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Ready to Lead on Day One: Predicting Novice Principal Effectiveness with Information Available at Time of Hire

Jason A. Grissom
Vanderbilt University

David S. Woo
University of Utah

Brendan Bartanen
Texas A&M University

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Jason A. Grissom[*]
Vanderbilt University

David S. Woo
University of Utah

Brendan Bartanen
Texas A&M University

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High rates of principal turnover nationally mean that school districts constantly are called on to recruit and select new principals. The importance of a school's principal makes choosing candidates who will be effective paramount, yet we have little evidence linking information known to school districts at time of selection to principal's future job performance. Using data from Tennessee, we test the degree to which observable information about novice principals from prior to entry, including qualifications, work history information, and effectiveness in prior roles, predicts practice ratings assigned to them in their initial years in the principalship. We find that educational attainment and years of experience in other jobs hold little predictive power. Performance ratings received as an assistant principal (AP) or teacher, however, do predict principal effectiveness. Moreover, APs who previously worked in schools with highly rated principals are more likely to be effective upon transitioning into the principalship.

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Staffing schools with effective principals is an important goal for states and school districts. From their first day on the job, principals serve a variety of central functions in schools, including managing resources, leading the instructional program, conducting classroom observations and providing teachers with feedback, hiring and retaining teachers, overseeing student discipline, ensuring school safety, and communicating with parents and other stakeholders, and their effectiveness in these roles is a key input to school success (Bartanen, 2020; Coelli & Green, 2012; Dhuey & Smith, 2014; Grissom et al., 2015; Liebowitz & Porter,

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2019). Yet identifying *which* candidates for school leadership positions are likely to be effective once they are hired is challenging, particularly for the brand-new principals who lead approximately 10% of schools nationally each year (Goldring & Taie, 2018). These principals are disproportionately located in high-poverty, low-achieving schools, where effective leadership matters most (Grissom, Bartanen, et al., 2019).

A challenge for school districts seeking to identify candidates who will be effective principals is that capacity for school leadership cannot be observed directly. Districts must rely on proxies. Unfortunately, we have little sense of which proxies are likely to be good signals of future performance. Few studies have attempted to link pre-service characteristics to performance measures once the principal is on the job, beyond examination of degree attainment or which leadership preparation program a candidate attended (e.g., Clark et al., 2009; Grissom, Mitani, et al., 2019). These studies generally conclude that the signal in such measures is weak, meaning that they are not useful as screening tools in principal selection processes. This challenge parallels one for selection of teachers, where "résumé information" similarly explains little variation in future effectiveness, though several recent studies have made some headway in improving predictions with formal application screening tools (Bruno & Strunk, 2019; Goldhaber et al., 2016). Such screening tools are not yet in common use for school leaders.

One area in which principal hiring processes could be advantaged relative to teacher hiring processes, at least for candidates brand-new to the role, is in the availability of information about job performance in other roles in education. Most new principals have been assistant principals (APs), and nearly all have been teachers. Particularly with the widespread adoption of multiple measures-based educator evaluation systems, districts often have access to carefully collected information about educators' on-the-job performance (Grissom & Youngs, 2016;

Steinberg & Donaldson, 2015). To the extent that they measure skills or behaviors that translate into running a school, performance metrics such as teacher value-added or AP evaluation ratings could contain valuable information about the likelihood of future success as a principal. However, research on the predictive power of performance in other educator roles is scarce.

This study undertakes a systematic examination of the predictive power of pre-service characteristics for principal performance in the initial years on the job, with an eye toward measures that districts can use to guide principal selection. We ask: to what extent does information likely to be available to school districts at time of hire, such as standard educational attainment, work history, and performance in prior roles, predict job performance for early-career principals? We leverage longitudinal personnel data from Tennessee, a particularly useful setting for this examination because of the state's investment, since 2011-12, in collecting multiple measures of principal performance via a statewide educator evaluation system. We focus primarily practice ratings given to principals by their supervisors using a standardized rubric, which prior research has shown to correlate with a variety of other performance measures (Grissom et al., 2018). We predict ratings for novice principals using measures gleaned from administrative data, meaning from a data source district officials presumably could also access in making selection decisions. Recognizing that we only observe performance outcomes for principals who actually assume the role, we estimate these relationships via both ordinary least squares and a two-step model that makes use of variation in competition for vacancies, measured by the number of potential local applicants per vacancy, to correct for sample selection.

We find that few pieces of standard résumé information, such as highest degree or years of experience as a teacher or AP, predict future leadership performance. Prior experience at the same school level (e.g., in high school) similarly contains little signal, though prior experience in

a high-enrollment school does appear to predict success running a large school. For new principals coming into the role from the assistant principalship, the best predictor of success is the rating of their practice as an AP assigned by their supervising principal. We also find some evidence that leaders who were higher-performing when they were teachers are more effective. Also, for leaders entering from either AP or teacher roles, the effectiveness of the principal with whom they most recently worked also predicts performance. This last finding may suggest the importance of being mentored by a high-performing leader, or the skills gained from observing effective leadership practice.

Potential Signals of Capacity for Leadership

School districts benefit from selecting and hiring high-quality principals. There are documented payoffs for teacher and student outcomes from bring an effective leader into a school (Coelli & Green, 2012; Grissom et al., 2015). Moreover, hiring an ineffective leader is costly, not only because less effective leaders are less able to improve schools but because less effective leaders are substantially more likely to turn over, which has its own consequences for schools and incurs replacement costs for the district (Bartanen et al., 2019; Levin & Bradley, 2019; Miller, 2013).

Accurately anticipating which principal candidates are likely to be effective, however, is difficult. School leadership is complex work that demands knowledge and skills across many domains, including instruction, organizational management, building climate and culture, and public engagement, among others (e.g., Grissom & Loeb, 2011; Leithwood et al., 2004; Sebastian & Allensworth, 2012). Direct measures of capacities across so many domains are challenging to collect. Licensure examinations, required by most states, purport to provide such

measures, but research suggests that licensure test scores contain little signal about future principal performance (Grissom et al., 2017).

Although some of the capacity that is required for success in school leadership is due to innate ability, capacity is also built through experiences that provide opportunities for learning the required knowledge, skills, and behaviors. School districts typically have access to information about those experiences. Pre-service education is an example; candidate résumés will include degree attainment information and where degrees were obtained. Prior evidence on the predictive power of this information is mixed. Studies find that higher degree attainment is associated with some principal performance outcomes but not others (e.g., Bastian & Henry, 2015; Dhuey & Smith, 2014; Grissom et al., 2018; Grissom & Loeb, 2011), though studies generally have not focused specifically on degrees held by new principals (cf. Bastian & Henry, 2015). Research on programs attended or their characteristics similarly does not produce robust conclusions. Studies have found find no evidence that competitiveness of undergraduate institution is associated with principals' ability to raise student test scores, for example (Clark et al., 2009; Dhuey & Smith, 2014).[1] Potentially more relevant is information about leadership preparation programs, which typically are university-based graduate programs though can be offered by other providers. Here, general characteristics like whether the program is in-state or how competitive its admissions are appear to have little signal (e.g., Bastian & Henry, 2015; Dhuey & Smith, 2014). Although some research suggests benefits to performance from attending an "exemplary" program, defined by its offerings (Darling-Hammond et al., 2010; Orr & Orphanos, 2011), efforts to link specific preparation programs to later outcomes typically have found either little evidence that principals from touted programs produce different outcomes or

[1] See Grissom et al. (2015) on the challenges of measuring principal performance by student test score gains.

that individual programs fail to provide consistent signals about principal effects across outcomes (e.g., Clifford et al., 2016b; Corcoran et al., 2012; Grissom, Mitani, et al., 2019).

Districts can also observe principals' work history information. Principals vary in how long they were a teacher, whether and how long they were an AP, and what other district roles they may have held. Studies generally have not found that total time in teaching correlates with principal performance outcomes (e.g., Clark et al., 2009; Grissom et al., 2018). Time as an AP seems more relevant to principal work, though the few studies linking principal performance (measured by student test score gains) to AP experience generally find no clear relationship (Bastian & Henry, 2015; Clark et al., 2009).

The Bastian and Henry (2015) study is noteworthy for taking a more nuanced look at new principals' work trajectories prior to entering the principalship and linking characteristics of those trajectories to performance, at least as measured by students' gains on state standardized tests in the principals' initial years on the job. In particular, they examine the school contexts in which new principals had prior experience, especially as an AP. They find some evidence that more effective high school principals previously had been a high school AP. They also find robust evidence that serving as an AP in a school with higher value-added to student achievement predicts seeing higher gains as a principal. The authors interpret this finding as suggesting that APs learn about effective school leadership from exposure.

A different kind of work history data about prospective principals to which districts are likely to have access is job performance in earlier roles in public education. Collection of such information has been facilitated by the widespread adoption of multiple-measures educator evaluation systems in the last ten years. For teachers, these systems typically collect classroom observation ratings and metrics based on student achievement, such as value-added. To the

extent that strong performance in the classroom translates into better leadership—perhaps because instructional leadership depends on understanding of successful instructional practice—teacher performance information may be valuable in principal selection decisions. To this point, in a study of data from Washington state, Goldhaber and colleagues (2019) find some evidence that principals' value-added to student achievement is higher when their value-added was higher when they were in the classroom.

For other educators, such as APs, student achievement-based measures may not be relevant, but districts can still collect ratings of their practice. In Tennessee, for example, APs are rated by their supervising principals using the same standardized rubric of leadership practices that principals themselves are rated on by their own supervisors. If principals provide accurate ratings of these practices, which according to the rubric are the same practices required of effective principals, districts should be able to glean valuable insight into a principal candidate's leadership capacity from these scores. We know of no research, however, that attempts to link AP practice ratings to their future success as a principal.

Data and Measures

We make use of longitudinal administrative data files including information on all public education personnel in Tennessee from the 2001-02 to 2016-17 school years, provided by the Tennessee Department of Education (TDOE) via the Tennessee Education Research Alliance at Vanderbilt University. These files contain information about employees' background and professional characteristics, including gender, race/ethnicity, years of experience, highest degree earned, and employment role and location. From 2011-12 forward, we can also access educator evaluation information, which we discuss further below. For most principals in this time period, we can also link to files identifying which university-based leadership preparation program they

completed. We merge these data with information on the characteristics of the schools and districts from TDOE and the National Center for Education Statistics' Common Core of Data (CCD) files. To construct some performance measures, we also access student-level enrollment and test score files, which contain information about student background, their teachers and schools, and their test score performance each year in the state's standardized testing program.

From the personnel files, we extract multiple job history measures, including what role the principal held immediately prior to moving into the principalship and years of experience in prior roles. The staff data contain a variable for total years of experience as an educator in Tennessee public schools but not time in individual job roles. However, we can construct job-specific experience measures for educators we observe moving into a role beginning in the second year of the data (2002-03). Because our models rely on the period beginning in 2011-12 (coinciding with the implementation of the state's educator evaluation system), we can construct good prior-job experience measures—most importantly, time as an AP—for nearly all new principals in the analysis. We top-code our AP experience measure at 11 years (the number of years between the start of the data file and the first year of analysis) and use categorical indicators. To construct a measure of teacher experience, we subtract from total the number of observed years of experience in any non-teaching role from the staff data's measure of total years of experience as an educator.[2]

The personnel files also permit us to capture measures of the working environment of new principals' prior positions. Nearly all were in school-based positions in the years prior to becoming a principal. For these educators, we observe school characteristics, such as school enrollment size, school level (e.g., elementary), and student demographic composition (e.g.,

[2] Alternatively, we use observed years of teacher experience from 2002 forward, and our main findings are qualitatively similar.

proportion who are eligible for free or reduced-price lunch). We also observe school achievement levels, which we summarize with a standardized achievement index measuring a school's average student scores across all state-mandated assessments administered in that school,[3] and school-level value-added (VA) in math and reading, which we combine. In addition, we use the staff files to identify the principal of the school in which any new principal most recently worked, permitting a linkage to that principal's characteristics and evaluation information.

Measuring Principals' Current and Prior Job Performance

Our primary outcome measure comes from supervisors' ratings of principals' practice. Beginning in 2011-12, Tennessee implemented a statewide educator evaluation system, called the Tennessee Educator Acceleration Model (TEAM).[4] Under this system, principals receive practice ratings twice each year from district leaders—the superintendent or his or her designee—who have been trained to rate principals using a rubric derived from the Tennessee Instructional Leadership Standards. These ratings comprise 50% of the overall evaluation score.[5] The TEAM rubric contains 22 indicators of leadership practice grouped (as of 2016-17) into 4 domains: Instructional Leadership for Continuous Improvement, Culture for Teaching and Learning, Professional Learning and Growth, and Resource Management. While the number of

[3] Students in grades 3-8 take yearly assessments in reading, language arts, mathematics, and science. High school students take end-of-course assessments in Algebra I, Algebra II, English I, English II, English III, Biology, Chemistry, and U.S. History. We construct the achievement index by standardizing student-level scores within grade and year (subject and year for EOC tests), then computing weighted school-level mean scores. Beginning in 2015-16, Tennessee transitioned to a new testing system, called TNReady. Due to implementation challenges, there was no testing in grades 3-8 in 2015-16. To avoid dropping this year, we impute in 2015-16 index by averaging the school's index from 2014-15 and 2016-17.

[4] The state also approved alternative evaluation systems, such as COACH and TIGER, that are employed by a few school districts. These systems also feature standardized rubrics that cover similar competencies. Approximately 85% of principals are in districts that adopted TEAM.

[5] The remainder of the evaluation score comes from school-level value-added (35%) and a school achievement measure (15%).

content of these indicators and domains has changed several times since 2011-12, prior research on these scores shows that, regardless of the specific indicators included on the rubric in a year, the indicators are so highly inter-correlated that they can be reduced to a single underlying performance score using factor analysis (Grissom et al., 2018). That is, the supervisors' ratings do not differentiate areas of principal performance and instead identify a single underlying principal effectiveness construct. For this analysis, we use the mean observation rating (standardized by year) as a summary measure of effective leadership practice—at least from the point of view of the principal's supervisor.[6]

We supplement our examination of principal practice ratings with an analysis of student achievement gains. Essentially, we estimate student-level achievement models with extensive covariates, including lagged achievement, and principal-by-school fixed effects.[7] We take the coefficients on the principal-by-school fixed effects—the schools' net achievement gain during that principal's tenure, adjusted for covariates—to be a rough measure of principal effectiveness, though we note that researchers have raised numerous questions about the validity of existing approaches to principal value-added models as measures of principal performance (see Grissom et al., 2015), which is why we emphasize the practice ratings as our main outcome. Still, we offer some analysis of principal-by-school VA as a closer comparison to the test score-based models of principal performance estimated in prior studies.

[6] An alternative to the mean observation rating is to factor-analyze the indicators to create a prediction for each principal. The factor score is almost perfectly correlated with the mean rating, however ($r = 0.99$). For simplicity, and to include principals from districts with alternative state-approved observation rubrics (for whom we do not have indicator-level data) we use the mean rating.

[7] Specifically, we regress a student's current-year standardized achievement score on a cubic polynomial of their prior-school scores in math, reading, and science, a cubic polynomial of their prior-school attendance, their demographic characteristics (race, gender, special education and gifted status, a flag for repeating the grade, a flag for switching schools during the current school year), school-by-year averages of the student characteristics, grade-by-year fixed effects, and principal-by-school fixed effects.

Some analyses also make use of new principals' performance in prior educational roles. One is performance as an assistant principal (AP). APs, like principals, receive practice ratings as part of TEAM. These ratings use the same rubric as principals' ratings, though APs typically are evaluated by their own principal, rather than a district supervisor. For principals who have been APs, we use the mean practice rating for the most recent year that such a rating was assigned. We also examine effectiveness as a teacher. We capture most recent classroom observation score if it is available, though only a subset of novice principals in our data had been classroom teachers since TEAM was initiated in 2011-12.[8] We also construct an average value-added to student achievement with a model of student test scores as a function of students' prior achievement and demographic characteristics, classroom characteristics, school characteristics, and teacher fixed effects.[9] Each teacher's average effect is estimated using any available years of data beginning in 2007-08, the first year for which we can link students and teachers reliably. This measure can only be created for teachers who had taught in a tested classroom since 2007-08, which omits many novice principals who had either taught only untested grades/subjects or who had held only non-teaching roles (e.g., assistant principalships) in the intervening years.

Sample

Tennessee is home to approximately 1,700 schools in 147 school districts. Our main analyses focus on first-year principals (i.e., those with no prior principal experience), of which the state employs approximately 150 each year. In robustness checks, we also examine outcomes for principals in years 1–3 on the job. Our analysis period begins in 2011-12, which is the first

[8] Approximately 43% of novice principals in our sample had been teachers at some point since TEAM's implementation.

[9] The exact covariates in these models mirror those described in footnote 7 for the principal-by-school models, except that we additionally control for classroom averages of the student covariates, and we control for most recent prior-year test scores and attendance rather than limiting to a prior school outcome.

year of the state's reformed educator evaluation system. Restricting to this later period also helps to ensure the accuracy of the job-specific experience measures for school administrators.

Table 1 describes first-year principals in these years. Sixty-one percent are female. Just 21% are Black, with nearly all of the remaining new principals reporting white as their racial category.[10] The average new principal is 44 years old and holds a degree beyond a Master's degree. Roughly five out of every six new principals enter the position from an AP role, and 12 percent enter the position directly from being a teacher. Only a small number of new principals occupied other positions (e.g., central office, school counselor) in the year prior to entering the principalship. While most new principals in Tennessee were also once APs, these spells are typically short, with the average new principal having just 3.7 years of AP experience. However, they have considerably more experience as teachers (11.6 years, on average). Almost 60 percent of new principals are in elementary schools, with demographic characteristics that closely mirror those for the entire state, on average.

Table 1 also summarizes prior effectiveness of new principals. New principals who were APs were rated above average (0.12 SD above the mean score for all APs) in their last year in the role. Among those entering from teaching, their most recent classroom observation score was substantially above average (0.64 SD). New principals with prior teacher VA scores were also above the statewide mean, on average (0.32 SD). In contrast to this relatively high performance in their earlier roles, new principals tend to score low in the distribution of principal ratings in their first year—about half a standard deviation below the statewide average. Their principal value-added is just above the statewide average.

Methods

[10] Only about 1% of Tennessee principals report another racial identification or ethnicity, and there are concerns about the accuracy of this information as reported by some school districts.

We model performance in the first year in the principalship as a function of principals' personal characteristics, characteristics of their current schools, and multiple potential signals of their leadership capacity at the time they are hired in years 2012-13 to 2018-19. We start our analyses with the 2012-13 school year because our analyses make use of signals in the prior school year, and the evaluation data is available starting in 2011-12. Our main model is described by equation 1:

$$Y_{idt} = Signal_{id,t-1}\beta_1 + X_{idt}\beta_2 + S_{idt}\beta_3 + \theta_t + \tau_d + \varepsilon_{idt} \quad (1)$$

where Y_{idt} is first-year performance measure (the first-year practice rating from the evaluation system or the principal VA score) for new principal *i* in district *d* at time *t*. $Signal_{id,t-1}$ is a set of potential proxies for school leadership capacity for principal *i* as of time *t-1*. These potential signals include measures of prior work experience, degree attainment, preparation program attended, measures of experience in different kinds of school environments, and performance measures from their time as an AP and teacher. We include a set of controls for personal characteristics, X_{idt}, which includes the principal's race[11], gender, age, and age-squared. The model also controls for school characteristics S_{idt} for the school that a principal works in during his or her first year. The school characteristics we include are the proportion of students that are eligible for free or reduced priced lunch, proportion of students that are Black, proportion of students that are Hispanic, proportion of students that received special education services, school size (in 100s), achievement level, grade level, and locale type. We include these school covariates because prior research has suggested that these environmental factors can influence principal evaluation scores (Grissom et al., 2018). We also include a time effect θ_t to account for

[11] We operationalize race as *Black* and *Not Black* because almost all principals newly hired principals in Tennessee during the period of our study are either black or white. Gender is operationalized as either male or not male.

statewide trends in or shocks to principal evaluation ratings. We cluster standard errors at the district level.

We estimate ordinary least squares models with and without district fixed effects (τ_d). Models with fixed effects account for time-invariant characteristics of districts that may relate both to principal effectiveness and the leadership signal measures. For instance, some districts may be more likely to give higher or lower observation scores to both APs and principals, leading to potential bias in correlations among scores, given that most principal hires are within-district.

We extend these models in two ways. First, we re-estimate the same models for principals in their first three years in the principalship. These models have larger samples, which can help with precision, but, given the importance of on-the-job learning for performance in principals' initial years of leadership, may have the disadvantage of attenuating the association between potential predictors of performance and the performance measure itself. However, we found minimal substantive differences between models relying on the first three years on the job and the single-year models we present below. Thus, for parsimony, we omit the three-year results here but can make them available upon request.

Second, we address potential sample selection bias that arises from the fact that we cannot observe principal performance for educators who are never hired into a principal position. For example, we might be concerned that districts tend to promote APs who receive higher evaluation ratings, which could bias the estimated relationship between prior evaluation information and principal performance in our sample of early-career principals.[12] We address the

[12] In particular, we might be concerned that districts prefer to promote higher-scoring APs, such that the lower-scoring APs that do end up in our sample (i.e., enter the principalship) are unrepresentative of lower-scoring APs, more broadly. If lower-scoring APs who enter the principalship are strong candidates in other (unobserved) dimensions, our estimates of the relationship between AP performance and principal performance will be attenuated.

potential for such bias with a Heckman selection model (Heckman, 1979). The first stage of the selection-correction model estimates the likelihood that eligible education personnel (i.e., those with administrator licenses) are selected into the principalship with a probit model. The second stage then models first-year principal performance (as in equation 1). We simultaneously estimate the two stages with the same potential leadership capacity signals and covariates using full information maximum likelihood. The first stage also includes the ratio of principal openings that year to the number of individuals in the district that have principal certification; in other words, when this value is higher, vacancies are less competitive, so it should be positively correlated with the likelihood that an educator becomes a principal but unrelated to their effectiveness as a principal, conditional on covariates. It can thus be excluded from the second equation, facilitating identification.[13] We exclude district fixed effects from these models because our instrument does not vary much over time within districts. These selection-corrected estimates allow for a check on the trustworthiness of the main estimates.

Predicting Early-Career Principal Performance

Experience and Education

We begin by testing the degree to which simple measures of prior work experiences signal principal effectiveness in the first year. Table 2 examines pathway into the principalship (columns 1–2) and length of experience in AP and teaching roles (columns 3–4). All models include principal demographics and school characteristics, though for parsimony those results are not tabulated (see Appendix Table 1 for full results). Even-numbered models include district fixed effects.

[13] Our substantive findings are very similar when removing this exclusion restriction but generally have larger standard errors.

Column 1 shows no evidence that principals coming from different roles perform differently in their first year in the principalship, on average. In no case can we reject the hypothesis that a coefficient is statistically different from zero at conventional levels (principals entering directly from teaching are the omitted group). We highlight that the difference between the two largest groups of new principals—those coming from AP roles and teaching—is very small and not statistically significant. Results are very similar with district fixed effects in column 2. Most recent prior position does not appear to be a good signal of future performance, though we note that with more than 80% of new principals coming from AP positions, our estimates are somewhat imprecise.

In columns 3 and 4, we replace binary prior-job indicators with job-specific years of experience measures. To allow for non-linearities, we operationalize AP and teacher experience as a series of experience categories; the omitted categories are zero years of AP experience and 0-3 years of teacher experience.[14] Experience in other roles is included as a continuous predictor. Again, we find no evidence that new principals with different amounts of prior experience in key roles is informative about their performance. There is no clear pattern in the coefficients, and none are statistically significant.

Table 3 examines novice principals' practice ratings as a function of their educational attainment. We examine both highest degree attainment and the preparation program that the principal attended. Tennessee has 19 leadership preparation programs, but many are very small and produced few new principals over the time span of our data. Following Grissom, Mitani, and Woo (2019), we show results for the 12 largest programs, plus an omnibus group for small

[14] Unless an exception is granted, the Tennessee Department of Education requires three years of teaching experience for an administrative license.

programs. We also combine principals who attended a preparation program outside the state. We choose program 8, which has the most principals in our sample, as the reference group.

We find no evidence that what degree a new principal holds predicts their performance rating, whether or not we condition on preparation program attended. Columns 4 and 6 offer some evidence that a principal's preparation program is associated with their first-year performance when conditioning on district fixed effects, shown by the joint test of significance for the program indicators; these indicators are not jointly significantly in in models without district fixed effects. Figure 1 plots the estimates for each program from the fixed effects model. The 95% confidence intervals show that small samples from most programs make it difficult to rule out zero even among programs at the ends of the distribution of effects estimates.

Other Work History Measures

We next turn to experience at the same grade level as the school the new principal leads. That is, we ask whether prior experience in an elementary school, for example, predicts higher early-career performance for elementary school principals. Table 4, Panel A shows multiple ways of operationalizing this experience: an indicator for ever working at the same level in any role, the number of years of experience we observe at the same level, an indicator for having any AP experience at the same level, the number of years of that AP experience, and whether the most recent school in which the principal worked was at the same level. We show results with and without district fixed effects. Results are consistent across models: we find no evidence that prior experience at the same grade level predicts performance ratings in the first year. In other analyses (not shown), we examined these patterns separately for elementary and secondary schools, and results were similar.

Panel B conducts a similar exercise, this time for school size. We define *similar size* to be falling into the same tercile[15] of enrollment size as the current school. Perhaps, for example, prior experience in a large school benefits performance in running a large school. We show similar operationalizations for size as for level in Panel A. Column 7 of Panel B suggests that there is a significant and positive relationship between years of experience as an AP in a similarly sized school and practice ratings as a first-year principal. Similarly, Column 9 shows that there is a significant and positive relationship with experience at a similarly sized school in the year prior to becoming a principal. However, neither of these associations holds when district fixed effects are included in the model (columns 8 and 10). Moreover, when we use quartiles and quintiles of school size to define similarity as a sensitivity check, we do not find significant associations between experience in schools of similar size and practice ratings, nor do we find clear evidence of an association when we look separately for small or large schools.[16] We conclude that this kind of experience is at best a weak signal of a principal's initial job performance.

Next, we consider whether past experiences in high-performing schools or with high-performing leaders predicts novice principal performance. Such a relationship could emerge either because educators learn about how to lead a school well in such environments or because of selection—that is, high-ability future leaders may be more likely to be hired into educational roles in such schools. For these and all subsequent analyses, we restrict our samples to the 91% of new principals who were either an AP or teacher in Tennessee in the year prior to becoming a

[15] Schools in the lowest tercile have fewer than 439 students enrolled, and schools in the largest tercile have more than 689 students enrolled.

[16] We conducted these analyses using quartiles and quintiles of school size and found that the coefficients were not consistent across different operationalizations of same school size. These results for quartiles and quintiles are reported in Appendix Table 2. Schools in the lowest quartile have fewer than 385 students, and schools in the largest quartile have more than 782 students. Schools in the smallest quintile have fewer than 348 students, and schools in the largest quintile have more than 855.

principal because new principals coming from other roles typically were not working in schools, meaning we are missing prior-job context information (they also often do not have performance information from the statewide educator evaluation system, which we examine later).

Table 5 considers three different indicators of school or leadership performance in the new principal's prior school: the school's value-added to student achievement, the school's achievement level, and the principal's practice rating. We show results separately for each of the three measures of prior school performance in columns 1 through 6 (with and without district fixed effects), then include them together in columns 7 and 8. In these models, we bootstrap standard errors because school VA is an estimated value, a practice we continue for subsequent analyses. While our preferred models pool principals coming from AP and teaching positions, we find qualitatively similar patterns when separating them, though smaller samples make the teacher estimates less precise (see Appendix Table 3).

We find that the prior school's VA (columns 1 and 2) and the prior principal's practice ratings (columns 5 and 6) separately predict the performance as a first-year principal, with and without district fixed effects. The achievement level of the prior school shows less robust evidence of an association; the coefficient is small and not statistically significant once district fixed effects are included (column 4). When we include all three measures in the model simultaneously (columns 7 and 8), we find that only the prior principal's practice rating remains statistically or substantively meaningful. Column 8, for instance, shows that a 1 SD increase in the prior principal's observation score is associated with a 0.13 SD increase in first-year principal observation score ($p < 0.001$). This result suggests that the salient predictor of new principal performance is having worked for an effective principal in your prior school, rather than merely working in a school with high test scores or growth.

Performance in Prior Educational Roles

In this section, we consider the extent to which measures of novice principals' own past performance (i.e., performance in prior positions as an AP or teacher) signal their first-year performance as a principal. Here, we can draw on three measures of prior effectiveness: AP practice ratings, teacher observation ratings, and teacher VA. For AP practice ratings, we use the mean rating from the year prior to becoming a principal. For teacher observation ratings, we use the most recent available rating, regardless of whether we observe it in the most recent year. Finally, we estimate an average VA measure by leveraging all available years of test score data.

Results for AP practice ratings appear in Table 6. We find a consistent positive relationship between past AP performance and new principal performance; column 2 (which includes district fixed effects) shows that a 1 SD increase an AP observation scores is associated with a 0.20 SD increase in first-year principal observation score. Columns 3 and 4 show that this pattern holds even when we account for measures of prior school performance. In particular, column 4 shows that both AP performance and the performance of the supervising principal predict first-year principal performance, conditional on one another. For districts making principal selection decisions, there appear to be independent benefits from hiring more effective APs and APs who worked under more effective principals.

Table 7 turns to teaching performance. Columns 1–2 consider mean VA over all years for which we can calculate this value. In both cases, we find evidence that teachers with higher VA to student achievement are more effective first-year principals, with a 1 SD increase in VA corresponding to about a 0.14 SD increase in practice ratings in the first year ($p < 0.05$). Columns 3–4 add the mean classroom observation rating, which are also positive but not statistically significant at conventional levels, perhaps due to the smaller sample of new

principals for whom we observe these ratings. Although still positive, value-added is no longer statistically significant in these models, reflecting both smaller samples and positive correlations with observation ratings. The last two columns add the prior school's VA, the prior school's achievement level, and the prior principal's practice rating. In model 6, both the mean teacher VA and observation coefficients are small and not statistically significant. The prior principal's practice rating, however, is positive ($\beta = 0.13$, $p < 0.001$), reinforcing the finding from Table 6 that the performance of an educator's most recent principal signals that educator's own propensity for success in the principal's office, even accounting for their own past performance.

Table 8 shifts to examining a different measure of novice principal performance: VA to student test scores in math and reading. For parsimony, we show only models with district fixed effects. Panel A shows the estimated relationship between principal VA and AP practice ratings. When AP practice ratings are the only prior performance measure included in the regression, we find that a 1 SD increase in AP practice ratings is associated with a 0.06–0.09 SD increase in principal VA ($p < 0.05$ in both subjects). However, inclusion of prior school performance makes this coefficient not statistically significant. Instead, we find a large positive association between prior school value-added and principal value-added in both subjects, similar to Bastian & Henry (2015). A one standard deviation increase in the prior school's VA is associated with a 0.27 SD increase in principal VA in math and 0.28 SD in reading.

Panel B of Table 8 looks instead at the performance of novice principals when they were teachers. We do not find strong evidence of a relationship between teacher VA or observation rating and principal VA in math. In reading, however, we find that a 1 SD increase in average VA as a teacher is associated with an increase in principal VA of approximately 0.1 SD. Average teacher observation ratings are also positively correlated, though not statistically significant at

conventional levels. The prior school's VA remains a consistent predictor of principal VA in both subjects in these models.

Results from Selection-Corrected Models

As described in the methods section, one potential concern with these analyses is that the relationship between measures of qualifications and experiences at time of selection and performance as a principal may be biased by sample selection. To account for this possibility, we re-estimate the main models with a Heckman selection correction, using a measure of the competitiveness of the principal vacancy as an instrument for whether an educator with principal certification actually enters the principalship.[17]

Results from selection-corrected models, which are reported in Appendix Tables 5–9, generally suggest that sample selection bias is not a major concern in modeling new principal performance. The inverse Mills ratio from the first-stage model of selection is seldom statistically significant in the second-stage model of first-year performance, thus producing results that are very similar to those from the uncorrected models.

To illustrate, Table 9 shows the selection-corrected estimates that correspond to Table 6, column 3, which tests whether the AP practice rating predicts the first-year principal practice rating. The AP practice rating is positive and statistically significant in the first stage, suggesting that higher-scoring APs are more likely to be hired as principals. Also, as in the appendix models, the competitiveness measure predicts selection in the expected direction; where there are more openings per educator with principal licensure, an individual's probability of being hired as a principal is higher. The inverse Mills ratio, however, is small in magnitude and not statistically

[17] With one exception, this instrument is statistically significant in every selection equation.

significant in the second stage. Further, the coefficient on the AP practice rating is 0.24 in column 2, which is very similar to the coefficient reported in Table 6 (0.23).

Discussion and Conclusions

Choosing new school leaders with the best chance for success in the position from the beginning is an important objective for school systems, especially given that novice principals are more likely to lead schools with larger numbers of low-income students and lower levels of achievement (Grissom, Bartanen, et al., 2019). Even accounting for selection, our analysis suggests that several metrics available to school districts at the time that a new principal is hired signal early-career performance. In particular, although length of experience in prior roles is not a predictor, success in those roles is. Among new principals entering from AP roles, the practice ratings they were given as APs in the past strongly predict their current practice ratings, and may predict value-added as well, though to a lesser degree. In other words, it appears that APs who implement successful leadership practices go on to be principals who implement successful leadership practices, on average. This finding makes intuitive sense, given close connections between APs' and principals' job responsibilities. Consistent with Goldhaber et al. (2019), we also find in some models that new principals who were more effective teachers, particularly as measured by their average VA to student achievement, are rated more highly as well, and have higher VA as principals, particularly in reading. We conclude that school districts with access to reliable information about potential principals' performance in prior roles will benefit from making that information integral to decisions about principal hiring.

We also find a robust connection between the practice ratings of the last principal with whom a principal worked—usually as an AP—and the new principal's own practice ratings. This relationship holds even when we condition on the new principal's own prior effectiveness. We

take this as likely evidence that future principals learn from working with, observing, and potentially being mentored by an effective leader in ways that benefit their own future performance. This on-the-job learning builds future capacity in ways that working in a school with a less effective principal does not.

These results sit in an interesting contrast to our findings regarding working previously in a high-VA school, which does not predict future practice ratings (nor does working with highly rated principal previously predict future value-added). Working in a high-VA school, however, does predict principal value-added in both math and reading, similar to a pattern observed in North Carolina (Bastian & Henry, 2015). Bastian and Henry (2015) interpret this connection as evidence that APs in high-VA schools learn something about how a successful school functions that they translate into their principal work. We do not want to make too much of principal VA as a measure of principal performance given concerns about its validity, and sorting may also explain this association. Still, this pattern suggests the possibility that what future principals learn from working with a highly rated principal and working in a high-performing school is different, with the former leading to effective leadership practices (but not necessarily higher growth) and the latter leading to higher test score growth (but not necessarily more effective practices). We consider this pattern an intriguing one for future research.

Perhaps as important as our findings about what characteristics of a novice principal's prior work history serve as signals of future effectiveness are conclusions about which are not. Length of service overall or in particular roles falls into this category; effective novice principals span the range of short and long tenures in AP, teaching, and other roles.[18] That length of time as an AP does not predict effectiveness but that markers of that experience, such as the

[18] Our findings cannot speak to the performance of novice principals with no teaching experience, given that Tennessee licensure requirements mandate at least three years.

effectiveness of the supervising principal, does supports conclusions from prior research that not all AP experiences prepare future building leaders to be successful in the role (Allen & Weaver, 2014). Similarly, level of degree attainment fails to predict effectiveness, though preparation program attended may partially differentiate new principals' ratings (see also Grissom, Mitani, et al., 2019). We do not find much evidence that experience overall or as an AP in a school of the same grade level or of similar size has a significant relationship with performance as a novice principal, nor does past experience in a high-achieving school.

Our results have implications for the design of principal selection processes. In choosing new principals, it appears that districts should place more value on prior performance and with which leaders a potential principal has served than on how long they have served, what degree they hold, and whether they have worked in a similar kind of school environment. Selection processes should be designed to ensure collection of detailed job history information that includes performance metrics and other signals and consideration and appropriate weighting of this information in hiring decisions. Such information can even be collected well in advance of principal selection for use in planning leadership development and preparation. A growing number of school districts have implemented "leader tracking systems" for this purpose, enabling districts to identify future leaders with evidence of the right capabilities early in the pipeline and target them with training opportunities and other experiences to prepare them for a future principalship (Anderson, Turnbull, & Arcaira, 2017). One use of such systems may be to match high-potential future leaders with effective mentors or supervising principals, which our results suggest may be especially valuable leadership development.

Our study faces several limitations. Although our data come from the universe of education personnel in Tennessee, and thus represent leaders across urban, suburban, and rural

contexts, we cannot be sure that our findings generalize to other states, particularly those without the kind of well-developed teacher and leader evaluation system that facilitates our analysis. Even in a state with a system that has been in place for nearly a decade, availability of effectiveness data combines with relatively small samples of new principals entering the principalship each year to place limits on power in some models. For example, the typical multiyear lag between time in the classroom and entry into a principal job means that we can examine teaching effectiveness measures for relatively few new principals. With a longer time horizon, future studies might uncover more consistent relationships between teacher observation information, including specific areas of the job in which a teacher excels, and principal performance. Another limitation is the perhaps narrow operationalizations of principal performance we employ. We rely primarily on practice ratings assigned by supervisors, which prior work suggests capture meaningful aspects of principals' work (Grissom et al., 2018), but other measures, such as feedback from teachers, might provide a more well-rounded view of novice principals' effectiveness.

Future work might delve more carefully into the mechanisms linking—or not—work history measures with principal performance. For example, are more effective teachers more likely to be effective principals because instructional skills and knowledge are useful in instructional leadership, or because those skills are correlated with other kinds of expertise (e.g., time management, relationship building) that makes a principal successful? At the same time, if teachers build those skills over a career, why is teaching experience not correlated with future principal effectiveness? Also, given the context-specific nature of school leadership, why does experience in a similar kind of school, including as an AP, not appear associated with novice principal performance? Our results also suggest that it would be useful to learn more about

mentoring relationships for future principals and how aspiring leaders build skills on-the-job prior to entry into the principal's office, as well as what strategies successful districts employ to develop and select high-quality early-career principals.

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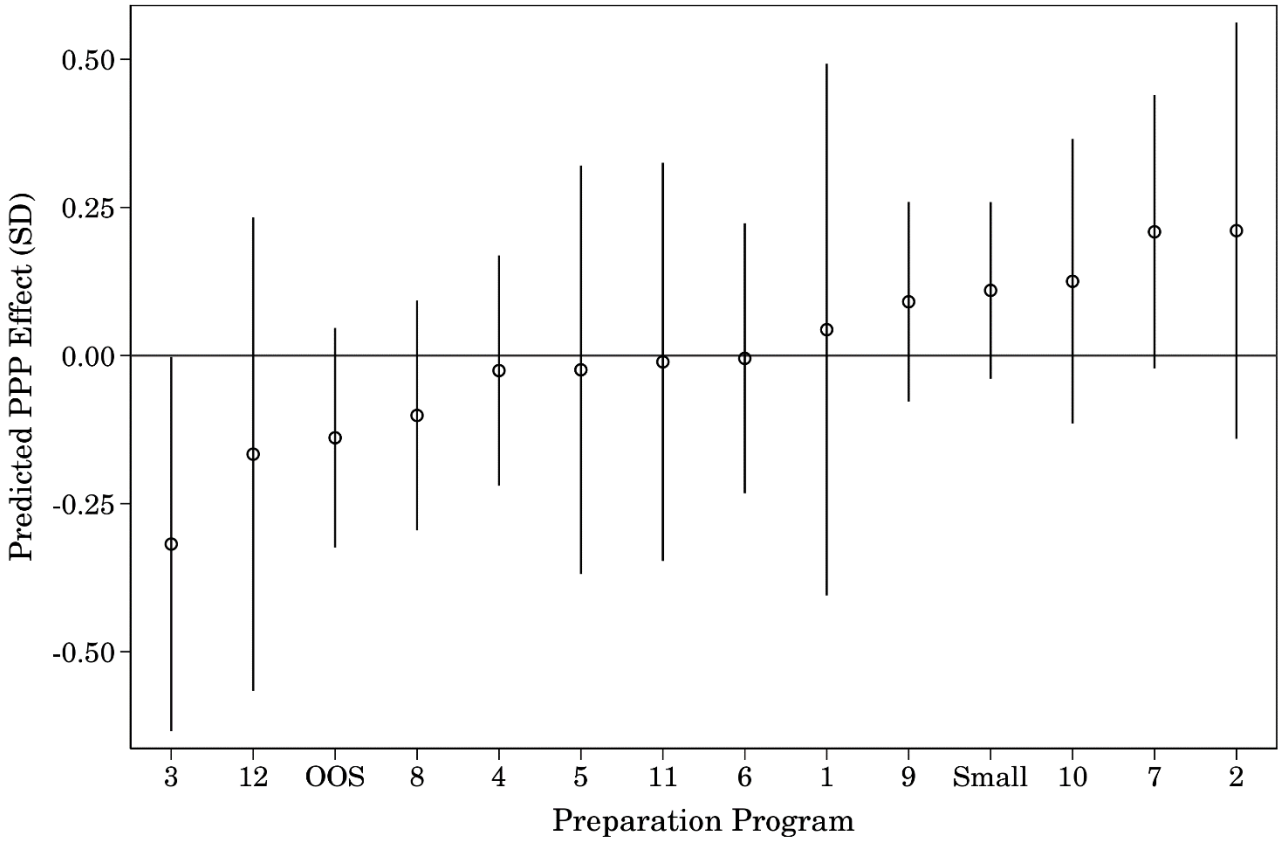
Figure 1. Principal preparation programs and predicted first-year principal practice ratings



OOS = Out-of-state programs, Small = omnibus category for small programs

Table 1. Characteristics of new principals and their schools

	Mean	SD	Min	Max
New principal characteristics				
Female	0.61	0.49	0.00	1.00
Black	0.21	0.41	0.00	1.00
Age	44.10	7.61	28.00	69.00
Highest degree is MA	0.36	0.48	0.00	1.00
Highest degree is EdS or doctorate	0.50	0.50	0.00	1.00
Prior Job: AP	0.83	0.38	0.00	1.00
Prior Job: Teacher	0.12	0.32	0.00	1.00
Prior Job: Student services	0.04	0.19	0.00	1.00
Prior Job: Central office	0.02	0.13	0.00	1.00
Years as an AP	3.69	3.07	0.00	16.00
Years as a teacher	11.64	6.48	0.00	35.00
School characteristics				
Proportion free/reduced lunch eligible	0.56	0.23	0.01	1.00
Proportion special education	0.16	0.09	0.00	0.99
Proportion Black	0.23	0.28	0.00	1.00
Proportion Hispanic	0.08	0.10	0.00	0.76
Achievement index (standardized)	-0.03	0.91	-4.86	2.67
School size (in 100s)	6.34	3.71	0.01	25.48
Elementary school	0.58	0.49	0.00	1.00
Middle school	0.20	0.40	0.00	1.00
High school	0.18	0.38	0.00	1.00
Urban	0.29	0.45	0.00	1.00
Suburban	0.16	0.36	0.00	1.00
Town	0.18	0.38	0.00	1.00
Rural	0.38	0.49	0.00	1.00
Prior performance measures (own and prior school/principal)				
Prior AP practice rating (for those entering from the AP role)	0.12	0.97	-4.52	2.10
Prior teacher observation rating (for those entering from teaching)	0.64	0.79	-2.00	1.85
Prior school value-added	-0.05	0.85	-4.52	2.36
Prior school achievement	0.11	0.88	-5.29	3.15
Prior principal's practice rating	0.07	1.03	-4.97	2.26
Average value-added as a teacher (if observed)	0.32	0.93	-4.04	3.54
Performance measures during first year in principalship				
Practice rating	-0.52	0.91	-5.03	1.99
Principal value-added (math)	0.07	0.98	-3.78	4.64
Principal value-added (reading)	0.06	1.03	-7.52	4.66

New principals N = 1266. Performance measures are standardized.

Table 2. Prior job experiences and novice principal practice ratings

	(1)	(2)	(3)	(4)
Prior Job: AP	0.05	0.07		
	(0.09)	(0.09)		
Prior Job: Student services	0.16	0.04		
	(0.12)	(0.13)		
Prior Job: Central office	0.12	0.22		
	(0.23)	(0.22)		
AP for 1 year			0.03	0.04
			(0.10)	(0.10)
AP for 2 year			0.00	0.05
			(0.11)	(0.09)
AP for 3 year			-0.08	-0.07
			(0.10)	(0.09)
AP for 4-5 years			-0.02	0.04
			(0.10)	(0.09)
AP for 6-7 years			0.07	0.08
			(0.11)	(0.12)
AP for 8 or more years			0.08	-0.01
			(0.12)	(0.12)
Teacher for 4-5 years			0.04	0.11
			(0.11)	(0.09)
Teacher for 6-10 years			0.05	0.06
			(0.09)	(0.07)
Teacher for 11-15 years			0.08	0.10
			(0.12)	(0.10)
Teacher for 16 or more years			-0.02	0.01
			(0.13)	(0.10)
Years in any other TN education job			0.01	0.01
			(0.01)	(0.01)
District fixed effects		X		X
Observations	1266	1266	1266	1266
Adjusted R^2	0.10	0.38	0.10	0.38

Standard errors clustered at school district level are reported in parentheses. All models control for demographics and school characteristics. Full table reported in Appendix Table 1.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 3. Educational attainment and novice principal practice ratings

	(1)	(2)	(3)	(4)	(5)	(6)
Highest degree is MA	0.12	0.09			0.13	0.10
	(0.11)	(0.09)			(0.11)	(0.09)
Highest degree is EdS or	0.03	0.02			0.06	0.04
doctorate	(0.09)	(0.07)			(0.08)	(0.07)
Preparation program 1			-0.19	0.18	-0.19	0.14
			(0.24)	(0.26)	(0.25)	(0.26)
Preparation program 2			0.28	0.34*	0.28	0.31+
			(0.18)	(0.17)	(0.19)	(0.17)
Preparation program 3			0.01	-0.22	0.02	-0.22
			(0.15)	(0.19)	(0.15)	(0.19)
Preparation program 4			0.04	0.07	0.05	0.08
			(0.12)	(0.15)	(0.12)	(0.15)
Preparation program 5			0.31+	0.10	0.30	0.08
			(0.17)	(0.19)	(0.19)	(0.18)
Preparation program 6			0.39+	0.10	0.39+	0.10
			(0.21)	(0.15)	(0.21)	(0.15)
Preparation program 7			0.30+	0.31*	0.30+	0.31*
			(0.18)	(0.15)	(0.18)	(0.15)
Preparation program 8			**Ref.**	**Ref.**	**Ref.**	**Ref.**
Preparation program 9			0.17	0.20	0.16	0.19
			(0.18)	(0.17)	(0.19)	(0.16)
Preparation program 10			0.24	0.22	0.26+	0.23
			(0.16)	(0.16)	(0.15)	(0.17)
Preparation program 11			-0.18	0.08	-0.17	0.09
			(0.18)	(0.15)	(0.18)	(0.15)
Preparation program 12			0.07	-0.05	0.05	-0.07
			(0.24)	(0.27)	(0.24)	(0.27)
Small preparation			0.27+	0.22	0.26+	0.21
programs (combined)			(0.15)	(0.13)	(0.15)	(0.13)
Out-of-state programs			0.07	-0.02	0.07	-0.04
(combined)			(0.12)	(0.15)	(0.13)	(0.15)
District fixed effects		X		X		X
Joint significance of prep programs			0.294	<0.001	0.295	<0.001
Observations	0.10	0.41	0.11	0.41	0.11	0.41
Adjusted R^2	916	916	916	916	916	916

Standard errors clustered at school district are reported in parentheses. All models control for demographic and school characteristics.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 4. Experience at the same grade level and size and novice principal practice ratings

Panel A: Experience at the same level	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any experience at the same level	0.03	0.01								
	(0.08)	(0.08)								
Years of experience at the same level			0.01	0.01						
			(0.01)	(0.01)						
Any AP experience at the same level					0.04	0.04				
					(0.07)	(0.07)				
Years of AP experience at the same level							0.01	0.01		
							(0.01)	(0.01)		
Prior school: Same Level									0.09	0.06
									(0.08)	(0.07)
District fixed effects		X		X		X		X		X
Observations	1162	1162	1162	1162	1162	1162	1162	1162	1162	1162
Adjusted R^2	0.11	0.39	0.11	0.39	0.11	0.39	0.11	0.39	0.11	0.39
Panel B: Experience in similarly sized school	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any experience in similarly sized school	0.01	-0.03								
	(0.08)	(0.07)								
Years of similarly sized school experience			0.01	0.00						
			(0.01)	(0.01)						
Any AP experience in similarly sized school					0.08	-0.00				
					(0.06)	(0.05)				
Years of AP experience in similarly sized school							0.02+	0.00		
							(0.01)	(0.01)		
Prior school: similar size									0.13*	0.04
									(0.07)	(0.07)
District fixed effects		X		X		X		X		X
Observations	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215
Adjusted R2	0.10	0.39	0.11	0.39	0.10	0.39	0.11	0.39	0.11	0.39

Standard errors clustered at school district are reported in parentheses. All models control for demographic and school characteristics. Similarly sized schools are schools in the same tercile of school size. Schools in the smallest tercile of schools have less than 439 students, and schools in the largest tercile of schools have more than 689 students.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 5. Prior school's performance and novice principal practice ratings (teachers and APs)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prior School: Value-Added	0.13**	0.08*					0.03	0.04
	(0.05)	(0.04)					(0.05)	(0.05)
Prior School: Achievement			0.10*	0.03			-0.01	-0.02
			(0.04)	(0.04)			(0.06)	(0.06)
Prior Principal's Practice Rating					0.29***	0.14***	0.27***	0.13***
					(0.04)	(0.03)	(0.04)	(0.04)
Prior Job: AP	0.03	0.07	0.04	0.08	0.00	0.08	-0.02	0.07
	(0.11)	(0.10)	(0.10)	(0.09)	(0.10)	(0.10)	(0.10)	(0.10)
District fixed effects		X		X		X		X
Observations	1147	1147	1174	1174	1029	1029	1004	1004
Adjusted R^2	0.12	0.39	0.11	0.38	0.23	0.41	0.23	0.41

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. All models control for demographic and school characteristics.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 6. AP practice ratings and novice principal practice ratings

	(1)	(2)	(3)	(4)
Prior AP Practice Rating	0.35***	0.20***	0.23***	0.13***
	(0.04)	(0.03)	(0.04)	(0.03)
Prior School: Value-Added			0.04	0.04
			(0.05)	(0.05)
Prior School: Achievement			-0.04	-0.05
			(0.06)	(0.05)
Prior Principal's Practice Rating			0.20***	0.12**
			(0.05)	(0.04)
District fixed effects		X		X
Observations	947	947	813	813
Adjusted R^2	0.26	0.45	0.32	0.47

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. All models control for demographic and school characteristics. Models 3 and 4 also control for experience and education.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 7. Average value-added as a teacher and novice principal practice ratings

	(1)	(2)	(3)	(4)	(5)	(6)
Average Value-Added as a Teacher	0.13*	0.14*	0.10	0.09	-0.01	0.02
	(0.06)	(0.06)	(0.07)	(0.10)	(0.05)	(0.06)
Average Teacher Observation Rating			0.12	0.11	0.08	0.02
			(0.10)	(0.09)	(0.08)	(0.08)
Prior School: Value-Added					0.01	-0.00
					(0.08)	(0.09)
Prior School: Achievement					-0.03	-0.01
					(0.11)	(0.09)
Prior Principal's Practice Rating					0.29***	0.13*
					(0.06)	(0.06)
Prior Job: AP	-0.03	0.09	-0.09	0.05	0.04	0.13
	(0.14)	(0.16)	(0.16)	(0.17)	(0.16)	(0.18)
District Fixed Effects		X		X		X
Observations	461	461	313	313	284	284
Adjusted R^2	0.14	0.41	0.14	0.44	0.25	0.46

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. All models control for demographic and school characteristics. Models 5 and 6 also control for experience and education.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 8. Prior performance and novice principal value-added in math and reading

Panel A: Including AP ratings	(1) Math VA	(2) Math VA	(3) Reading VA	(4) Reading VA
Prior AP Practice Rating	0.09*	0.05	0.06*	0.02
	(0.03)	(0.03)	(0.03)	(0.04)
Prior School: Value-Added		0.27***		0.28***
		(0.06)		(0.05)
Prior School: Achievement		-0.10+		-0.04
		(0.05)		(0.06)
Prior Principal's Practice Rating		-0.02		0.04
		(0.03)		(0.03)
Observations	918	800	914	797
Adjusted R^2	0.31	0.37	0.30	0.32

Panel B: Including Average VA	(1) Math	(2) Math	(3) Math	(4) Reading	(5) Reading	(6) Reading
Average Value-Added as a Teacher	0.05	0.02	-0.04	0.11**	0.10+	0.11*
	(0.06)	(0.07)	(0.06)	(0.04)	(0.06)	(0.04)
Average Teacher Observation Rating		-0.01	-0.09		0.12	0.11
		(0.08)	(0.08)		(0.07)	(0.09)
Prior School: Value-Added			0.22*			0.31**
			(0.11)			(0.11)
Prior School: Achievement			-0.13			0.13
			(0.10)			(0.09)
Prior Principal's Practice Rating			0.04			0.02
			(0.07)			(0.07)
Prior Job: AP	0.08	0.08	-0.01	-0.03	-0.08	-0.12
	(0.16)	(0.15)	(0.20)	(0.15)	(0.19)	(0.18)
Observations	480	324	289	476	320	285
Adjusted R^2	0.31	0.38	0.38	0.29	0.33	0.39

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. All models include district fixed effects and control for demographic and school characteristics. Models 3 and 4 of Panel A, and models 5 and 6 of Panel B also include experience and education.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Table 9. AP practice ratings and novice principal practice rating, with selection correction

	(1)	(2)
Main		
AP Practice Rating	0.35***	0.24***
	(0.04)	(0.03)
Prior School: Value-Added		0.04
		(0.05)
Prior School: Achievement		-0.04
		(0.06)
Prior Principal's Practice Rating		0.20***
		(0.04)
Selection		
# openings/# certified	16.03***	14.89***
	(1.51)	(1.79)
AP Practice Rating	0.10***	0.14***
	(0.03)	(0.03)
Prior School: Value-Added		0.04
		(0.04)
Prior School: Achievement		-0.02
		(0.05)
Prior Principal's Practice Rating		-0.03
		(0.03)
Inverse Mills Ratio	0.07	0.07
	(0.10)	(0.12)
Observations	10788	10116
Selected	947	813
Chi Sq.	429.67	550.27
df M	48	50

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. First-stage model controls for principal characteristics, experience, education, and prior school characteristics; second-stage model controls for principal characteristics, experience, education, and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

APPENDIX

Appendix Table 1. Prior job experiences and novice principal performance

	(1)	(2)	(3)	(4)
Prior Job: AP	0.05	0.07		
	(0.09)	(0.09)		
Prior Job: Student services	0.16	0.04		
	(0.12)	(0.13)		
Prior Job: Central office	0.12	0.22		
	(0.23)	(0.22)		
AP for 1 year			0.03	0.04
			(0.10)	(0.10)
AP for 2 year			0.00	0.05
			(0.11)	(0.09)
AP for 3 year			-0.08	-0.07
			(0.10)	(0.09)
AP for 4-5 years			-0.02	0.04
			(0.10)	(0.09)
AP for 6-7 years			0.07	0.08
			(0.11)	(0.12)
AP for 8 or more years			0.08	-0.01
			(0.12)	(0.12)
Teacher for 4-5 years			0.04	0.11
			(0.11)	(0.09)
Teacher for 6-10 years			0.05	0.06
			(0.09)	(0.07)
Teacher for 11-15 years			0.08	0.10
			(0.12)	(0.10)
Teacher for 16 or more years			-0.02	0.01
			(0.13)	(0.10)
Years in any other TN education job			0.01	0.01
			(0.01)	(0.01)
Black	-0.19**	-0.19**	-0.19**	-0.19**
	(0.07)	(0.07)	(0.07)	(0.07)
Male	-0.14*	-0.16**	-0.14*	-0.15**
	(0.05)	(0.05)	(0.06)	(0.05)
Age	-0.08**	-0.11***	-0.09**	-0.12***
	(0.03)	(0.03)	(0.03)	(0.03)
Age Squared	0.00*	0.00***	0.00**	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Proportion FRPL	-0.09	-0.23	-0.11	-0.27
	(0.25)	(0.19)	(0.24)	(0.18)
Proportion Black	1.14*	0.66	1.11*	0.64
	(0.50)	(0.41)	(0.49)	(0.40)
Proportion Hispanic	0.03	0.09	-0.00	0.08
	(0.23)	(0.22)	(0.23)	(0.24)

Achievement Index	-0.28	0.08	-0.28	0.11
	(0.38)	(0.31)	(0.39)	(0.32)
School Size in 100s	0.24***	0.13*	0.23***	0.13*
	(0.05)	(0.06)	(0.05)	(0.06)
Middle School	0.01	0.00	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
High School	-0.07	0.02	-0.07	0.02
	(0.08)	(0.08)	(0.09)	(0.08)
Suburban	-0.01	0.01	-0.02	0.00
	(0.08)	(0.07)	(0.09)	(0.08)
Rural	0.11	0.04	0.10	0.02
	(0.15)	(0.11)	(0.15)	(0.12)
Town	-0.03	0.01	-0.04	-0.01
	(0.14)	(0.09)	(0.14)	(0.09)
Includes district fixed effects		X		X
Observations	1266	1266	1266	1266
Adjusted R^2	0.10	0.38	0.10	0.38

Standard errors clustered at school district are reported in parentheses. All models include year fixed effects.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 2. Experience at the same size and novice principal performance

Panel A: Quartiles	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any experience in similarly sized school	0.02	0.02								
	(0.08)	(0.08)								
Years of similarly sized school experience			0.00	0.00						
			(0.01)	(0.01)						
Any AP experience in similarly sized school					0.07	0.02				
					(0.08)	(0.08)				
Years of AP experience in similarly sized school							0.01	0.00		
							(0.01)	(0.01)		
Prior school: similar size									0.07	0.01
									(0.08)	(0.08)
District fixed effects		X		X		X		X		X
Observations	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215
Adjusted R^2	0.10	0.39	0.10	0.39	0.10	0.39	0.10	0.39	0.10	0.39
Panel B: Quintiles	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Any experience in similarly sized school	0.01	0.02								
	(0.09)	(0.07)								
Years of similarly sized school experience			0.01	0.01						
			(0.01)	(0.01)						
Any AP experience in similarly sized school					0.07	0.04				
					(0.08)	(0.07)				
Years of AP experience in similarly sized school							0.01	0.01		
							(0.01)	(0.01)		
Prior school: similar size									0.02	-0.01
									(0.07)	(0.07)
District fixed effects		X		X		X		X		X
Observations	1215	1215	1215	1215	1215	1215	1215	1215	1215	1215
Adjusted R2	0.10	0.39	0.10	0.39	0.10	0.39	0.10	0.39	0.10	0.39

Standard errors clustered at school district are reported in parentheses. All models control for demographic and school characteristics. Schools in the smallest quartile of schools have less than 385 students, and schools in the largest quartile of schools have more than 782 students. Schools in the smallest quintile of schools have less than 348 students, and schools in the largest quintile of schools have more than 855 students.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 3. Prior school's performance and novice principal practice rating

Panel A: APs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prior School: Value-Added	0.12*	0.08*					0.03	0.05
	(0.05)	(0.04)					(0.05)	(0.05)
Prior School: Achievement			0.09*	0.01			-0.00	-0.04
			(0.04)	(0.04)			(0.06)	(0.06)
Prior Principal's Practice Rating					0.30***	0.15***	0.28***	0.14***
					(0.04)	(0.03)	(0.05)	(0.04)
District fixed effects		X		X		X		X
Observations	1013	1013	1037	1037	900	900	878	878
Adjusted R^2	0.14	0.41	0.13	0.40	0.25	0.43	0.26	0.44
Panel B: Teachers	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Prior School: Value-Added	0.19	0.10					0.13	0.04
	(0.13)	(0.24)					(0.15)	(0.32)
Prior School: Achievement			-0.05	0.04			-0.29	-0.10
			(0.20)	(0.27)			(0.24)	(0.42)
Prior Principal's Practice Rating					0.26*	0.19	0.25*	0.20
					(0.11)	(0.22)	(0.10)	(0.28)
District fixed effects		X		X		X		X
Observations	134	134	137	137	129	129	126	126
Adjusted R^2	0.06	0.39	-0.01	0.39	0.07	0.38	0.12	0.34

Standard errors bootstrapped over 500 replications and clustered at school district are reported in parentheses. All models control for demographic and school characteristics.

+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 4. Prior job experiences and novice principal performance (selection-corrected)

	(1)		(2)	
	Selection	Main	Selection	Main
Openings per certified personnel	10.29***		10.19***	
	(0.42)		(0.42)	
Prior Job: AP	1.40***	0.15		
	(0.03)	(0.14)		
Prior Job: Student Service	0.22***	0.18		
	(0.06)	(0.14)		
Prior Job: Central Office	0.42***	0.15		
	(0.09)	(0.21)		
AP for 1 year			1.05***	0.10
			(0.05)	(0.14)
AP for 2 year			1.24***	0.08
			(0.05)	(0.14)
AP for 3 year			1.41***	0.01
			(0.05)	(0.15)
AP for 4-5 years			1.45***	0.08
			(0.04)	(0.15)
AP for 6-7 years			1.35***	0.16
			(0.05)	(0.16)
AP for 8 or more years			1.23***	0.16
			(0.05)	(0.15)
Teacher for 4-5 years			0.05	0.04
			(0.07)	(0.13)
Teacher for 6-10 years			-0.05	0.04
			(0.06)	(0.11)
Teacher for 11-15 years			-0.10	0.07
			(0.07)	(0.12)
Teacher for 16 or more years			-0.14*	-0.03
			(0.07)	(0.13)
Years in other education roles			-0.00	0.01
			(0.01)	(0.01)
Inverse Mills Ratio		0.09		0.08
		(0.15)		(0.11)
Observations		66760		66760
Selected		1266		1266
Chi Sq.		173.97		179.99
df M		24		32

Standard errors clustered at school district are reported in parentheses. First stage models control for principal characteristics; second-stage model controls for principal and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 5. Educational attainment and novice principal performance (selection-corrected)

	Selection	Main
Openings per certified personnel	9.86***	
	(0.50)	
Highest degree is MA	0.02	0.13
	(0.05)	(0.10)
Highest degree is EdS or doctorate	0.16**	0.10
	(0.05)	(0.10)
Preparation program 1	0.10	-0.16
	(0.11)	(0.22)
Preparation program 2	0.45***	0.35+
	(0.10)	(0.18)
Preparation program 3	0.00	0.01
	(0.10)	(0.18)
Preparation program 4	-0.06	0.03
	(0.05)	(0.10)
Preparation program 5	0.08	0.32
	(0.12)	(0.22)
Preparation program 6	0.06	0.40**
	(0.06)	(0.12)
Preparation program 7	0.09	0.32*
	(0.08)	(0.14)
Preparation program 8	**Ref.**	**Ref.**
Preparation program 9	0.20***	0.21+
	(0.06)	(0.11)
Preparation program 10	-0.17*	0.23
	(0.08)	(0.15)
Preparation program 11	0.26**	-0.13
	(0.10)	(0.18)
Preparation program 12	-0.08	0.07
	(0.10)	(0.20)
Small preparation programs (combined)	-0.05	0.24*
	(0.06)	(0.11)
Out-of-state programs (combined)	0.04	0.08
	(0.07)	(0.13)
Inverse Mills Ratio		0.21
		(0.16)
Joint significance of prep programs		<0.001
Observations		34809
Selected		901
Chi Sq.		152.82
df M		35

Standard errors clustered at school district are reported in parentheses. First-stage model controls for principal and prior school characteristics; second-stage model controls for principal and current school characteristics. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 6. Experience at the same grade level and novice principal performance (selection-corrected)

	(1)	(2)	(3)	(4)	(5)
Main					
Any experience at the same level	-0.08				
	(0.15)				
Years of experience at the same level		0.00			
		(0.01)			
Any AP experience at the same level			0.16		
			(0.18)		
Years of AP experience at the same level				0.03	
				(0.02)	
Prior school: Same Level					-0.03
					(0.14)
Selection					
# openings/# certified	9.04***	9.32***	10.31***	9.79***	8.96***
	(1.36)	(1.36)	(1.39)	(1.36)	(1.37)
Any experience at the same level	-0.66***				
	(0.05)				
Years of experience at the same level		-0.03***			
		(0.00)			
Any AP experience at the same level			1.00***		
			(0.05)		
Years of AP experience at the same level				0.11***	
				(0.01)	
Prior school: Same Level					-0.69***
					(0.05)
Inverse Mills	0.19	0.18	0.15	0.16	0.19
	(0.21)	(0.21)	(0.19)	(0.20)	(0.21)
Observations	57871	57871	57871	57871	57871
Selected	1162	1162	1162	1162	1162
Chi Sq.	162.80	159.55	154.78	157.25	162.21
df M	22	22	22	22	22

Standard errors clustered at school district are reported in parentheses. First-stage model controls for principal characteristics, experience, education, and prior school characteristics; second-stage model controls for principal characteristics, experience, education, and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 7. Experience in similarly sized schools and novice principal performance (Terciles) (selection-corrected)

	(1)	(2)	(3)	(4)	(5)
Main					
Any experience in similarly sized school	-0.06				
	(0.13)				
Years of similarly sized school experience		0.01			
		(0.01)			
Any AP experience in similarly sized school			0.18		
			(0.16)		
Years of AP experience in similarly sized school				0.03+	
				(0.02)	
Prior school: similar size					0.06
					(0.12)
Selection					
# openings/# certified	8.65***	8.81***	9.33***	9.08***	8.69***
	(1.29)	(1.31)	(1.28)	(1.29)	(1.30)
Any experience in similarly sized school	-0.62***				
	(0.05)				
Years of similarly sized school experience		-0.04***			
		(0.00)			
Any AP experience in similarly sized school			0.97***		
			(0.06)		
Years of AP experience in similarly sized school				0.10***	
				(0.01)	
Prior school: similar size					-0.60***
					(0.04)
Inverse Mills	0.15	0.16	0.14	0.12	0.16
	(0.20)	(0.20)	(0.21)	(0.20)	(0.20)
Observations	60600	60600	60600	60600	60600
Selected	1215	1215	1215	1215	1215
Chi Sq.	142.63	140.68	137.55	135.83	142.30
df M	22	22	22	22	22

Standard errors clustered at school district are reported in parentheses. First-stage model controls for principal characteristics, experience, education, and prior school characteristics; second-stage model controls for principal characteristics, experience, education, and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 8. Prior school's performance and novice principal ratings (selection-corrected)

	(1)	(2)	(3)
Sample	APs	Teachers	Combined
Main			
Prior School: Value-Added	0.03	0.13	0.04
	(0.05)	(0.16)	(0.05)
Prior School: Achievement	-0.00	-0.31	-0.01
	(0.06)	(0.24)	(0.07)
Prior Principal's Practice Rating	0.28***	0.25*	0.27***
	(0.05)	(0.10)	(0.04)
Prior Job: AP			0.01
			(0.20)
Selection			
# openings/# certified	14.19***	10.23***	11.98***
	(1.64)	(0.93)	(1.18)
Prior School: Value-Added	0.04	0.09	0.05
	(0.04)	(0.06)	(0.03)
Prior School: Achievement	-0.01	0.09	0.01
	(0.05)	(0.09)	(0.04)
Prior Principal's Practice Rating	0.03	-0.04	0.02
	(0.02)	(0.04)	(0.02)
Prior Job: AP			-1.42***
			(0.06)
Inverse Mills Ratio	0.11	-0.21	0.03
	(0.22)	(0.14)	(0.18)
Observations	11177	39018	50195
Selected	878	126	1004
Chi Sq.	227.76	37.01	201.12
df M	26	26	27

Standard errors clustered at school district are reported in parentheses. First-stage model controls for principal characteristics, experience, education, and prior school characteristics; second-stage model controls for principal characteristics, experience, education, and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Appendix Table 9. Prior performance and novice principal performance (selection-corrected)

	(1)	(2)	(3)
Outcome	Practice Ratings	Math VA	Reading VA
Main			
Average Value-Added as a Teacher	-0.01	0.03***	0.02**
	(0.06)	(0.01)	(0.01)
Average Teacher Observation Rating	0.03	-0.00	-0.01
	(0.09)	(0.01)	(0.01)
Prior School: Value-Added	0.01	0.57***	0.43***
	(0.08)	(0.02)	(0.02)
Prior School: Achievement	-0.04	-0.09***	-0.06**
	(0.09)	(0.03)	(0.02)
Prior Principal's Practice Rating	0.28***	0.00	0.00
	(0.05)	(0.01)	(0.01)
Prior Job: AP	-0.08	-0.03	0.02
	(0.20)	(0.02)	(0.02)
Selection			
# openings/# certified	11.12***	-3.25*	-3.28*
	(1.20)	(1.42)	(1.40)
Average Value-Added as a Teacher	0.01	0.04+	0.04+
	(0.03)	(0.02)	(0.02)
Average Teacher Observation Rating	0.22***	-0.05+	-0.04
	(0.03)	(0.03)	(0.03)
Prior School: Value-Added	0.05	0.09*	0.07
	(0.04)	(0.04)	(0.05)
Prior School: Achievement	-0.05	-0.04	-0.00
	(0.06)	(0.05)	(0.06)
Prior Principal's Practice Rating	-0.01	0.04	0.05+
	(0.03)	(0.03)	(0.03)
Prior Job: AP	1.02***	-0.05	-0.05
	(0.08)	(0.08)	(0.07)
Inverse Mills Ratio	-0.07	0.01	-0.01
	(0.20)	(0.01)	(0.01)
Observations	24917	24802	24798
Selected	284	24106	24063
Chi Sq.	.	9696.84	20600.88
df M	49	53	53

Standard errors clustered at school district are reported in parentheses. First-stage model controls for principal characteristics, experience, education, and prior school characteristics; second-stage model controls for principal characteristics, experience, education, and current school characteristics.
+ p<0.10, * p<0.05, ** p<0.01, *** p<0.001