
	(0.054)	(0.069)	(0.060)	(0.105)	(0.083)
# Role Changes Sq	0.906**	0.896**	0.918**	0.866**	0.893**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
First Position					
ELA & SS			1.196**	1.221**	1.700**
			(0.033)	(0.035)	(0.054)
STEM			1.209**	1.233**	1.723**
			(0.037)	(0.039)	(0.060)
Arts			0.895*	0.884*	1.234**
			(0.045)	(0.047)	(0.069)
Special Ed			0.462**	0.456**	0.534**
			(0.020)	(0.020)	(0.025)
CTE			1.118	1.126	1.437**
			(0.068)	(0.072)	(0.098)
PE			0.751**	0.759**	0.992
			(0.033)	(0.034)	(0.048)
Other			0.932	0.948	1.306**
			(0.047)	(0.050)	(0.073)
Athletics			0.234**	0.234**	0.394**
			(0.057)	(0.057)	(0.109)
Business & HR			0.899	0.972	0.424
			(0.194)	(0.227)	(0.231)
Inst. Support			0.747	0.695*	1.202
			(0.127)	(0.128)	(0.304)
Other Administration			0.310**	0.298**	0.931
			(0.030)	(0.032)	(0.133)
Library & Technology			0.160**	0.128**	0.217**
			(0.068)	(0.058)	(0.103)
Student Support			0.158**	0.131**	0.288**
			(0.017)	(0.015)	(0.034)
Operations			0.304	0.448	0.000
			(0.248)	(0.359)	(0.002)

Table 3 (continued)
Discrete Time Hazard of Risk of becoming Principal, 1995-2023

	1 Individual	2 w/ FE	3 w/ Role	4 w/School	5 w/Change
School Conditions					
Same District				1.071**	1.076**
				(0.024)	(0.025)
Middle School				1.295*	1.287
				(0.161)	(0.167)
High School				1.174	1.098
				(0.197)	(0.195)
Other School				1.344*	1.315
				(0.189)	(0.194)
Salary (adj.)				1.501**	1.811**
				(0.190)	(0.158)
Enrollment				0.607**	0.865**
				(0.037)	(0.011)
% FARM				0.966	0.992
				(0.022)	(0.013)
% LEP				0.802**	0.998
				(0.031)	(0.016)
% Asian				1.043	1.016
				(0.037)	(0.013)
% Black				1.077	1.065**
				(0.059)	(0.016)
% Hispanic				0.904	1.098**
				(0.056)	(0.025)
Proficiency (std.)				0.870**	0.942**
				(0.016)	(0.010)
Low Accountability				0.996	1.010
				(0.051)	(0.053)
High Accountability				0.673**	0.715**
				(0.019)	(0.021)
Urban				1.162	1.153
				(0.118)	(0.122)
Town				0.963	0.944
				(0.104)	(0.107)
Rural				1.021	0.953
				(0.082)	(0.080)
School Fixed Effects		X	X	X	X
Baseline Hazard	X	X	X	X	X
Observations	11,824,520	11,824,520	11,824,520	11,823,829	11,823,829
Pseudo R^2	0.103	0.202	0.203	0.223	0.293
BIC	128294	77646	66687	61901	55110
Log Likelihood	-63887	-38575	-33013	-30514	-27120

Notes: *p<0.05; **p<0.01. Coefficients are odds ratios. Robust standard errors in parentheses. Reference categories are White, male, Elementary, mid-level accountability, and Suburban. % White omitted due to multicollinearity. Salary is adjusted for regional cost-of-living differences and within-year standardized. Proficiency is within-year standardized.