Curbing or Facilitating Inequality? Law, Collective Bargaining, and Teacher Assignment Among Schools in California

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Abstract

Research demonstrates that a teacher "quality gap" exists in California. Teachers in schools with high percentages of low-income, minority, and low-performing students tend to be less experienced and more frequently uncredentialed. Research also shows that teachers prefer to teach in schools with lower percentages of low-income, minority, and low-performing children and that teachers prefer to teach in schools with better working conditions. This study takes as a given the preferences of teachers and seeks to understand the effects of the rules and incentives provided by law, policy, and collective bargaining agreements on teacher assignment within and between school districts. Put differently, the study asks: Do law, policy, and collective bargaining agreements curb or facilitate the teacher quality gap in California?

The study finds that, although the State of California provides modest incentives to teach in hard-to-staff schools, the State has effectively ceded authority for teacher assignment to local school boards and administrators and the collective bargaining agreement rules they negotiate with teachers unions. Contrary to certain previous research, however, this study finds that, when comparing California districts to each other, more determinative teacher transfer and assignment rules in collective bargaining agreements (i.e., strong seniority preference rules) are associated with a greater percentage of credentialed teachers in school districts. The study then employs a hierarchical linear modeling strategy to determine the relationship between transfer and assignment rules and the distribution of teachers between schools within districts. Consistent with prior research, this study finds that schools with higher percentages of minority students, schools that are growing, and larger schools all have lower percentages of credentialed and experienced teachers. Contrary to certain previous research and conventional wisdom, however, this study finds no persuasive evidence that the seniority preference rules in collective bargaining agreements independently affect the distribution of teachers among schools or exacerbate the negative relationship between higher minority schools and teacher quality. Interviews with school district human resource administrators in California provide some explanation for this outcome: In many districts, to ensure a more equitable distribution of teachers, administrators negotiate and implement discretionary language in transfer and assignment rules, collaborate with union leaders to suspend or work around determinative rules, or employ strategies to "end-run" the rules.

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Introduction and Summary

Good teachers make a difference. Even among researchers and scholars who disagree about whether and which educational resources produce gains in educational achievement, there is a growing consensus that high-quality teachers can produce such gains, particularly among low-income and minority children (Rivkin, Hanushek & Kain, 2005; Darling-Hammond, 2000). While the elusive qualities of good teaching are difficult to identify, most agree that good teachers matter.

Given that quality teaching matters and matters more for minority children, one might expect public policy to be designed to ensure that schools with high percentages of low-income and minority children would be most likely to possess highly qualified teachers. One might expect school district superintendents and principals to assign their best teachers to such "hard-to-staff" schools. One might expect school boards and state legislatures to develop aggressive incentive programs—such as the somewhat ignominiously named "combat pay" schemes—to get the best teachers in the lowest performing schools.

Yet study after study has confirmed that teachers with the least experience and those without credentials are concentrated in poor and minority schools and California is no exception (Darling-Hammond, 2004; Esch, et al., 2005). Equally troubling, the estimated average salaries of California teachers in poor and minority schools lag far behind those of teachers in wealthy schools with mostly white children (The Education Trust-West, 2005). That such teacher resource inequality exists is, by now, unsurprising. The question is whether such inequality exists in spite or because of legal and policy structures in the Golden State.

Many teachers may avoid poor and minority schools because those schools lack sufficient resources, present difficult working conditions, are plagued by poor leadership, or constrain good teachers' autonomy to teach as they wish (Esch, et al., 2005, Darling-Hammond 2004). Others have contended that teachers choose not to teach in schools with a high minority, high-poverty, low-performing population (Hanushek, Kain & Rivkin, 2003). The reasons that teachers choose not to teach in poor and minority schools are critical to designing policies that will attract good teachers to tough assignments. Though clearly important, however, our focus in this paper is not on teachers' intrinsic preferences. Instead, we seek to understand the legal, policy, and contractual structures in California that, on the one hand, are designed to place highly qualified teachers in low-income, high-minority schools and those legal, policy, and contractual structures that may, on the other hand, constrain efforts to get good teachers into more difficult teaching assignments or those that may actually exacerbate the quality gap. Put simply, do law, policies, and teacher contracts curb or facilitate the teacher quality gap?

After reviewing the literature on teacher preferences and teacher assignment rules, we proceed in three parts. First, we examine the state legal and regulatory regime that affects teacher hiring and assignment. In California, the state legislature has plenary power to establish laws and regulations that would control the hiring and assignment of teachers. Our analysis shows, however, that current legislative efforts to close the teacher quality gap are quite modest. Rather, the state has effectively ceded its authority to control hiring and assignment to local school districts and the collective bargaining agreements those districts establish with the local teachers' union. The remaining areas in which the legislature still exerts some influence over hiring, assignment, and retention is through (1) recently enacted legislation that gives greater authority to principals in low-performing schools in filling vacant positions and puts a limit on the length of time that priority must be given to current district teachers in filling vacancies; (2) modest incentives to encourage new teachers to enter the profession and/or teach in challenging assignments (*e.g.,* the Assumption Program of Loans for Education), (3) grant monies for teacher induction programs such as the Beginning Teacher Support and Assistance program (BTSA) available to all school districts, (4) targeted salary bonuses for certain teachers with advanced training to teach in hard-to-staff schools (the National Board for Professional

Teachers Standards Certification Incentives Program) and (5) its mandate—pursuant to both the No Child Left Behind Act and the legislation enacting the settlement of the *Williams v. California* litigation—to ensure that all core academic classes in *all* schools are staffed by "highly qualified" teachers. Notably, however, several other state programs that were adopted in the late 1990's and sought to place teachers in difficult assignments were de-funded during the economic downturn in recent years.

Second, we systematically analyze school district policies and rules regarding teacher assignment. Although there are exemplary districts that have developed policies and practices to close the teacher quality gap, those policies may be hindered by hiring and assignment practices. Noteworthy is the extent to which collective bargaining agreements (CBAs) contain rules for teacher hiring, teacher transfer, and reassignment of those teachers who have been "surplussed" or "excessed" out of a current teaching assignment. Among those rules is the frequent preference that is granted to teachers with seniority in filling vacancies within the district or in maintaining teachers in current positions when schools are forced to let go of teachers. As others have argued and at least one study has found, such seniority preference rules may contribute to inequality among schools in terms of teacher experience and credentials, as teachers exercise their seniority preferences to transfer out of high-minority, high-poverty schools (Moe, 2005a; Riley, et al., 2002; but see Nelson, 2006). In the first extensive quantitative analysis of the effects of CBAs on teacher distribution among schools, Moe (2005a) specifically found that seniority transfer rights in CBAs exacerbated the teacher quality gap between schools with high-minority and low-minority student populations. Similarly, another group of researchers has provided evidence that, due to the contractual requirements for internal posting of open teaching positions prior to opening the positions to outside applicants, certain high-minority urban districts are unable to compete for high quality teachers because the best teachers are often hired by other districts by the time the positions are opened to outsiders. (Levin, Mulhern, & Shunk, 2005; Levin & Quinn, 2003).

To test those assertions, we gathered hundreds of certificated employee (teacher) collective bargaining agreements from throughout California and coded them based on how determinative the transfer and leave provisions of the agreement are in making hiring and assignment decisions. We then initially explored through simple bivariate correlations *the relationship between the strength of the transfer and assignment rules in collective bargaining agreements and certain school district factors, such as district size, student ethnicity and performance, average teacher salaries, and teacher quality measures.* We find that the larger the school district, the stronger the textual provisions for leave and transfer in the district's collective bargaining agreement, suggesting that large districts may have more intra-district inequality among schools and that large districts are disadvantaged in the hiring process. We also find, however, that school districts with more determinative transfer and leave provisions tend to have greater percentages of credentialed teachers, suggesting that these provisions may help districts recruit and retain higher quality teachers with policies that allow more senior teachers to transfer to preferred schools. We cannot determine, however, whether the stronger seniority provisions are acting alone to attract and retain teachers or whether those provisions are accompanied by other attractive contractual provisions or other correlated district-level factors that attract and retain qualified teachers. Moreover, we recognize the potential endogeneity of the relationship between certificated teachers on the one hand and more determinative transfer and leave provisions on the other—strong seniority preference provisions may be the result of more qualified teachers and stronger unions.

We then compare the quality of teachers across school districts in California to determine whether there is any relationship between CBA transfer rules and the quality of a district's teacher force. Paralleling the conceptual framework and statistical strategy employed by Moe (2005a), we employ ordinary least squares (OLS) regression techniques to model the factors that may contribute to teacher quality (as measured by teacher certification and more than two years' experience) in a school district, including the percent minority students, median district school and class sizes, district growth, and the strength of the transfer and leave provisions in the CBA. We find that districts with more determinative transfer and leave provisions, have greater percentages of credentialed teachers, even after controlling for a wide-range of other district characteristics, suggesting that strong CBAs may put school districts at an advantage in hiring and retaining quality teachers. (Again, we cannot discern whether the more determinative transfer provisions are acting alone or in concert with other contractual provisions or other uncontrolled factors nor can we rule out the potential endogeneity of the relationship between determinative transfer rules and qualified teachers). However, to the degree that these strong provisions attract teachers because teachers may eventually use them to transfer to more favorable schools, these provisions may also exacerbate intra-district teacher quality gap. We also find that district growth and median percent minority students among the district's schools are significantly and negatively associated with the percent credentialed teachers. Finally, we find that, among the variables in our model, only the median percent minority students significantly affects the percent experienced teachers in the district.

We then compare the quality of teachers between schools within districts to determine whether those districts with strong transfer and leave provisions have greater teacher quality gaps between schools. Moe (2005a) employed fixed-effects least squares regression methods to demonstrate that determinative seniority preference provisions exacerbate the teacher quality gap between high-minority and low-minority schools. Moe's insightful analytic approach specifically found an interaction effect between the percentage of minority students in a school and seniority preference transfer language in a district's CBA on the experience levels and certification status of teachers in the school. Our analysis parallels the basic strategy of Moe's, including a statistical strategy that in part seeks to detect any interaction between CBA transfer language and the percentage of minority students in a school. But our study analyzes a different data set, applies a different coding scheme for the CBA transfer language, employs a different statistical technique, and comes to different conclusions.

Because schools are nested within districts, and CBA provisions operate at the district level, while other factors—such as percent minority students, average class size, student enrollment, and school growth—may affect teacher quality at the school level, OLS regression techniques (even fixed effects models) cannot be used to estimate the independent effects of district level variables on the quality of the teachers within schools. For that reason, we employ hierarchical linear modeling (HLM) techniques to account for the hierarchical structure of schools within districts. Not surprisingly, in general we find that those schools with greater percentages of minority students, those with more students, those that are growing, and (somewhat surprisingly) those with smaller average class sizes have fewer certified and fewer experienced teachers. Yet we find no convincing evidence that this problem is worse in those districts with strong transfer and leave provisions. In other words, there is no independent effect of transfer and leave provision strength on the quality of teachers in schools within districts. We also do not find compelling evidence that the transfer and leave provisions indirectly affect the distribution of teachers by either amplifying or attenuating the relationships between teacher quality measures and school characteristics (percent minority students, average class size, student enrollment, and growth).

Why don't our findings support the conventional wisdom that seniority preferences and internal posting requirements significantly contribute to the teacher quality gap? Our final analyses—a qualitative exploration of the practices of human resources administrators in school districts—provides some explanation for this finding. We conducted 19 semi-structured interviews of human resources directors from a stratified sample of school districts throughout the state to better understand teacher hiring and assignment practices on the ground. Although one must always be cautious in generalizing from such a small sample, we found a striking pattern among the districts: although all administrators report that they comply with the letter of the rules in CBAs, effective school district administrators are seldom hindered in their teacher hiring and assignment practices by apparently strong CBA language because they (1) negotiate for and exercise clauses in CBAs that permit them to make hiring and assignment decisions that are in the districts' and students' "best interests" irrespective of seniority preferences, (2) develop strong working relationships with union leaders that allow them to mutually suspend or work around apparently strong contract language for the best interests of students, and (3) employ strategies to end-run CBAs, such as "hiding" open positions until after the internal post-and-bid process is completed or refusing to choose an insider and re-posting the position after the internal processes are completed. In some instances, administrators and unions have even developed policies to encourage the best candidates to teach in hard-to-staff schools such as hiring early and giving low-performing schools preference for those early hires or requiring teachers with special training to remain in low-performing schools regardless of seniority.

We note that it is also possible that we find no effect of contract language on the distribution of teachers within and across districts because the text of the transfer rules in CBAs does not matter—all school districts may simply honor the assignment preferences of teachers with seniority because the professional culture and practice in California rewards senior teachers with the teaching assignments of their choice. It is also possible that those districts with less determinative transfer language nonetheless give seniority preference as a matter of practice out of the expectation that they would eventually have to give up such preferences at the bargaining table. While none of the study's participants suggested such professional and practical influences, we cannot rule them out.

Does all of this mean that CBAs do no harm? Not necessarily. That administrators and teachers feel it necessary to be creative about getting around contracts to meet the needs of low-performing schools seems problematic. Moreover, our qualitative analysis and literature review reveal that there are certain districts in which strict teacher assignment rules in CBAs do affect the district's ability to hire the best-qualified teachers and result in inequalities among schools. Yet our research demonstrates that the experience of those districts runs counter to the experience of most districts and does not support the union critics' theories of how transfer and leave provisions are uniformly deleterious for poor and minority children. Put bluntly, our research suggests that merely changing the language of the rules of teacher assignment in CBAs will do little to close the teacher quality gap.

Literature Reviews

In this section we review the research on teacher quality in the United States and California, which demonstrates a clear quality gap; the literature on teacher preferences for school assignments; and the very limited research on the effects of collective bargaining agreements on teacher assignment. From this literature, we develop the theoretical framework that structures our analyses in the following section.

The Teacher Quality Gap in the U.S. and California

Of the many disparities evident in the U.S. educational system, one of the most glaring is students' access to qualified teachers. While research has demonstrated that access to qualified teachers is one of the most powerful determinants of student achievement (Betts, Rueben, & Danenberg, 2000; Goe, 2002), there is great inequality in access to this critical resource (Darling-Hammond, 2000). Low-performing, low-income, and minority students are the least likely to be taught by qualified teachers, because they often attend hard-to-staff schools, which have difficulty recruiting and retaining qualified teachers (Betts et al., 2000; Darling-Hammond, 2002; Hanushek, Rivkin & Kain, 2003, Joint Venture, 2001; The Center for the Future of Teaching and Learning, 2002). These students are likely to encounter not only one underqualified teacher, but rather a string of teachers poorly prepared to help them catch up – exacerbating the academic achievement gap (The Center for the Future of Teaching and Learning, 2005).

Hard-to-staff schools (typically urban schools that serve large concentrations of low-income students, low-performing students, and/or students of color) are plagued by insufficient teacher applicants for open positions and tremendous teacher turnover. Teachers often do not choose to work in these schools, and when they do, they usually do not stay for long (Claycomb & Hawley, 2000; Hanushek, Kain, & Rivkin, 2003; Lankford, Loeb, & Wyckoff, 2002; Lippman, Burns, & McArthur, 1996; Southeast Center for Teaching Quality, 2002; Watson, 2001). Because these hard-to-staff schools are unable to find qualified teachers, they must use alternative methods to staff their classrooms, such as hiring uncredentialed teachers, teachers with emergency permits or waivers, strings of substitute teachers, or teachers who have not been trained in the subject area they are asked to teach (Education Commission of the States, 1999).

In California, for example, intern teachers are 18 times more likely to work in the quarter of California schools with more than 90 percent minority students as they are to work in the quarter of schools with less than 30 percent minority students (Esch, et al. 2005). Similarly, schools serving 91-100% minority students have an average of 20% underprepared and/or novice teachers, while those serving few or no minority students have an average of 11% underprepared or novice teachers. The same goes for low-achieving schools, as one out of every five teachers (21%) in the lowest achieving schools are underprepared and/or novice, compared to only 1 in 10 teachers (11%) in the highest achieving schools (Esch, et al. 2005).

Additionally, hard-to-staff schools are usually plagued with high teacher turnover as teachers are perpetually leaving and need to be replaced. The problems of teacher recruitment and retention likely compound each other because teachers may be wary of joining a school that many teachers are leaving and teachers may be more likely to leave a school that is unable to attract new, qualified teachers. High levels of turnover produce a snowball effect in which the teachers left behind find the school to be a more undesirable place to work and leave themselves. In other words, turnover begets more turnover (Dworkin, 1987).

One way to measure the inequitable distribution of qualified and experienced teachers across schools is to examine teacher salaries. Teacher salaries, usually based upon a salary schedule, reflect teachers' years of experience, years teaching in a particular district, certification status, and educational level. Estimates of teachers' salaries across California demonstrate that high-poverty and high-minority schools spend tens of thousands of dollars less on teacher salaries than low-poverty and low-minority schools of similar size – even when comparing schools in the same school district (Education Trust-West, 2005). More experienced and highly credentialed teachers tend to migrate to low-poverty and low-minority schools where there are fewer challenges and better working conditions – leaving students in high-poverty and high-minority schools with the teachers with the least experience and training (Education Trust-West, 2005).

The high teacher turnover and large numbers of underqualified teachers that characterize hard-to-staff schools have many negative impacts on students and schools. Having a series of substitutes or underqualified teachers prevents students from having consistent and effective learning opportunities (Darling-Hammond, 2002). High teacher turnover also places a large monetary burden on hard-to-staff schools as they have to constantly recruit and train new teachers (Nobscot Corporation, n.d.). Ironically, it is the students and schools who can least afford the costs of high teacher turnover and unqualified teachers who are most likely to bear these costs (National Commission on Teaching and America's Future, 2003).

Teachers' Preferences for Schools

There is much debate as to what exactly makes some schools so hard-to-staff. While it is apparent that teachers are avoiding working at these schools, it is unclear what particularly about these schools teachers are avoiding. Is it the characteristics of the students in the school, the working conditions in the school apart from student characteristics, or both?

Student Characteristics

It may be that teachers are reluctant to work with certain kinds of students, such as low-income students, low-performing students, and students of color. After all, hard-to-staff schools tend to have large concentrations of these students. Additionally, teacher transfer patterns show that when teachers move from one school to another, they tend to move away from poor students, students of color, and low-performing students.

For example, Carroll et al. (2000) examined teacher attrition and retention patterns in approximately 70 percent of California school districts between 1993 and 1997. Using California's Comprehensive Basic Educational Data System (CBEDS), they discovered that the odds that a teacher would transfer out of a particular school was positively related to the percentage of black students, the percentage of Hispanic students, and the percentage of students eligible for free or reduced-price lunch in the school.

Outside of California, the findings are similar. Hanushek et al. (2003) completed a comprehensive study of teacher mobility in Texas between 1993 and 1996, using matched student/teacher panel data from the Texas Education Agency's statewide educational database to develop pre- and post-move school comparisons for teachers who switched schools. Hanushek et al. found that teachers who transferred between schools systematically favored schools with higher-achieving, non-minority, higher-income students. Lankford et al. (2002) found similar teacher transfer patterns in New York public schools between 1993 and 1998. Their data demonstrate that when teachers switched school districts, the average percentage of poor students, limited English proficient students, and nonwhite students at the receiving school was less than half of the average percentage of these students at the sending school. Finally, Scafidi et al. (n.d.) analyzed the mobility and retention of elementary school teachers in Georgia between the 1991-92 and the 2000-01 school years. Consistent with the findings in California, Texas, and New York, teachers in Georgia were found to be more likely to change schools – both within and across districts – if they began their teaching careers in schools with lower student test scores, large numbers of low-income students, or higher proportions of minority students.

Working Conditions

There is growing evidence, however, that teachers may not be avoiding hard-to-staff schools because of the student demographics, but rather because of other characteristics of the school, such as poor working conditions. Upon further examination of teacher transfer patterns, one finds that they are not only correlated with student characteristics, but they are also correlated with working conditions. In other words, when teachers transfer from one school to another, the receiving schools also tend to have better working conditions than the sending schools. The reason for this dual correlation is that student demographics and school working conditions tend to be highly correlated themselves. Low-income, low-performing, and minority students tend to attend schools with less adequate facilities, fewer resources and materials for students, lower teacher salaries, and fewer opportunities for teachers to participate in school-wide decision making (Boyd, Lankford, Loeb, & Wyckoff, 2003; Carroll, Fulton, Abercrombie, & Yoon, 2004; Darling-Hammond, 2003; Ingersoll, Quinn, & Bobbitt, 1997; Oakes, 2002a; Schneider, 2004).

Even the researchers who find that teachers preference away from certain student characteristics concede that they are unable to determine if teachers are moving because of the student demographics or because of other factors, such as working conditions. For example, Hanushek et al. (2003) hypothesized, “If the results capture teacher preferences for student race or ethnicity, then districts possess few policy options. But, we might speculate that these estimates at least partially proxy for more general working conditions” (p. 40). Student demographics may serve as proxies for working conditions when teachers select a school in which to work. By avoiding unattractive working conditions, highly qualified teachers may inadvertently be avoiding low-income students, low-performing students, and students of color.

There is evidence that teachers care about school working conditions and might be motivated to stay at a school that they would otherwise leave if the working conditions were improved. Specifically, studies have found the following working conditions to be important to teachers and likely to impact the distribution of teachers among schools: salary[1], class size[2], administrative support[3], school facilities[4], input on school-wide decisions[5], and resources for students[6].

Some studies have found that working conditions might be even *more* important to teachers than student demographics in terms of teacher recruitment and retention. For example, Loeb, Darling-Hammond, and Luczak (2005) linked Harris Survey data to other district data on salaries and staffing patterns and found that student characteristics became insignificant predictors of teacher turnover when district salary levels and teachers' ratings of working conditions – including large class sizes, facilities and space problems, multi-track schools, and lack of textbooks – were added to the model. In other words, salaries and working conditions were found to be stronger predictors of teacher turnover than student demographics.

According to Darling-Hammond (2002),

> This suggests that the frequently observed flight of teachers from schools serving low-income and minority students is at least in part a function of the degree to which many of those schools also exhibit poor working conditions rather than solely attributable to the characteristics of the students or communities themselves. From a policy perspective this is good news, since it points to remediable factors – i.e., the availability of materials, class sizes, high-quality

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[1] See Imazeki (2002); Kirby et al. (1999); Lankford et al. (2002); Mont & Rees (1996); Murnane, Singer, & Willett (1989); Rickman & Parker (1990); Theobald & Gritz (1996)
[2] See Chambers & Fowler Jr. (1995); Hanushek & Luque (2000); Lankford et al. (2002)
[3] See Darling-Hammond (2002); Farkas et al. (2000); Ingersoll (2003); Johnson & Birkeland (2003); Metropolitan Life Survey (2001); Sclan (1993)
[4] See Buckley, Schneider, & Shang (2004); Darling-Hammond (2002); Earthman (2002); Public Education Network (2003)
[5] See Chapman & Hutcheson (1982); Hare & Heap (2001); Howard (2003); Ingersoll (2002); Sclan (1993)
[6] See Theobald & Gritz (1996)

> leadership, and professional learning opportunities – that can be altered by policy to shape the availability of teachers to all students (p. 64).

Another study suggests that teachers do not avoid particular groups of students; rather they avoid undesirable school environments. Horng (2005) found that working conditions, not student characteristics, are the more powerful determinant of where teachers choose to work. Horng used a web-based survey to examine the tradeoffs teachers would make among ten attributes when selecting a school in which to work: salary, class size, administrative support, input on school-wide decisions, commute time, resources for students, school facilities, student performance, student ethnicity, and student socioeconomic status. The study disentangled working conditions from student characteristics and found that the former were statistically more important than the latter when teachers considered where to work. Of the ten attributes, school facilities, administrative support, and class size were the three most important to teachers. Additionally, having clean and safe facilities was more than twice as important to teachers as each of the three student demographic attributes.

The difficulty for researchers, of course, is finding a quantifiable variable that somehow captures working conditions effectively. Concepts such as site leadership, shared decision-making, administrative support and the like are difficult to operationalize for analysis. Thus, in this study we acknowledge the potential effects of such working conditions, but, as discussed in the next section, we only employ two such variables in our models of the quality of teachers at the site and district levels: class size and school/district size.

Collective Bargaining Agreements' Transfer Provisions

Whether qualified teachers leave hard-to-staff schools due to student demographics or working conditions, it is apparent that one, or both, of these factors is affecting the distribution of qualified teachers in public schools. Though important, such teacher preferences are not the central focus of this study. Our concern is over the rules that govern teacher assignment, particularly those found in collective bargaining agreements. Indeed, conventional wisdom posits that constraining language in CBAs facilitates the maldistribution of teachers.

In the 1960s, teachers (and other public employees) began to organize and collectively bargain in the standard industrial labor manner for rights and benefits. Since then, many states have recognized the right of teachers to collectively bargain. As noted below, California's teacher collective bargaining law is relatively union friendly and includes many mandatory bargaining items and much discretion to bargain over other items that affect the working conditions of teachers. Generally, CBAs may include everything from what constitutes a "standard day" to the evaluation of teacher performance to teachers' salary schedules.

Rules governing the voluntary and involuntary transfer of teachers are another common contract provision. In many CBAs, seniority, as opposed or in addition to administrative or student need, dictates the ability of a teacher to transfer within a school district, allowing the most experienced and, arguably, the most qualified teachers the greatest ability to transfer into the most desirable schools. In extreme—though rare—cases, the CBA would provide for the ability of senior teachers to "bump" a more junior teacher out of her current position. Taken into consideration with the reviewed literature showing that teachers preference away from low-performing, high-poverty, high-minority schools, this suggests in theory that the most senior, experienced teachers will opt out of the schools with the most need, thus facilitating, at least in part, the quality gap in public schools.

Surprisingly, very little empirical research exists regarding the effects of teacher unionization and collective bargaining. Indeed, some surmise that educational researchers avoid the topic because of its politically charged nature (Hannaway & Rotheram, 2006). Here we review the primary research on the effects of CBAs, particularly the effects of the transfer rules.

Teachers Unions, Collective Bargaining, and Student Outcomes

Empirical studies of the general effects of teachers unions on student achievement have been mixed. Studies have shown small increases in secondary school math scores and SAT performance, generally between 1 and 4 percent, in states that are highly unionized as compared to states that are not highly unionized (Milkman, 1997; Nelson & Rosen, 1996; Grimes & Register, 1990; Kurth, 1987; Eberts & Stone, 1987). However, Hoxby (1996), in one of the more carefully controlled studies on teachers unions effects on student achievement, shows that unionization worsens student achievement when measured by dropout rates, all else being equal.

The Effects of Collective Bargaining Agreement Transfer Provisions

While the research on the effects of teachers unions, broadly, has been mixed, somewhat more reliable findings, albeit incomplete, have been made in the few studies assessing transfer provisions in collective bargaining agreements. Those studies suggest that collective bargaining agreements in which preference for hiring and transferring is given to senior teachers are most prevalent in large school districts and appear to facilitate the maldistribution of teachers, causing the least experienced teachers to be in the neediest schools and districts.

Levin and Quinn (2003) of the New Teacher Project examine hiring practices in four hard-to-staff districts (three large urban districts – one in the Southwest, Midwest, and Eastern regions – and one mid-size district in the Midwest). The districts had between 62 and 85 percent non-white students and between 66 and 75 percent of students in these districts qualified for free or reduced-price lunch. Contrary to popular belief, Levin and Quinn (2003) show that highly qualified teachers apply to these hard-to-staff districts in high numbers. The late timelines in hiring practices, however, push hiring into late summer causing many qualified applicants to accept positions elsewhere or withdraw from the hiring process altogether. One prominent reason for the late hiring timeline is a transfer privilege in the collective bargaining agreements. All four of the districts examined were required to post openings to intra-district transfers, in which preference is given to the most senior teachers, before making the positions open to the applicant pool consisting of teachers applying from other districts or from college. Levin and Quinn (2003) conclude that the "evidence suggests that although these barriers are frequently neglected by policymakers, they are among the greatest impediments to raising teacher quality in urban classrooms"(p. 50). While the conclusions Levin and Quinn (2003) reach are noteworthy, the small number of school districts studied makes the findings difficult to generalize to other states and districts.

More recently, the New Teacher Project expanded the scale of the study and focused exclusively on transfer provisions (Levin, Mulhern, and Schunck, 2005). This time using five representative urban districts from across the U. S. (one district from each of the following regions: Eastern, Mid-Atlantic, Midwestern, Southern, and Western, including San Diego Unified in California), Levin, et al. (2005) find that schools in these districts are often forced to hire surplussed or excessed teachers they do not want or who may not be a good fit for the job. They argue that the quality of such teachers is questionable at best, citing that more than a quarter of surveyed principals said that all of the excessed teachers placed in their schools have been unsatisfactory and more than one-fifth of principals reported that at least half of voluntary transfers were unsatisfactory. Moreover, between one-quarter and one-third of principals acknowledged encouraging a poorly performing teacher to transfer or placing one on an excess list. Thus, transfers have become the *de facto* removal process because very few teachers are formally terminated for poor performance. Not only do low-performing schools in urban districts, which are in need of the highest quality teachers, lose the best teacher applicants to surrounding districts that hire earlier, but they are forced to accept the poorest quality transfers through this process. Again, though, while interesting, the conclusions drawn in the study are based on principals' reporting on transfers and teacher quality; they are not based on any objective or systematic measures of teacher quality the quality of teachers urban districts lose due to the late hiring process or the quality of transfers in and out of the schools. Moreover, they offer no comparison between the urban districts studied and the surrounding districts which supposedly hire quality teachers because of earlier hiring timelines.[7]

Riley, Fusano, Munk and Peterson (2002) provide a more systematic look at collective bargaining agreements and transfer privileges in California. Riley, et al. (2002) had a team of researchers rate the "restrictiveness" (i.e., the degree to which administrative discretion is constrained) of 5 key standard articles in CBAs, one of which was transfers and assignments, from more than 460 districts throughout the state. For transfers and assignments, who made the decisions (whether it was the principal or others) and how the pool of applicants was restricted (whether seniority decided and whether preference was given to inside applicants) were scored on a scale of 0 to 3; 3 being the most restrictive. Riley, et al. (2002) find that large school districts have the most restrictive language concerning transfers and assignments in their collective bargaining agreements, thus giving the most preference to senior teachers and arguably creating the least opportunity for the school district to match the right teacher with the classroom where he is needed most. Riley, et al. (2002) state that 337 of the 460 schools districts examined, over 75 percent, were "too" restrictive and therefore placed "too much" emphasis on seniority without regard for teacher quality and fit of assignment. Similar to Levin and Quinn (2003) and Levin, et al. (2005), this study does not systematically demonstrate a relationship between transfer provisions in collective bargaining agreements and teacher quality or student achievement. All three of these studies, then, while sharing interesting insights into collective bargaining agreements and transfer provisions, fail to show generally how the restrictiveness of these agreements affects teacher quality or student achievement.

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[7] It bears note that the California state legislature is currently considering a bill (SB 1655) that would (1) prohibit a superintendent of a school district from transferring a teacher who requests to be transferred to a low performing school (i.e., those ranked in deciles 1 to 3 on the state's Academic Performance Index (API)), and (2) prohibit the governing board of a school district from giving priority to a teacher who requests to be transferred over other qualified applicants after April 15 prior to the year the transfer would be effective.

Hess and Kelley (2006) analyze collective bargaining agreements in 20 districts chosen randomly from the 199 agreements on file at the Bureau of Labor Statistics. Similar to Riley et al. (2002), Hess and Kelley (2006) rate how restrictive collective bargaining contracts are in key articles in the contracts, again, including transfers and assignments. They code the contracts based on whether the transfer and assignment clause is nonexistent, vague, or restrictive. They find that the contracts are less restrictive than previous research suggests and conclude that "potentially restrictive contract language is often ambiguously couched or paired with potentially contradictory language"(p. 86). It should be noted that the study's sample was limited and difficult to generalize to large states. Fourteen states are represented in their sample,[8] yet, not one of the districts selected was from any of the five states with the largest number of teachers.[9] And, once again, like the previously reviewed research, the study makes no connection between the restrictiveness of contracts and teacher quality or student outcomes other than to suggest that restrictive contracts could make it more difficult for principals to staff schools with the right teachers.

Moe (2005a), unlike the previous studies, concentrates on transfer rules and how they affect the distribution of teachers within districts. Data are from a 1999 random sample of elementary schools from 371 California school districts.[10] Similar to Riley et al. (2002) and Hess and Kelley (2006), collective bargaining agreements' transfer provisions were coded for whether or not seniority was given preference in voluntary and involuntary transfers. Then, employing a fixed-effects OLS regression strategy, Moe (2005a) examined how transfer rules interact with the effect of four school characteristics (school size, school growth, class size, and student disadvantage) on the distribution of

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[8] States included in the sample are: Arkansas, Colorado, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Missouri, New Jersey, Ohio, Oklahoma, Oregon, Utah, and Wisconsin.

[9] The five states with the largest number of teachers are: California, Florida, Illinois, New York, and Texas. In total these states account for over 36 percent of the teachers nationwide; 1,082,532 out of 2,988,750 (*Source*: National Center for Education Statistics, *nces.ed.gov/programs/stateprofiles/*).

[10] These data were later narrowed to only include: districts with more than 4 elementary schools, so that teachers would have choice between schools; districts in which the median school had at least 5 percent inexperienced or uncredentialed teachers, in order that there be enough variation in these variables; and districts in which the median school had more than 15 percent or less than 85 percent minority students, also in order that there be enough variation in these variables.

inexperienced and uncredentialed teachers across schools. This central insight permitted Moe to detect whether seniority preference provisions exacerbate the teacher quality gap for disadvantaged students. Results from the study show that, absent union effects, the percentage of inexperienced teachers in a school increases with the school's size, its recent growth, and its minority composition. More relevant to the current discussion, the results show that districts with the most constraining transfer rules magnify the impact minority composition has on the percentage of inexperienced teachers in a school, more than doubling the impact. Additionally, the same trend holds true for the impact of transfer rules on the percentage of uncredentialed teachers: districts with the strongest transfer rules magnify the impact that minority composition had on the percentage of uncredentialed teachers. Moe (2005a) concludes that problems plaguing the socially disadvantaged in our schools are only exacerbated by transfer rights in collective bargaining agreements.

While Moe's study is by far the most thorough and sophisticated analysis of the effects of transfer provisions on teacher quality and while our study parallels Moe's basic conceptual approach, Moe's analysis has several limitations. First, due to the hierarchical structure of schools within districts, Moe's fixed effects regression strategy, while able to capture the interaction effects between transfer rules and school characteristics related to teacher quality, is unable to observe the direct effects of those transfer rules on the distribution of teachers within. Additionally, fixed effects regressions do not adequately take into account the clustering of schools within districts and may therefore provide mis-estimates of the effects of district-level characteristics (e.g., transfer rules) on school-level outcomes. Finally, Moe's data are also somewhat dated as the CBAs were those in use in 1999 with other teacher, district, and school data from the years immediately following a one-year lag. It is entirely possible that the NCLB mandate to place a "highly qualified" teacher in every classroom has, since then, affected the number and distribution of certificated teachers in and among schools. As will be seen below, we address these concerns in our analysis by collecting up-to-date contracts and using an HLM strategy to account for the nesting of schools within districts.

Finally, a study that reaches contrary conclusions to both Moe (2005a) and Levin, Mulhern, and Schunck (2005) was released by the American Federation of Teachers (Nelson, 2006) after we completed our analyses. Using national data from the 1999-2000 Schools and Staffing Survey (SASS) and the related 2000-01 Teacher Follow-Up Survey (TFS), Nelson (2006) analyzed the transfer rates of teachers out of high-poverty and low-poverty schools and sought to determine the effects of a CBA on those transfer rates. That study found that "[i]n high-poverty schools where teachers have a collectively bargained agreement, the transfer rate to another school or another district is 7.5 percent, which is on par with the national average transfer rate of 7.3 percent. In high-poverty schools where teachers do not have a collective bargaining agreement, the transfer rate to another school is 11.3%" (p. 3). The study also found that a collective bargaining agreement is associated with reduced teacher transfer rates from urban high poverty-schools, and that low-poverty and high-poverty schools in urban school districts with collective bargaining agreements are about equally likely to replace transferring teachers with first-year teachers, while high-poverty schools hire first-year teachers at three times the rate of low-poverty schools in districts without collective bargaining agreements. As will be seen, these findings—though focused on differences in teacher transfer rates among schools rather than differences in the quality of teachers among schools—are consistent with our findings. That said, the study has several notable limitations. First, in comparing the effects of collective bargaining on transfer rates among schools with differing characteristics (high poverty vs. low poverty), the study does not control for other factors that might affect transfer rates (*e.g.,* school size, class size, school growth, etc.). Second, because data on teacher transfer rates and data on whether a school district is subject to collective bargaining come from different datasets, the authors could not match individual teachers to districts and therefore could not directly observe the effects of a CBA on teacher transfer rates. Finally, because the data are national in scope, the study cannot account for differing legal and policy regimes among states. Our study addresses each of these concerns.

The State Legal and Policy Rules Affecting Teacher Assignment in California

In this section, we seek to answer the question: What state legislation and policies are designed to affect the assignment of teachers across and within school districts, particularly those policies designed to place high quality teachers in hard-to-staff districts and schools? As a general matter, the state has plenary power over education in the state and could legislate any (not otherwise illegal) rule for the hiring and assignment of teachers. In practice, however, the state has ceded much of this authority to local district school boards, administrators, and collective bargaining agreements.

Brief Historical Overview

Until 1961, California school districts had the authority to unilaterally determine working conditions for teachers. That year, the California Legislature enacted the Brown Act, which granted public employees the right to join or not join employee organizations and recognized the right of such organizations to meet with employers to discuss working conditions. The Brown Act, however, failed to revoke school boards' right to make final decisions and contained no process for adjudicating disputes between employers and employees. In 1965, the Winton Act was enacted which split public school employees from California public employees generally. The Winton Act retained the meet-and-confer provisions of the Brown Act for school employees, but added dispute resolution processes such as fact-finding and mediation. It was not until the passage of the Educational Employment Relations Act (EERA), also known as the Rodda Act, in 1975 that school employees were afforded full bargaining rights. While EERA does not impose collective bargaining on school districts, it grants school employees the right to form and join a union. It leaves the process of negotiating a contract to the union and the school district, and provides the legal framework within which collective bargaining occurs. Unionization of school employees followed quickly after EERA's enactment; today, all but approximately 150 of California's 1,056 school districts are unionized (Riley, et al., 2002).

The California Education Code and Teacher Assignment and Transfer

The California Education Code grants school district superintendents the authority to assign and transfer all school employees subject to the best interests of the district. California Education Code § 35035(c): "Subject to the approval of the governing board, [the superintendent of each school district shall] assign all employees of the district employed in positions requiring certification qualifications, to the positions in which they are to serve. This power to assign includes the power to transfer a teacher from one school to another school . . . within the district when the superintendent concludes that the transfer is in the best interest of the district." The California legislature does circumscribe school districts' assignment power, however, by forbidding the use of a "strict ethnic ratio" in the assignment of certificated employees. Education Code § 44830.7.

State legal precedent supports superintendents' authority to reassign or transfer teachers. California teachers have neither a vested nor protected right in a specific grade, class, or school assignment. *Bolin v. San Bernardino City Unified School District*, 155 Cal. App. 3d 759, 767 (1984); *see also Thompson v. Modesto City High School District*, 19 Cal. 3d 620 (1977). The appellate court in *Malynn v. Morgan Hill Unified School District*, 137 Cal. App. 3d 785, 788 (1982) explained:

> It has been well settled since at least 1932 that tenure does not infringe upon the general power of assignment. Subject only to the requirement of reasonableness, a school district is entitled to assign teachers anywhere within their certificate, according to the needs of the district. *Tenure does not bestow on the school teacher a vested right to a specific school or to a specific class level of students within any school*.

(internal citations omitted). Consequently, state courts tend not to interfere with the exercise of superintendents' assignment discretion, where it is not in conflict with statutory law. *Id.*

Nevertheless, California law limits this power of superintendents with subsection (d) of Education Code § 35035: "Upon adoption, by the district board, of a *district policy* concerning transfers of teachers from one school to another school within the district, have authority to transfer teachers consistent with that policy" (emphasis added). District policy concerning teacher assignment is established pursuant to the Educational Employment Relations Act (EERA), California Government Code §§ 3540 *et seq.* The Act specifies that certain matters are mandatory subjects of public bargaining: transfer and reassignment policies are mandatory subjects pursuant to California Government Code § 3543.2(a).[11] Therefore, superintendents must follow the policies established by the collective bargaining agreements between school districts and teachers' union in regard to the assignment and transfer of teachers.

Teacher Compensation

Similarly, California Education Code § 45028 forbids school districts and superintendents from departing from the salary schedules determined by collective bargaining agreements pursuant to EERA.[12] *See* California Government Code § 3543.2(d)-(e). However, California Government Code § 3543.2(d) permits public school employers and teachers' unions, to meet and negotiate regarding the payment of additional compensation based upon criteria other than years of training and years of experience. If no mutual agreement is reached, Education Code Section 45028 applies. Therefore, a school district's or superintendent's efforts to incentivize teachers to less favorable school assignments with policies such as "combat pay" or bonuses are thwarted if the applicable teachers' union refuses to authorize such a bargain.

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[11] California Government Code § 3543.2(a): "The scope of representation shall be limited to matters relating to wages, hours of employment, and other terms and conditions of employment. 'Terms and conditions of employment' mean health and welfare benefits as defined by Section 53200, leave, *transfer and reassignment policies*, safety conditions of employment, class size, procedures for the evaluation of employees, organization security pursuant to Section 3546 . . . ." (emphasis added).

[12] Education Code § 45028(a): "Effective July 1, 1970, each person employed by a school district in a position requiring certification qualifications, except a person employed in a position requiring administrative or supervisory credentials, shall be classified on the salary schedule on the basis of uniform allowance for years of training and years of experience, except if a public school employer and the exclusive representative negotiate and mutually agree to a salary schedule based on criteria other than a uniform allowance for years of training and years of experience [pursuant to EERA]."

Hiring

School districts' governing boards are granted the authority to hire teachers pursuant to Education Code §§ 35160, 35160.1, and 44831. The California Education Code, however, limits school districts' hiring discretion in three important ways. First, section 44830 permits school districts to employ only those teachers who have been certified by the California Commission on Teacher Credentialing (CCTC). Teachers applying for certification in California must first obtain a college degree. They must also demonstrate the academic preparation in the subject matter in which they wish to teach and complete a teacher preparation program. An applicant may show academic preparation, otherwise known as subject matter competence, by completing an approved subject matter preparation program in a California college or by passing one or more subject matter competency tests adopted by the CCTC. Upon completion of the teacher preparation program, the applicant must receive formal recommendation from the California college or university where they completed the program.

Second, sections 44918 and 44921 grant certain temporary and substitute teachers preferential reemployment rights to vacant teaching positions for which they are "certified and qualified to serve." *Taylor v. Board of Trustees*, Cal. 3d 500 (1984). This means that school districts must give priority in their hiring processes to applicants for vacant teaching positions who have served as a temporary or substitute teacher in the preceding school year. Lastly, Section 44929.21(b) grants permanent status classification to any teacher who has served in a district for two complete consecutive school years in a position requiring certification qualifications and is reelected for the next succeeding school year. Permanent status confers tenure rights on teachers or a right to the continuation of employment; prior to achieving permanency, probationary teachers have no due process rights, other than timely notice, in the context of contract nonextension ("non-re-election") and reemployment in succeeding years is merely a matter of school district discretion. *Abraham v. Sims*, 2 Cal. 2d 698 (1935).

The Mandate for "Highly Qualified" Teachers and State Incentives to Teach in Low-Performing Schools

The state has sought to address the problem of getting qualified teachers into hard-to-staff schools through several measures. First, though equally applicable to all schools and Districts, the requirement of the No Child Left Behind Act (NCLB) that all classrooms must be staffed by a "highly qualified" teacher, as well as the parallel state legislation enacted as part of the settlement in the landmark *Williams v. California* litigation, aims to ensure that disadvantaged and minority children have access to a high quality teacher. In California, this means that the teacher must have a valid preliminary or clear credential or be in a recognized intern program. No doubt this legislation has had the effect—at least on paper—of ensuring that California's teachers possess appropriate credentials, but concern remains over the ability of school districts to find "highly qualified" teachers in certain subject areas (*e.g.,* special education).

Second, based at least in part on the findings of Levin, Mulhern, and Schunck (2005), the legislature recently passed and the governor signed two bills (SB 1655 and SB 1209) that provide streamlining of the credentialing requirements in California, measures to lessen credentialing hurdles for teachers coming from out-of-state, and support for professional development and induction, and incentives to senior teachers to support new teachers in hard-to-staff schools. Most notably are the provisions that give principals in low performing (one-through-three-decile) schools the authority to refuse to accept the transfer of a district teacher into a vacant position and that place a limit on the length of time that priority must be given to current district teachers in filling vacant positions.

Third, the state has previously created programs targeted at encouraging teachers to teach in hard-to-staff schools, but only a couple survive. Prior to the recession that plagued California's technology sector, the State had at least four such programs: (1) Cal Grant T which provided tuition and fee assistance to students in teacher preparation programs who agreed to teach in a low-performing school, (2) Teacher Recruitment Incentive Program (TRIP), which provided centers to assist school districts in recruiting qualified teachers to low-performing and hard-to-staff schools, (3) Teaching as a Priority Block Grant Program (TAP),which provided competitive block grants to districts providing incentives to recruit and retain credentialed teachers to teach in low-performing schools, and (4) Governor's Teaching Fellowship, which provided $20,000 for tuition and living costs to individuals pursuing a first teaching credential if they agreed to teach for at least four years in a low-performing school.[13] Each of these programs had potential, but none was systematically evaluated for the legislature stopped funding all of them by the 2003-04 school year. Surviving the recession, however are two programs: (1) the Assumption Program of Loans for Education (APLE) which provide modest loan forgiveness for teachers who agree to teach in high-need subjects and schools and (2) salary bonuses to certain highly qualified teachers who agree to teach at least half-time in high-need schools (the National Board for Professional Teacher Standards (NBPTS) Certification Incentives Program). Absent these programs, however, the state does little to affect the hiring and assignment of teachers to hard-to-staff schools.

At bottom, then, much teacher assignment and hiring policy is crafted through the collective bargaining process. Given that this policy-making arena is often unrecognized and behind closed bargaining doors and given that little is known about the effects of CBA transfer and assignment rules on the distribution of teachers, we explore these contracts and their effects through both quantitative and qualitative methods.

Collective Bargaining Agreements and Teacher Assignment: Quantitative Analyses

Although the state has delegated the hiring and assignment of teachers to local school district administrators, those administrators do not have complete discretion to hire, transfer, and release teachers in their school districts. On the contrary, rules set forth in CBAs are often designed to influence or even dictate how such decisions are made. In this section, we first describe the primary

[13] The state also provides block grants to school districts to support new teacher induction programs such as new teacher mentors and coaches through the Beginning Teacher Support and Assistance (BTSA) program, but that program is not necessarily targeted to placing and retaining teachers in hard-to-staff schools and districts.

teacher assignment provisions in collective bargaining agreements—the transfer and leave provisions. We then seek to identify those school district characteristics that are associated with strong (i.e., more determinative) transfer and leave provisions and find that larger school districts tend to have stronger transfer and leave provisions. Next, we analyze the effects of the transfer and leave provisions on the distribution of teachers within and across school districts in California. Using OLS regression, we first explore whether the strength of the transfer and leave provisions is associated with the quality of a school district's teaching force. We find that strong transfer and leave provisions are positively associated with the percent certified teachers in a school district, but have no significant relationship with the percent of experienced teachers. Turning from the inter-district effects of the transfer and leave provisions, we finally analyze—with hierarchical linear modeling techniques—whether transfer and leave provisions affect the distribution of teachers among schools within districts in California. We find no evidence that the transfer and leave provisions directly affect the distribution of teachers. Additionally, while we find significant relationships between our measures of teacher quality and four school characteristics (percent minority students, average class size, student enrollment, and growth), we find no evidence that the district transfer and leave provisions amplify or attenuate those relationships.

What do Collective Bargaining Agreements Say about Teacher Assignment?

Under California law, teacher transfer practices are a term and condition of employment that is subject to mandatory collective bargaining in those districts that establish a teacher contract through collective bargaining. Although CBAs vary dramatically in size—from just a couple dozen pages to some 300 pages—all of them provide rules for two instances in which the assignment of teachers is affected: rules for teachers who take a leave of absence from the district for whatever reason and rules for voluntary and involuntary transfer of teachers. We seek to better understand the effects of those rules, which often provide for seniority preference in assignment.

Data Collection

Pursuant to the California Public Records Act, we wrote to each of the 987 school districts (excluding county offices of education) in California, asking that each send us its current certificated employees collective bargaining agreement, if it had such an agreement. (We note that, according to Riley et al. (2002), some 150 districts in California do not have union representation for teachers.) We followed that initial request with an e-mail to the district superintendent (if an e-mail address was available) or a telephone call (if a telephone number was available). We received a total of 704 responses, a response rate of 71 percent. Because we are studying the effects of the CBAs on teacher assignment among schools, we limited our sample of districts to those with four or more schools (a strategy also employed by Moe (2005a)) to ensure that there were sufficient transfer opportunities within a district so that a teacher has viable and meaningful transfer options. Statewide, there are 565 such districts. We collected 488 responses from that population, a rate of 86 percent.

Description of Transfer and Leave Provisions

Although CBAs have dozens of provisions that affect the terms and conditions of employment, and although many such provisions might affect a teacher's choice to work in a particular school district (e.g., the relative salary schedules and benefits packages among districts undoubtedly affect teachers' choices), we chose to analyze the two provisions that most directly affect the assignment of teachers to schools within districts: the transfer and leave provisions.

Generally speaking, the transfer provisions provide rules for voluntary transfers and involuntary transfers. Voluntary transfers are those in which a teacher indicates that she would like to be transferred out of a school and considered for vacancies at other school sites. The CBA typically sets forth criteria for selecting teachers to fill vacant positions. Seniority may be among those criteria and is the primary focus of our analysis. Some districts have transfer provisions that make no mention of seniority. More common, however, are those that use seniority as a factor for selecting among applicants for a vacancy, but seniority is not determinative. El Segundo Unified School District's CBA is exemplary:

> If more than one unit member has applied for a given position, the one best qualified as determined by the District shall be recommended to the Board of Education. Criteria for determining qualifications shall be limited to:
>
> 1. Credential requirement
> 2. Subject major and minor and/or grade level assignments
> 3. Evidence of instructional effectiveness and appropriate experience as reflected in regular performance evaluations
> 4. Rating on oral interview by selection committee
> 5. Other specific skills that relate to the specific vacancy.
>
> Such qualifications being equal, seniority in the school district and at the school site, in that order shall prevail.

In other instances, such as the CBA for Black Butte Union School District, seniority preference prevails, so long as the teacher is minimally qualified for the vacant position: "If two or more unit members with the appropriate state required credentials for the position apply for the vacancy, the unit member with the greatest seniority shall receive the transfer or reassignment." In the very rare case in California, teachers with seniority possess "bumping" rights, i.e., the ability to displace a teacher from a currently filled position. Los Angeles Unified School District's contract provides such rights in a very limited circumstance:

> Teachers who have for at least eight consecutive years served at one or more locations designated as Title I or Urban Impact I schools may apply for transfer.
>
> Where necessary, displacements shall be made to accommodate applicants.

While it is always an imprecise business to glean the drafters' intent behind contractual text that is the product of consensual negotiations, it seems fair to say that, at least from the perspective of teachers union leaders, the purpose of seniority preference in transfer and assignment rules is to recognize and reward longevity in the organization and, perhaps, establish an internal culture and hierarchy in which one must "pay one's dues." The reward and incentive system reflected in the Los Angeles Unified contract language seems obvious. Moreover, from both a school district's and a union's perspective, such seniority preference language may be designed to attract teachers to more challenging school districts with the clear promise that, if you successfully serve the district for a number of years, you will be rewarded with "choice" assignments. The difficulty, of course, is that those organizational purposes may not be aligned with the interests of children in high-poverty, high-minority, low-performing schools.

It is also important that teachers who are currently employed by a school district (and therefore possess district seniority) frequently receive preference for vacant positions as compared to outside applicants. That preference may be no more than advance notice of a vacant position, as many collective bargaining agreements provide for a period of time (frequently ending by April 15 of each year) in which vacancies are posted internally prior to being advertised to outsiders. Some contracts require that insiders be at least interviewed for a position. Some may provide a selection preference for insiders; either a requirement that an insider be selected if the insider is qualified or that the insider be selected if all else is equal between qualified inside and outside candidates. Occasionally, contracts specify that outside candidates cannot even be considered if there are any inside applicants. Many CBAs also require that written reasons be provided—either automatically or upon request of the teacher—to inside applicants who are not selected.

Transfer provisions also frequently include rules for involuntary transfers. Typically, there are two types of involuntary transfers: "administrator-initiated transfers" are those that occur at the behest of a district or site-based administrator and "surplus" or "excess" transfers that occur when a reduction in staff is necessary at a school site. When layoffs from the district as a whole are necessary (frequently due to declining enrollment), seniority plays a determinative role in virtually all CBAs. Nearly all provide that, the least senior teacher is laid off first. Consequently, we focused on the involuntary transfer (non-layoff) section of the contracts. Seniority can play a role in such transfer decisions in both the sending and receiving schools. When an administrator must choose a teacher to transfer, seniority can be determinative, a factor, or a non-factor.[14] On the receiving end, if an administrator must choose among multiple teachers being involuntarily transferred from other schools, seniority can also be determinative, a factor, or a non-factor. In rare cases, an involuntarily transferred teacher can displace (i.e., bump) a less-senior teacher at the receiving school. This can cause serial bumping of teachers.

The second portion of CBAs that we analyzed was the leave provisions of the contract. Teachers may take a leave of absence for many different reasons, including a family care leave (maternity, elder care), medical leave, personal leave, and so forth. In virtually all districts, for short-term leaves (e.g., personal days, bereavement leaves, sick days, short-term family and medical leaves), teachers are entitled to return to their previous assignment. Districts generally hire substitute teachers for these short-term leaves. For longer leaves, teachers are guaranteed by contract and, in the case of family and medical leave, by law, that they will be returned to employment in the district. Whether, upon return from leave, teachers are returned to their previous assignment differs among CBAs. Finally, for extended leaves (sabbaticals, year-long unpaid leaves), it is nearly always the case that teachers, if the leave was approved by the district, are re-employed by the district, but are not guaranteed a return to the position they left. We focused on the provision that varies the most among contracts: whether teachers returning from long-term (over twelve month), paid leaves are guaranteed their previous assignment or not. This provision affects the distribution of teachers across schools because it may allow a returning teacher to bump another teacher who has taken her place. For periods over twelve months, the replacement teacher is probably not a substitute teacher, and bumping would result in an involuntary transfer.

Coding the Collective Bargaining Agreements: The Transfer/Leave Score (TLS)

[14] Note that for the involuntary sending of teachers it is technically reverse seniority at play - i.e., the least senior teacher among those who can be excessed is chosen. For example, if a school needs one less math teacher, reverse seniority among the teachers in the math department can be determinative, a factor, or a non-factor.

Because we seek to understand the effects of the transfer and leave provisions in CBAs and because there is apparent variation among the CBA rules for transfer and leave, we coded the transfer and leave provisions in the CBAs for all districts in our sample (n=488) and assigned each district a single score, the transfer/leave score (TLS) that reflects the collective strength of those provisions. In coding the transfer and leave provisions we answered six questions and provided a score for each question:

1. What role does seniority play in voluntary transfer teacher assignments?
   a. No seniority language=0
   b. Seniority a factor, but not determinative=1
   c. Seniority determinative=2
   d. Displacement of other teachers based on seniority permitted (bumping)=3
2. What role does seniority play in selecting a teacher to involuntarily transfer?
   a. No seniority language=0
   b. Seniority a factor, but not determinative=1
   c. Seniority determinative=2
3. What role does seniority play in receiving a teacher who is being involuntarily transferred?
   a. No seniority language=0
   b. Seniority a factor, but not determinative=1
   c. Seniority determinative=2
   d. Displacement of other teachers based on seniority permitted (bumping)=3
4. How are outside applicants considered relative to inside applicants?
   a. No preference for inside applicants=0
   b. Inside applicant is factored into decision, but not determinative=1
   c. Inside applicant is determinative=2
5. When is the District required to provide reasons for denying a voluntary transfer request?
   a. Not required at all=0
   b. Required upon request=1
   c. Required in every instance=2
6. What position must a teacher be given upon returning from long-term paid leave?
   a. Not guaranteed prior assignment=1
   b. Guaranteed prior assignment=2

The score for each of the questions was greater the more determinative the language of the contract. The total TLS is the sum of the scores for each of the six questions, which theoretically can range from 1 to 14 but, for our sample, actually ranges from 1 to 10. Figure 1 displays the distribution of districts by TLS.

INSERT FIGURE 1 HERE

Coding was done by two researchers who developed a list of strict coding decision rules that provide for virtually all types of language in CBA transfer and leave provisions. Any ambiguous contract language was coded by consensus of the researchers. Reliability analyses were conducted (using SPSS) to examine the relationships between individual questions which compose the total transfer/leave score and the internal consistency of the total score. An Alpha (Cronbach) model is used to examine the internal reliability or consistency of the total transfer/leave score, based on the average inter-question correlation. The Cronbach's alpha coefficient is 0.488, indicating that the six questions may not be measuring the same underlying construct. A reliability coefficient of 0.70 or higher is usually considered "acceptable" in most social science research, however, there is no combination of the TLS questions which has a coefficient exceeding 0.70. Consequently, we conduct analyses using the sum of the coding for the six questions (TLST) as well as the coding for Question 1 only (TLS1). A repeated measures analysis of variance with a Tukey's test for nonadditivity is significant at a $p<0.001$ level, indicating that there is no multiplicative interaction among the six questions. A Hotelling's t-square test demonstrates that the null hypothesis that all six questions have the same mean can be rejected. Finally, an intraclass correlation coefficient was calculated to measure the consistency of agreement of values within cases (i.e., inter-rater reliability) with a 95% confidence interval level. The single measures intraclass correlation is 0.111 – which is statistically significantly different than 0.

INSERT TABLE A HERE

Table A presents the bivariate correlations for the coding of Questions 1 through 6 and the total transfer/leave score. Not surprisingly, the coding for the first three questions are significantly correlated suggesting that contracts with more determinative language for voluntary transfers also tend to have more determinative language for sending and receiving involuntarily transferred teachers. Interestingly, the coding for each of the six questions are not always significantly correlated. For example, contracts which have more determinative language for receiving an involuntarily transferred teacher do not necessarily have more determinative language for considering outside applicants relative to inside ones, providing reasons for denying a voluntary transfer request, or the placement of a teacher returning from long-term paid leave. As previously suggested, the six questions may not measure a single underlying construct. However, the total transfer/leave score, as a sum of the six questions, is significantly correlated with the coding of each of the six questions.

A Note on Measuring Teacher Quality and Modeling the Distribution of Quality Teachers

Our quantitative analyses examine how the transfer and leave provisions of collective bargaining agreements are related to other district characteristics and how these provisions affect the distribution of teachers within and between districts. We are particularly interested in the distribution of "quality" teachers. Although, as we discussed, there is a growing consensus that teaching affects student outcomes, i.e., higher quality teachers produce greater student achievement gains, there is little consensus on the specific characteristics of teachers that are related to student outcomes. There is some evidence that teachers' experience levels (at least in the first few years of teaching),[15] general academic and verbal abilities,[16] educational attainment,[17] and certification status[18] are related to student outcomes. Thus, any single measure of "teacher quality" may not capture the specific characteristics of teachers that produce student achievement gains. For our quantitative analyses, like Moe (2005a), we use two measures of teacher quality: 1) the percent of teachers who are fully-credentialed (CRED); and 2) the percent of teachers with more than two years of teaching experience (EXP).[19] More specifically, CRED is the percent of teachers in the school (or district) who have completed a teacher preparation program and hold a preliminary, clear professional, or life credential, and EXP is the percent of teachers in the school (or district) who are not first-year or second-year

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15 See Betts, et al., 2000.
16 See Hanushek, 1992; Ferguson & Ladd, 1996
17 See Betts, et al., 2000; Ferguson & Ladd, 1996.
18 See Betts, et al., 2000; Goldhaber & Brewer, 2000; Darling-Hammond, 2000.
19 We had initially considered using average teacher salary at the school and district level as the outcome variable, but chose instead to use experience and certification as measures of teacher quality because experience is highly correlated with teacher salary and because school-level data on teacher salary were unavailable.

teachers. Note that for the inter-district correlation and regression analyses, these variables are measured at the district level and for the intra-district hierarchical linear modeling analyses, these variables are measured at the school level. These variables were chosen in large part because data are available for each of them and there is some evidence that each is related to student outcomes, though we recognize that they are not robust measures of teacher quality. The purpose of this analysis is exploratory: we seek to identify those school district characteristics that are associated with strong transfer and leave provisions.

How Do Collective Bargaining Agreements Differ Among School Districts? (Correlation Analyses)

We begin our quantitative analyses by investigating the relationships between the collective bargaining agreement transfer/leave score (TLS) and other district characteristics with bivariate correlations (using SPSS 14.0). We include all the districts in our population (i.e., districts with more than three schools) – for a total of 567 districts. Cases are excluded pairwise, so only 488 districts (from which we collected and coded contracts) are used for the TLS correlations.

Data

Two different versions of TLS are used for these analyses: TLST is the total transfer/leave score or the sum of the six coding questions. We hypothesize that among the CBA provisions we coded, the role of seniority in voluntary transfer decisions (Question 1) has the greatest influence on the distribution of teachers. TLS1 is the coding for Question 1 only. We include two measures of district-level teacher quality: percent credentialed teachers (CRED) and percent experienced teachers (EXP). We include four different measures of size: number of schools in the district (SIZE), growth in student enrollment (GROW), natural log of median student enrollment in the district's schools (MENR), and median average class size (MCSZ). We have three measures of student performance: median API in the district's schools (MAPI), median percent of students proficient in English Language Arts (MELA), and median percent proficient in Math (MMAT). The median percent minority students (MMIN) is a measure of student disadvantage.[20] We use two dummy variables to distinguish between the types of school districts: elementary (ELEM) and high school (HIGH) – with unified districts as the default – and two dummy variables to identify the urbanicity of the district's location: urban (URB) and suburban (SUB) – with town/rural as the default. DAYS is the number of service days required by teachers in the district. Finally, we include two funding variables: average teacher salary (SAL) and natural log of per pupil expenditures (PPE). Data were taken from the National Center for Education Statistics (NCES) 2003-04 Common Core of Data (CCD) or the California Basic Educational Data System (CBEDS). Table B provides certain descriptive statistics for these variables.

INSERT TABLE B HERE

Results

INSERT TABLE C HERE

Table C presents the bivariate correlation coefficients. As expected, TLST and TLS1 are highly correlated. We are also not surprised to find that both TLST and TLS1 are significantly correlated with DSIZE. The contract transfer and leave provisions of large school districts tend to be more determinative. There are at least two possible explanations for this. First, it is possible that collective bargaining units, which are much larger in larger school districts, may possess greater political power and greater power at the bargaining table and are therefore able to negotiate for more favorable terms than their smaller district counterparts. Yet this explanation may not be complete or may not be accurate because it fails to account for the other vocal political interests that may be active in larger districts and may oppose union positions (e.g., business leaders), and it fails to explain why unions in small districts, which may have fewer competing political interests, are not able to wield as much

[20] In the discussion of our hierarchical linear model below, we explain why we chose percent minority as the measure for student disadvantage at both the district and school level.

power at the bargaining table.[21] A second reason for the stronger TLS in larger school districts may be that, in those districts, teacher assignment is so complex that it is efficient for both teachers and administration to rely on rules to organize teacher assignment, rather than ad hoc and potentially contested discretionary decision-making.[22] That those rules are reflected in CBAs, as opposed to standard school board policies is likely due to the influence of unions and the fact that teacher assignment is a mandatory bargaining subject.

There is an unexpected significant positive correlation between TLST and CRED. This correlation indicates that districts with more determinative transfer and leave contract language generally have larger percentages of credentialed teachers. One possible explanation is that credentialed teachers are attracted to and remain in districts with high TLS because they can eventually exercise their seniority rights to transfer to the most desirable schools in the district. However, if this is true, then one would expect to also find significant positive correlations between TLST and EXP which we do not. In other words, more experienced teachers should also be attracted to and remain in districts with high TLS, but this is not the case. One might also expect to find a significant positive correlation between TLS1 and CRED which we do not, although that may also be due to the limited range and variability of TLS1. We explore the possible TLST-CRED relationship further in the next section when we use regression to control for the effects of other district characteristics on CRED.

Interestingly, TLST is significantly and negatively correlated with MELA suggesting that the transfer and leave provisions of teacher contracts are more determinative in districts with lower percentages of English-Language Arts proficient students at the typical school. Stronger contract language may be important to teachers in districts with low-performing schools so that they can use certain provisions, such as seniority rights, to transfer out of those schools (assuming that there are more preferable, high-performing schools in the district as well). TLST is negatively but not

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[21] See Moe (2005b) who finds that unions are typically the most powerful participants in school board elections because of their single-minded focus on education and that they are equally powerful in districts of all sizes.
[22] Our thanks to Terry Moe for this helpful insight.

significantly correlated with MAPI and MMAT, indicating that the transfer and leave provisions are not as strongly related to these other student performance measures. Also, TLS1 is not significantly related to any of the three student outcome variables, but the lack of significance may be due to the limited range and variability of TLS1.

We also examine the relationship among the other district-level variables. Most of the significant correlations are as expected, some of which are highlighted here. The two measures of teacher quality are significantly correlated with each other, as are the three measures of student performance. Districts with large minority student populations tend to be larger districts with bigger schools and larger average class sizes, have fewer quality teachers and lower student performance, require less days of service from teachers, have less college-educated adults in their boundaries, and be in urban areas. Student outcomes are significantly and positively correlated with the average teacher salary, number of service days required of teachers, and the percent of adults with college degrees in the area. The student performance measures are also significantly and positively correlated with the percent credentialed and percent experienced teachers in the district, suggesting that these may be appropriate measures of teacher quality.

There are some surprising significant correlations among the district variables (other than the TLST-CRED and TLST-MELA relationships described above). Of note, PPE is significantly and negatively correlated with MAPI, MMAT, and SAL. This indicates that districts which spend more per pupil actually have lower average teacher salaries and lower-performing students. Interestingly, PPE is also not significantly correlated with the teacher quality measures, indicating that districts that spend more per student do not necessarily have larger percentages of credentialed and experienced teachers.

Discussion

This exploratory analysis was designed to identify the school-district-level characteristics that are related to the strength of transfer and leave provisions. As we expected, larger school districts tend to have stronger transfer and leave provisions. This is likely due to the utility of transfer and leave provisions in ordering the very complex problem of assigning hundreds (or thousands) of teachers to dozens of schools and the strength of unions in obtaining such strong provisions. As a result any analysis of the effects of TLS on any outcomes (e.g., teacher quality) must control for the effects of district size. We also find that TLS is significantly and positively correlated with one of the teacher quality measures, teacher certification. This too is unsurprising given that such strong transfer provisions (perhaps accompanied by other attractive CBA provisions) may both attract and retain higher quality teachers, although this finding does contradict the conclusions of Levin, et al. (2005), which suggest that such strong transfer and leave provisions cause large school districts to lose high quality teachers in the hiring process. In either event, we directly estimate the effects of TLS on our teacher quality measures in the next section.

Do Collective Bargaining Agreements Affect the Distribution of Teachers Among Districts? (Regression Analyses)

We next employ OLS regression techniques (using SPSS 14.0) to investigate the effects of the collective bargaining agreement transfer and leave provisions on the distribution of teachers between districts. Specifically, we model the relationship between the transfer and leave provisions of CBAs and the quality of the teaching force in a school district while controlling for other district-level factors that may affect the quality of teachers.

Data

Outcome variables. We use two measures of teacher quality for our outcome variables: 1) the percent of teachers in the district who are fully-credentialed (CRED); and 2) the percent of teachers in the district with more than two years of teaching experience (EXP). These percentages were calculated from the California Basic Education Data System's (CBEDS) 2003-04 Professional Assignment

Information Form (PAIF) datafiles by aggregating the individual teacher reports of credential status and years of teaching at the district level.

Independent variables. The transfer/leave score (TLS), our independent variable of interest, reflects provisions in the collective bargaining agreements which vary between districts and theoretically impact the distribution of quality teachers across districts. TLST is the total transfer/leave score or the sum of the six coding questions. TLST has a possible range of 1 to 14 but an actual range of 1 to 10. Note that we did not use TLS1 for these regression analyses because TLST and TLS1 are highly correlated.

We also include 13 other independent variables as controls. All data are from the 2003-04 academic year unless otherwise noted. SIZE is the number of schools in the district. GROW is the percent increase or decrease in the student enrollment between 2002-03 and 2003-04. MENR is the natural log of the median student enrollment in the district's schools. MCSZ is the median average class size for grades 4-6.[23] MMIN is the median percent minority students.[24] MELA is the median percent students proficient in English-Language Arts. ELEM is whether the district is an elementary school district and HIGH is whether it is a high school district – as compared to a unified school district. URB is whether the district is in an urban (i.e., large or mid-size city) location and SUB is whether it is in a suburban (i.e., urban fringe of a large or mid-size city) location – as compared to a town or rural location. PPE is the natural log of the total per pupil expenditures. DAYS is the number of teacher required service days (including teaching days and staff development days). EDU is the percent of adults (age 18-64) in the district boundaries with a college degree from Census 2000 data.[25]

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[23] Average class size is calculated by CBEDS as enrollment in classes divided by the number of classes excluding special education classes, other instruction-related assignments, department chairs, classes with no enrollment, and classes with enrollment over 50. Note that average class size is different from pupil-teacher ratios.

[24] Minority students in this study are those designated as American Indian/Alaska Native, Hispanic/Latino, or African American (not Hispanic).

[25] EDU data is reported in the NCES CCD but is originally from the Census 2000 School District Demographics Project.

Each of these variables has a theoretical effect on the percent of credentialed/experienced teachers in a district, as outlined in Table D.

INSERT TABLE D HERE

Data for SIZE, EDU, and URB/SUB were taken from the National Center for Education Statistics (NCES) 2003-04 Common Core of Data (CCD). Data for GROW, SAL, and PPE were acquired from a CBEDS Ed-Data query of all districts in California. Data for the rest of the variables were taken from the CBEDS 2003-04 School Information Form (SIF), Certificated Salaries and Benefits, Academic Performance Index (API) Base, and Accountability Progress Reporting (APR) datafiles.

Some variables included in the bivariate correlations are removed from these regression analyses to avoid possible multicollinearity problems. In particular, MPAI and MMAT are not included because they are highly correlated with MELA, and all three variables measure student performance. As previously noted, TLS1 is excluded for similar reasons. PPE and MCSZ are also highly (negatively) correlated but they measure different constructs so both are kept in the model. Additionally, SAL is removed because of an endogeneity problem: a higher average teacher salary may make a district more attractive to quality teachers, but more experienced teachers in a district will also make the average teacher salary greater because teachers' salaries are in part based upon years of service.

We include all the districts in our population (i.e., districts with more than three schools). However only 420 of these districts have complete sets of data and are ultimately used for the regression analyses.

Results

We first regress the 13 control variables and TLST on percent credentialed teachers in the district. This model is statistically significant (at a $p<0.001$ level). Approximately 25.3% of the variability in district percent credentialed teachers is accounted for by the variables in this model, after taking into account the number of predictor variables. Note that if TLST is not included in the model, the other variables account for about 24.2% of the variability in percent credentialed teachers, suggesting that TLST does contribute to the full model. Furthermore, the R square change (between the model with TLST and the model without TLST) is significant at a $p<0.05$ level, indicating that the overall contribution of TLST to the model is significant. We next examine how TLST affects the distribution of credentialed teachers among districts.

INSERT TABLE E HERE

Table E presents the unstandardized regression coefficients and robust standard errors for this analysis. Most interestingly, TLST has a significant, positive effect on the percent credentialed teachers in the district, even after controlling for a number of other district characteristics which could also affect the distribution of teachers. This suggests that districts with more determinative transfer and leave provisions may have an easier time recruiting and retaining credentialed teachers. The TLST coefficient indicates that a one unit increase in the total transfer/leave score is associated with a 0.36 increase in the percent credentialed teachers in the district, assuming that all other variables in the model are held constant. As we postulated in the previous section, credentialed teachers may be attracted to districts with high TLS because they can eventually exercise their seniority rights to transfer to the most desirable schools in the district. Even if they must begin their career in an undesirable school, determinative transfer provisions "guarantee" them the opportunity to transfer to a more favorable school once they have "paid their dues." We recognize, however, that the relationship between TLS and the percentage of credentialed teachers may be endogenous in that school districts with high percentages of credentialed teachers may have stronger unions and may therefore push for more determinative transfer language. Moreover, we also cannot determine whether there are other uncontrolled contractual or district level factors that are highly correlated with TLS and may also work to attract and retain certified teachers.

While a higher TLST appears to create some positive effects on the distribution of quality teachers across districts, if our explanation is accurate, it is likely to produce some negative effects on the distribution of quality teachers within districts – in particular, schools with large populations of poor, minority, and/or low-performing students are less likely to have experienced teachers (who can use their seniority rights to leave these schools). We examine this hypothesis in the following section with intra-district analyses.

The other significant coefficients in our percent credentialed teachers regression are not surprising. District growth and median percent minority students are negatively and very significantly (at a $p<0.001$ level) correlated with the percent credentialed teachers in the district, after controlling for the other district-level variables. As we predicted, districts with large student enrollment increases from one school year to the next make it difficult for districts to staff their schools with large proportions of credentialed teachers. Similarly, when there are large percentages of minority students at the median (i.e., typical) school, credentialed teachers are less likely to want to work in the district. The coefficients for the district type dummy variables are significant and also fit our hypotheses – elementary districts tend to have higher proportions of credentialed teachers while high school districts tend to have lower. Examination of the standardized (beta) coefficients for each of these significant relationships reveals that MMIN is the strongest predictor of percent credentialed teachers, followed by TLST. A one standard deviation change in the median percent minority students leads to a 0.552 standard deviation decrease in predicted percent credentialed teachers, with the other variables held constant. And, a one standard deviation increase in the total transfer/leave score is associated with a 0.113 standard deviation increase in percent credentialed teachers.

Next we run a regression with the same predictor variables but use percent experienced teachers as the outcome. This model is statistically significant (at the $p<0.001$ level) but only explains 6.1% of the variability in percent experienced teachers, after taking into account the number of predictor variables. Consequently, these variables do not explain much of the variability in the distribution of experienced teachers among districts. We are not surprised to find that most of these variables are not significantly related to the percent of experienced teachers. Table E presents the unstandardized regression coefficients and robust standard errors for this analysis. We find that only the intercept and MMIN variable have significant coefficients (at the $p<0.05$ level) for this model. As the median percent of minority students increases by one, the percent of experienced teachers in the district decreases by approximately 0.06. As we suggested in the Literature Review section, the aversion to teaching in schools with large numbers of minority students may be based in whole or part upon the highly correlated poor working conditions than to teachers not wanting to teach minority students. In this model, TLST does not have a significant effect on the percent experienced teachers in the district after controlling for the other variables.

Discussion

This regression analysis provides some evidence to resolve the apparent tension between the findings of Levin, et al. (2005) that large urban districts with restrictive transfer and leave provisions are placed at a disadvantage in the teacher hiring process due to internal posting rules and the consequent later posting of positions to outside applicants, and the argument—supported by our correlations analysis—that restrictive transfer and leave provisions may actually work to attract and retain higher qualified teachers to large districts. Because TLST is significantly and positively related to the percent credentialed teachers, it appears that, on average and controlling for other district-level factors including district size, restrictive transfer and leave provisions may work to attract and/or retain certified teachers. We recognize, however, the potential endogeneity of the relationship between TLS and the percentage of credentialed teachers, as school districts with high percentages of credentialed teachers may have stronger unions and may therefore secure more determinative transfer language. Moreover, we also cannot determine whether there are other uncontrolled contractual or district level factors that are highly correlated with TLS and may also work to attract and retain certified teachers.

Although it is far from surprising, we also emphasize the very significant and negative relationship between percent minority and teacher quality. That such a relationship remains so robust, despite the many controls will be considered further below, as we investigate whether determinative transfer and leave provisions create and/or exacerbate inequality among schools within districts, as teachers exercise their seniority preferences.

Do Collective Bargaining Agreements Affect the Distribution of Teachers Within School Districts? (Hierarchical Linear Modeling Analyses)

We use hierarchical linear modeling (HLM) to examine whether the transfer and leave provisions of district collective bargaining agreements affect the distribution of quality teachers among schools within districts. Specifically, to determine whether the transfer and leave provisions of CBAs affect the quality of teachers in schools, we model (using HLM 6.02) the effects of various factors, including seniority preferences in transfer and leave provisions, on teacher quality at the school site level.

Data

Outcome variables. For these intra-district analyses, we use two school-level measures of teacher quality for our outcome variables: 1) the percent of teachers in the school who are fully-credentialed (CRED); and 2) the percent of teachers in the school with more than two years of teaching experience (EXP). The California Basic Education Data System's (CBEDS) Professional Assignment Information Form (PAIF) collects data from individual teachers and reports aggregated school-level data in the Teacher Credentials and Experience datafiles. The most recent data available from CBEDS for these variables are for the 2003-04 academic year. We use the percentages for credentialed (CRED) and experienced (EXP) teachers averaged over the 2002-03 and 2003-04 academic years because these percentages often fluctuate from one year to the next, especially in schools with few teachers. Because collective bargaining agreements are generally renegotiated every three years, most of the agreements that we collected for this study (during the 2005-06 school year) were in effect in 2002-03 and 2003-04. Additionally, the transfer and leave provisions are rarely altered so the provisions we coded were likely in effect during these school years.

Independent variables. The transfer/leave score (TLS), our independent variable of interest, reflects provisions in the collective bargaining agreements which vary between districts and theoretically impact the distribution of quality teachers within districts. Two different variations of the TLS were used in our intra-district quantitative analyses. TLST is the total transfer/leave score or the sum of the six coding questions. TLST has a possible range of 1 to 14 but an actual range of 1 to 10. We hypothesize that among the CBA provisions we coded, the role of seniority in voluntary transfer decisions has the greatest influence on the distribution of teachers. TLS1 is the coding for Question 1 only and distinguishes among contracts which have no seniority language, require seniority to be a factor in voluntary transfer decisions, mandate that seniority be definitive in these decisions, and allow the bumping of less senior teachers by more senior ones.[26]

We include one other district-level variable, size as measured by the number of schools in the district because, as previously discussed, TLS and district size are significantly correlated. Large districts tend to have higher transfer/leave scores. We include district size in our model as a district-level control variable, because we are interested in the relationship between TLS and the distribution of teachers after taking into account district size. Data for the total number of schools in the district

[26] Appendix __ provides results for two other variations of TLS: TLS1a and TLS1b. Both of these variables are dichotomous variables that reflect two opposing theoretical views of how administrators interpret discretionary transfer provisions, i.e., those in which seniority is a factor, but not determinative. TLS1a codes those CBAs in which seniority plays no role as "0" and all others as "1," reflecting the theory that administrators take a conservative approach to contract interpretation and simply use seniority as a determinative in filling vacancies, irrespective of the discretion they actually possess. TLS1b codes those CBAs in which seniority is determinative as "1" and all others as "0," reflecting the theory that administrators take advantage of discretionary transfer language in filling vacancies and do not give priority to seniority in those instances.

(DSIZE) was acquired from the National Center for Education Statistics (NCES) 2003-04 Common Core of Data (CCD).

We include four school-level control variables in our models: natural log of student enrollment (ENROLL), school growth (GROWTH), average class size (CSIZE) and percent minority students (MINORITY). Moe (2005a) included these four school-level variables in his analyses based on their theoretical role in affecting the distribution of teachers across schools. Our review of the literature and qualitative exploration support Moe's selection of these school-level variables as controls.

First, a large student enrollment is likely to cause a school to hire more uncredentialed and inexperienced teachers because teachers tend to prefer teaching in smaller schools with greater sense of community, less school bureaucracy, and stronger personal relationships among teachers and students. Large schools are often forced to hire whomever they can find to fill their classrooms. Additionally, because large schools have more teachers, those schools may feel that having a few less prepared or experienced teachers is not as harmful to the overall academic program.

Second, school growth also potentially works against schools in terms of staffing their classrooms with experienced and credentialed teachers. Schools with rapid growth in student enrollment have to hire many new teachers – who are often literally new teachers with little experience and sometimes incomplete credentials.

Third, average class size can work in either direction. On the one hand, teachers tend to prefer working in schools with small class sizes, and those schools are better able to attract and retain experienced and credentialed teachers. On the other hand, schools with small class sizes also need more teachers and may be forced to hire less experienced and uncredentialed teachers to meet that need.

Finally, student disadvantage likely plays a role in a school's ability to hire and keep credentialed and experienced teachers. As described in the Literature Review section, teachers tend to prefer teaching in schools with fewer minority students, low-income students, and low-performing students – although it is unclear whether teachers' preferences are based more upon actual student characteristics or the highly correlated school working conditions. Regardless, schools with many minority students, low-income students, and/or low-performing students have a more difficult time recruiting and retaining experienced and credentialed teachers. However, these three measures of student disadvantage are highly correlated, making it problematic to include more than one of them in a statistical model. Moe (2005a) chose to use percent minority students as a measure of student disadvantage and, again, we agree with his rationale and use the same variable. There is an endogeneity problem with measures of student performance and teacher quality – schools with low student-performance have difficulty attracting credentialed and experienced teachers, but a lack of credentialed and experienced teachers likely leads to low student-performance. Measures of the social-economic status of students' families (usually percent eligible for free/reduced lunch) are often inaccurately reported, especially in high schools.

Data for the four school-level predictor variables (CSIZE, MINORITY, ENROLL, and GROWTH) are from the California Basic Educational Data System (CBEDS) School Information Form (SIF) and Academic Performance Index (API) Base datafiles. CSIZE is the average class size for grades 4 through 6 at the school, as recorded in the 2004 API Base datafile.[27] MINORITY is the percent of students in the school designated as Hispanic/Latino, African American (not Hispanic), or American Indian/Alaska Native, as reported on the 2003-04 SIF. Total student enrollment is the number of students from Kindergarten to grade 12 plus ungraded elementary and secondary classes, as reported on the 2003-04 SIF. ENROLL is the natural log of the total student enrollment at the school.

[27] Note that class size is calculated by CBEDS as the enrollment in classes divided by the number of classes (excludes special education classes, other instruction-related assignments, department chairs, classes with no enrollment, classes with enrollment over 50). This is not the same as the pupil-teacher ratio. Pupil-teacher ratios are usually smaller than average class sizes because all full-time equivalent teaching positions are counted, including those not assigned to regular classrooms.

GROWTH is the percent increase or decrease in the total student enrollment at the school between 2002-03 and 2003-04. Table F provides some descriptive statistics for all our variables for Sample A.

INSERT TABLE F HERE

Samples

We conduct each set of analyses (described below) using five samples of districts and schools. Sample A includes all districts with a coded collective bargaining agreement and all schools in those districts, except high schools and those with any missing data for the four school-level predictor variables or two outcome variables. After screening out districts with three or fewer schools, there are 567 districts in our population. Of those districts, we collected CBAs from 480 of them and eight of them reported that they do not have a CBA.[28] Consequently, there are 488 districts included in Sample A.[29] All schools in these districts with full sets of data for the average class size, minority students, school growth, and student enrollment variables are included in Sample A except high schools.[30] High schools are excluded for theoretical reasons and the limitations of the HLM software. Teachers generally do not transfer between elementary and high schools. Additionally, because the HLM software removes cases that do not have values for all variables in the model and average class size was calculated by CBEDS for grades 4 through 6, all high schools do not have a value for this variable and would be removed by the HLM program in any event. Ultimately, there are 5199 schools in Sample A. Table G describes Samples B, C, and D, which are subsets of Sample A. LAUSD was removed because it is an outlier in terms of district size. There are 693 schools in LAUSD, whereas the mean district size without LAUSD is 14 schools and the next largest district has only 185 schools. Charter schools were removed because teachers generally do not transfer—pursuant to the terms of a

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[28] Note that if a district reported that it did not have a CBA, it was coded as: TLST = 1, TLS1 = 0, TLS1a = 0, and TLS1b = 0.

[29] A level-2 case cannot be included in the HLM analyses if it is missing values for any of the level-2 variables. Therefore, districts without TLS must be excluded. The districts from which we did not collect a CBA tend to be small districts. The excluded districts ranged from having 4 to 40 schools.

[30] HLM analyses remove level-1 cases which do not have data for all of the level-1 variables in the model.

CBA—between charter and non-charter schools and many charter schools do not participate in district collective bargaining. Additionally, many of the charter schools in the state are outliers in terms of the outcome variables. For example, a number of charter schools have no or very few credentialed teachers. For analyses using Sample E, average class size was removed as a variable because high schools do not have a value for this variable and the HLM program would remove all of the schools from this sample if average class size were included.[31]

INSERT TABLE G HERE

Methodology

We use a hierarchical linear model (HLM) to analyze the distribution of quality teachers among schools within districts. In this section we present an extended discussion of our HLM strategy for those readers unfamiliar with the method. Readers familiar with the method may skip ahead to the Results section.

HLM is an appropriate strategy for this analysis because we have predictors at both the district and school levels and outcome variables at the school level. HLM allows us to account for the nested structure of schools *within* districts. Failure to account for this nested structure can lead to the misestimation of standard errors in traditional regression analyses. HLM is also appropriate because we are interested in whether and how district-level characteristics (particularly TLS) affect level-1 relationships (e.g., the relationship between percent minority students and percent credentialed teachers), either amplifying or attenuating them. Hierarchical linear modeling allows us to examine both the direct effects of school- and district-level variables on school-level outcomes as well as the effects of district-level variables on the relationships between school-level variables and school-level outcomes.

[31] Note that we did not remove districts and schools from our samples based upon their values for the outcome and predictor variables. By contrast, Moe (2005a) removed districts in which the median school has less than five percent inexperienced or uncredentialed teachers and districts with less than 15 percent or more than 85 percent minority students.

It is more appropriate to use a hierarchical linear model for these analyses than a traditional ordinary least squares (OLS) regression for four reasons. First, standard OLS regression does not easily take into account the clustering effect of schools within districts.[32] It is incorrect to treat schools within the same district as independent because they are affected by the same district-level conditions, such as collective bargaining agreement provisions. In contrast, HLM accounts for the random variation and structural effects that may exist at both the school and district levels. The methodology adjusts for correlated error terms of schools within the same district and allows for more accurate measurement of variation across districts (Raudenbush & Bryk, 2002).

Second, aggregation bias can be a problem in OLS regression when a variable affects different levels. For example, the percent minority students at a school may have both a school-level and a district-level effect on the distribution of quality teachers. At the school level, percent minority students may be a proxy for the working conditions at the school. At the district level, it may be a proxy for district funding, district office support, and bureaucracy. Consequently, the percent credentialed/experienced teachers at a school may be affected by both school-level and district-level conditions related to percent minority students. HLM appropriately decomposes the different effects of variables into level-1 and level-2 components (Raudenbush & Bryk, 2002).

Third, OLS regression cannot measure the direct effects of district-level variables (such as TLS) on school-level outcomes. Although it is possible to use a fixed-effects estimation strategy to overcome both of the first two problems with standard OLS, fixed effects does not allow for the measurement of the direct effects of district-level variables on school-level outcomes. At best, OLS with fixed effects can only detect interaction effects of district-level variables and school-level variables on school-level outcomes.

Fourth, HLM can measure possible heterogeneity of regression coefficients. A fixed effects OLS regression would assume that the relationships between the school-level predictor variables and

[32] Moe (2005a) used a robust (Huber-White) estimator of variance to account for the clustering of schools within districts.

the outcome variables are the same across all districts. With HLM, we can emulate a random effects model to allow for possible variability in the slope coefficients across districts, and try to account for that variability with district-level factors. In other words, we can examine whether district-level variables amplify, attenuate, or have no effect on level-1 relationships (Raudenbush & Bryk, 2002).

We use HLM 6.02 to build our two-level hierarchical linear model. The following descriptions of our models and how their statistics can be interpreted are adapted from *Hierarchical Linear Models: Applications and Data Analysis Methods* (Raudenbush & Bryk, 2002).

● ***Unconditional (Random-Effects ANOVA) Model***

Our analysis begins with fitting a one-way random-effects ANOVA model in order to determine the total amount of variability in the school-level outcome variables (percent credentialed teachers and percent experienced teachers) within and between districts. This model can be represented with the following equations:

Level-1: $Y_{ij} = \beta_{0j} + r_{ij}$
Level-2: $\beta_{0j} = \gamma_{00} + u_{0j}$

● ***Initial Specification Level-1 Model***

Next we develop a model to represent the distribution of quality teachers (as measured by the two outcome variables) in each of the *J* districts. Our within-district/between-schools model (level-1) treats teacher quality as a function of four school characteristics: average class size (CSIZE), percent minority students (MINORITY), school growth (GROWTH), and natural log of student enrollment (ENROLL). This model regresses the outcome variable (percent credentialed/experienced teachers) for school *i* in district *j* (Y_{ij}) on the four school characteristics and can be represented with the following equation:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{CSIZE})_{ij} + \beta_{2j}(\text{MINORITY})_{ij} + \beta_{3j}(\text{GROWTH})_{ij} + \beta_{4j}(\text{ENROLL})_{ij} + r_{ij}$$

The variance of r_{ij} (σ^2) represents the residual variance at level-1 that remains unexplained after taking into account average class size, percent minority students, school growth, and student enrollment. We group-mean center the level-1 variables so the intercept (β_{0j}) can be interpreted as the percent credentialed/experienced teachers at the average school in the district. By centering the level-1 predictors around their group means (rather than grand means), schools are compared to other schools in the district rather than to all schools in the sample. Our theoretical assumption is teachers generally choose among schools within their district rather than between districts when considering transfers because they may take advantage of seniority and "insider" preferences in the transfer provisions of CBAs. Therefore, teachers usually compare schools to other schools in the district. This also takes into account the fact that a school with 300 students may be considered small in some districts but large in other districts.[33] Group-mean centering is analogous to a fixed effects analysis because it removes the fixed effect of each level-2 case from the level-1 analysis.

- ***Level-1 Random-Intercept Regression Model***

We initially estimate the level-1 model as a random-intercept model meaning that the coefficients for the four school-level variables are fixed and only the intercept is allowed to vary randomly. This model is compared to the unconditional, one-way ANOVA model to observe the adjusted means for the outcome variables and the reduction in school-level and district-level variation accounted for by the four school-level variables.

- ***Level-1 Random-Coefficient Regression Model***

We employ a random-coefficients model (or an intercepts- and slopes-as-outcomes model) to determine how much each of the school-level variables affects the distribution of percent credentialed/experienced teachers within districts. In this model, the intercept and all four coefficients are allowed to vary randomly. Consequently, each district's distribution of percent credentialed/experienced teachers is characterized in terms of five parameters: an intercept (β_{0j}) and four regression coefficients (β_{1j}, β_{2j}, β_{3j}, and β_{4j}). β_{0j} is the mean percent credentialed/experienced

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[33] OLS regression typically accounts for this by measuring variables as a deviation from the district median.

teachers in district j. β_{1j}, β_{2j}, β_{3j}, and β_{4j} are the differentiating effects of each of the four school-level characteristics in district j. Each of the distributive effects (β_{0j}, β_{1j}, β_{2j}, β_{3j}, and β_{4j}) are net of the others. Consequently, the regression coefficients represent the degree to which differences in each of the school-level characteristics is related to differences in the outcome variable, after taking into account the other three school-level predictors. For example, the percent minority students differentiating effect in district j (β_{2j}) is the adjusted mean percent credentialed/experienced teachers variation between schools in district j, after controlling for the effects of average class size, school growth, and student enrollment.

● ***Specification of Final Level-1 Model***

Results of the unconditional, random-intercept, and random-coefficients models are used to specify the final level-1 model. Specifically, the slope t-statistics, slope reliabilities, variance components, and model deviances are examined to determine which school-level coefficients should be included in the model and whether the error terms of each should be fixed or allowed to vary randomly. However, theoretical considerations drive the ultimate specification of the final level-1 model.

● ***Hierarchical Models***

Our base hierarchical models are built by adding a district-level variable to the final level-1 model. Specifically, transfer/leave score (TLS) or district size (DSIZE) are added to each of the level-2 equations for theoretical reasons – we believe that TLS and district size could plausibly have independent effects on the outcome variables and effects on the level-1 relationships. We develop three separate base hierarchical models, adding only DSIZE in the first, only TLST in the second, and only TLS1 in the third. To develop our full hierarchical models, we include both DSIZE and a TLS variable to each of the level-2 equations. The first full model accounts for DSIZE and TLST, and the second full model accounts for DSIZE and TLS1. District size is used as a control variable in these models as we are most interested in the effects of the collective bargaining agreement transfer and leave provisions on the distribution of quality teachers after taking into account the effects of district size. It should be noted that we did not intend to build a comprehensive model to explain the variability in the outcome variables within and across districts. Rather, the purpose of our hierarchical models is to examine the effects of TLS on the distribution of quality teachers, after controlling for school-level predictors and district size.

The level-2 predictors are entered into the model uncentered (rather than grand-mean centered), because we are not interested in comparing the size and transfer/leave provisions of a district to the average district in the sample. Again, our level-1 model is:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\mathrm{CSIZE})_{ij} + \beta_{2j}(\mathrm{MINORITY})_{ij} + \beta_{3j}(\mathrm{GROWTH})_{ij} + \beta_{4j}(\mathrm{ENROLL})_{ij} + r_{ij}$$

The generic level-2 model can be represented by the following equations:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}{*}(\mathrm{DSIZE}) + \gamma_{02}{*}(\mathrm{TLS}) + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11}{*}(\mathrm{DSIZE}) + \gamma_{12}{*}(\mathrm{TLS}) + u_{1j}$$
$$\beta_{2j} = \gamma_{20} + \gamma_{21}{*}(\mathrm{DSIZE}) + \gamma_{22}{*}(\mathrm{TLS}) + u_{2j}$$
$$\beta_{3j} = \gamma_{30} + \gamma_{31}{*}(\mathrm{DSIZE}) + \gamma_{32}{*}(\mathrm{TLS}) + u_{3j}$$
$$\beta_{4j} = \gamma_{40} + \gamma_{41}{*}(\mathrm{DSIZE}) + \gamma_{42}{*}(\mathrm{TLS}) + u_{4j}$$

where γ_{10}, γ_{20}, γ_{30}, and γ_{40} represent the relationship between the respective school-level characteristic and the outcome variable at the average district. For example, γ_{10} represents the relationship between average class size and percent credentialed/experienced teachers at the average district. If one of these coefficients is significant it means that the school-level characteristic is significantly related to the outcome variable, after controlling for the other three school-level predictors, district size, and TLS. γ_{02} represents the independent effect of TLS on the outcome variable. A significant γ_{02} indicates that TLS significantly changes the mean percent credentialed/experienced teachers. γ_{12}, γ_{22}, γ_{32}, and γ_{42} represent the effects of TLS on the relationship between the respective school-level characteristic and the outcome variable, when controlling for the other school-level predictor variables and district size. For example, γ_{12} represents the extent to which TLS affects (amplifies or attenuates) the relationship between average class size and the percent credentialed/experienced teachers at the school level. If one of these coefficients is significant, it indicates that the relationship between the school-level characteristic and the percent credentialed/experienced teachers varies significantly between districts by TLS.

Ultimately, we conduct separate analyses for each of the two dependent variables (percent credentialed teachers and percent experienced teachers) for three base hierarchical models (only DSIZE, only TLST, and only TLS1) and two full hierarchical models (DSIZE+TLST and DSIZE+TLS1). Therefore each analysis is repeated ten times for each of the five samples. Additionally, Appendix A provides the results of base and full hierarchical models using two other versions of TLS: TLS1a and TLS1b.

Results

In this section, we describe and interpret the results of the ten analyses for Sample A in detail. Then we present the results of the ten analyses for Samples B, C, D, and E and highlight interesting findings.

● ***Unconditional (Random-Effects ANOVA) Model***

As described above, we first fit a one-way random-effects ANOVA model. Table H presents the results of these analyses for Sample A.

INSERT TABLE H HERE

● ***Percent Credentialed Teachers Analysis***

The estimated percent credentialed teachers average district mean (or the grand-mean) is 92.76. This statistic is actually an average of an average – the average school-level percent credentialed teachers is calculated for each district in the sample, and the grand-mean of 92.76% represents the average of those averages across all districts in the sample. The 95% confidence interval around this estimate is (92.03, 93.49). The pooled within-district or school-level variance is 102.68. This represents a large variation in the percent credentialed teachers within districts. The district-level variation or the variance among the 488 district means is 52.18. This represents the estimated variability of the true district means (β_{0j}) around the grand-mean (γ_{00}) of 92.76. A χ^2 test indicates that this variance is significantly greater than zero, suggesting that there is a significant variation in percent credentialed teachers among districts. Additionally, the estimated proportion of variance between districts (i.e., the intraclass correlation) is 0.33. This means that 33% of the variation in percent credentialed teachers exists between districts. The 95% plausible value range for the district mean percent credentialed teachers is (78.61, 106.91), indicating a fairly substantial difference between districts.[34]

● ***Percent Experienced Teachers Analysis***

We calculate the same set of statistics for the other outcome variable, percent experienced teachers. The estimated percent experienced teachers average district mean is 89.47 with a 95% confidence interval of (88.92, 90.02). The pooled school-level variance is 105.43 and the district-level variance is 25.01. There is a significant variation in percent experienced teachers among districts. The estimated proportion of variance between districts is 0.19, indicating that about a fifth of the variation in percent experienced teachers exists between districts. The mean percent experienced teachers in a district has a 95% plausible value range of (79.67, 99.27) – not as large of a range as percent credentialed teachers, but still fairly large.

● ***Level-1 Random-Intercept Regression Model***

Next, we perform analyses with a random-intercept model. We enter average class size, percent minority students, school growth, and student enrollment in this level-1 equation. Those variables are

[34] Note that while the calculated 95% plausible value range has an upper limit of 106.91, in practical terms, there cannot be more than 100% credentialed teachers.

group-mean centered and fixed so that the adjusted means for the outcome variables can be observed. Table G presents the statistics for this model for Sample A.

● ***Percent Credentialed Teachers Analysis***

The residual school-level variance that remains unexplained for the percent credentialed teachers analysis is 50.06. This means that the within-district variation is reduced by 52.62 or 51% when controlling for these four variables. Therefore, these four variables account for approximately half the variance in percent credentialed teachers within districts. The residual district-level variance is 48.59, indicating that the between-district variation was only reduced by 3.59 or 7%. This makes sense given that the predictor variables included in this model are school-level variables. They therefore account for a substantial amount of the variability between schools but not much of the variability between districts. As expected, there is still significant variability between districts.

The mean percent credentialed teachers, even after controlling for these variables, still has a substantial 95% plausible value range of (79.98, 107.30).[35] Additionally, the relationships between each of the predictor variables and percent credentialed teachers are highly significant, indicating that each of these variables has a significant differentiating effect on the percent credentialed teachers at a school. The coefficients for minority, enrollment, and growth are all negative, as expected, indicating that schools with greater percentages of minority students, larger student enrollments, and more growth tend to have smaller proportions of credentialed teachers. The coefficient for class size is positive, indicating that schools with larger class sizes also have higher percentages of credentialed teachers. This may be the case because schools with larger class sizes need fewer teachers for the same number of students, so it is easier for them to have higher percentages of credentialed teachers.

● ***Percent Experienced Teachers Analysis***

The residual school-level variance for the percent experienced teachers analysis is 54.73, representing a 50.70 or 48% decrease in the intra-district variation. This indicates that the four school-

[35] Once again, in practical terms, there cannot be more than 100% experienced teachers.

level variables account for almost half the variance in percent experienced teachers. The residual district-level variance is 24.20, indicating that the inter-district variation was only reduced by 0.81 or 3%. A significant amount of the variation in the intercept remains unexplained even after controlling for the school-level variables, and the 95% plausible value range of the mean percent experienced teachers between districts is about the same – (79.93, 99.21). The coefficients for the four predictor variables are all significant and have the same signs as the parallel analysis with percent credentialed teachers as the outcome.

● ***Level-1 Random-Coefficient Regression Model***

The random-coefficient model is identical to the random-intercept model except the coefficients of the school-level variables are allowed to vary randomly. Table G presents the results of this model for Sample A.

● **Percent Credentialed Teachers Analysis**

Again the relationships of all four school-level predictor variables and the percent credentialed teachers at a school are significant. However, the coefficients are fairly small, indicating modest effects of the school-level predictors. In the typical district, as the percent minority students increases by one percent, the percent credentialed teachers at the school decreases by six hundredths of a percent. In the average district, as the percent growth of student enrollment at a school increases by one percent, the percent credentialed teachers at the school decreases by two hundredths of a percent. As average class size increases by one student in the typical district, the percent credentialed teachers at the school increases by one and a half tenths of a percent. The natural log of the student enrollment coefficient is -1.77, indicating that an increase of one student is related to approximately two hundredths of a decrease in percent credentialed teachers.[36] Another way to interpret the coefficients is to calculate the effects on the dependent variable associated with a one standard deviation change in the independent variable. A one standard deviation change in CSIZE, MINORITY, ENROLL, and GROWTH is

[36] Note that the student enrollment coefficient is divided by 100 to account for the natural log transformation.

associated with a change in percent credentialed teachers of +0.056%, -0.004%, -6.053%, and -0.001%, respectively. One of the reasons why the effects are so small is because the range of percent credentialed teachers across all schools in the sample is very narrow. The 95% confidence interval around the grand-mean indicates that 95% of the schools in the sample have between 92.03% and 93.48% credentialed teachers. Therefore, even a hundredth of a percent change in the percent credentialed teachers may be a relatively significant difference.

A comparison of the estimated variances of the school-level and district-level random effects for this model and the unconditional model shows that the variance within districts has been reduced by 58.79 (or 57%) while the variance between districts has only been reduced by 2.49 (or 5%). These reductions are slightly more than the reductions for the random-intercept model compared to the unconditional model. In other words, the random-coefficients model explains more of the variance between schools and districts than the random-intercept model.

● Percent Experienced Teachers Analysis

Our level-1 random coefficient model of percent experienced teachers produces very large and statistically significant t-ratios for each of the school-level variables, indicating that they are all significant predictors of percent experienced teachers. The signs for each of the coefficients are the same as with the percent credentialed teachers analysis, and the size of the coefficients are very similar. As the minority students at a school in the average district increases by one percent, the percent experienced teachers decreases by seven-hundredths of a percent. An increase of one student at a school in the typical district is related to a one hundredth of a percent decrease in the percent experienced teachers. A one percent growth in student enrollment at the typical district is associated with a six-hundredths of a percent decrease in experienced teachers. As average class size increases by one student at the average district, the number of experienced teachers increases by about two tenths of a percent. A one standard deviation change in CSIZE, MINORITY, ENROLL, and GROWTH is associated with a change in percent experienced teachers of +0.094%, -0.004%, -3.483%, and -0.006%, respectively.

The estimated variances of the percent experienced teachers model provide some unexpected results. As expected, compared to the unconditional model, the school-level variance has been reduced by 58.29 (or 55%). Surprisingly though, the district-level variance actually increased by 0.47 (or 2%). This means that compared to both the unconditional model (without any school-level variables) and the random-intercept model, this model actually explains less of the variance between districts.

● ***Specification of Final Level-1 Model***

Analysis of the level-1 random-intercept and random-coefficient models for both outcome variables demonstrates that the relationship between each of the school-level predictor variables and the outcome variable is significant. The regression slopes for each variable are fairly small but the t-ratios are all significant at a $p<0.01$ level. Therefore all four variables are kept in the final level-1 model.

For the random-coefficient models, residual variances for the percent minority students and student enrollment predictors are significant when controlling for the other three school-level variables. In other words, the homogeneity of variance tests for the district-level random effects indicates that the relationship between each of these variables and the percent credentialed/experienced teachers varies between districts, and the slopes of these relationships have significant unexplained variation after the other three variables are taken into account. This makes sense theoretically as well. The relationship between percent minority students and percent credentialed/experienced teachers may vary between districts, because a high percent minority student population may be a proxy for poor school working conditions in some districts, but may be particularly attractive in other districts – for example, bilingual teachers often prefer teaching at schools with large populations of English language learners. Additionally, a high percent minority student population may mean a large percentage of African American students in one district and a large percentage of Latino students in another. Theory also supports the finding that the relationship between student enrollment and percent credentialed/experienced teachers varies between districts. For example, in some districts large schools may be ones with extra resources and support for teachers. In other districts, large schools may have a lack of community and increased bureaucracy. Consequently, the relative size of a school may impact teachers' school preferences differently in different districts.

The residual variance for average class size is not significant for both outcome variables, and the unexplained variance in school growth is significant for the percent experienced teachers analysis but not significant for the percent credentialed teachers analysis. However, theoretical considerations indicate that the coefficients of these two variables should be allowed to vary randomly as well. For example, in districts with better support for teachers from the district office, classroom aides, and school support staff, large class sizes may not be as undesirable to teachers as large class sizes in other districts. Similarly, the relationship between school growth and the percent credentialed/experienced teachers may vary between districts. In districts that have difficulty attracting teachers, schools with growing student populations will have an especially difficult time hiring additional teachers. Whereas, in districts with newly developing communities (particularly affluent ones), new schools may not have as much difficulty finding teachers because there may be more potential teachers in the new communities, and teachers are often attracted to work in schools with new facilities. Additionally, some districts have policies (and agreements with the collective bargaining units) to balance the percentage of experienced teachers at new schools and existing schools, even if such balance requires transfers or restrictions on transfers to the new site.

Plausible value estimates provide an idea of how much districts actually vary in their regression slopes. For example, for the percent credentialed teachers analysis, the MINORITY-CRED, CSIZE-CRED, ENROLL-CRED and GROWTH-CRED slopes have a 95% plausible value range of (-0.21, 0.10), (-0.58, 0.86), (-8.46, 4.92), and (-0.12, 0.08), respectively. The 95% plausible value range of these slopes for the percent experienced teachers analysis are (-0.20, 0.07), (-0.67, 1.09), (-8.44, 6.63), and (-0.25, 0.13). This means that all of the regression slopes may within a 95% plausible value range actually vary from positive to negative. For example, in some districts, greater percent minority students at a school is associated with greater percent credentialed teachers, while in other districts larger proportions of minority students are associated with lower percentages of credentialed teachers. This fits our theoretical hypothesis that the relationship between percent minority students (or average class size, enrollment, school growth) and percent credentialed/experienced teachers varies depending on the district context. Therefore, it is appropriate to allow these slope coefficients to vary randomly across districts.

Inspection of correlation, reliability, and deviance statistics further supports our decision to allow all regression slopes to vary randomly. The correlations estimated from the random-coefficient regression model demonstrate that the four predictor variables are weakly correlated, ranging from an absolute value of 0.001 to 0.454. Therefore there is enough independent variation to treat each of them as separate, randomly varying district effects. The reliability estimates from the random-coefficient regression model also help guide the specification of our final level-1 model. All of the random level-1 coefficient reliabilities are greater than 0.05, indicating that a sufficient amount of the observed variation is potentially explainable, and none of the coefficients needs to be treated as fixed or nonrandomly varying. Deviance statistics provide further support for our final level-1 model. While the random-intercept models (with all of the coefficients fixed) are simpler models, the more complex random-coefficients models are justified when the deviance associated with each of the models is compared. Table G compares the deviance associated with the random-intercept and random-coefficients models. The reduction in deviance for the percent credentialed teachers model is 381.35 which is significant when compared against the χ^2 distribution with 14 df. Similarly, the reduction in deviance for the percent experienced teachers model is also significant at 310.45 with 14 df. Therefore, the simpler, fixed coefficient model can be rejected as inadequately representing the actual variation in the data.

For the final level-1 model (for both outcome variables), MINORITY, CSIZE, ENROLL, and GROWTH are included as level-1 predictor variables, and all four coefficients are allowed to vary randomly. Note that this is identical to the random-coefficients model.

● ***Hierarchical Models***

INSERT TABLE I HERE

Table I presents the fixed effects and variance components for the three base hierarchical models and the two full hierarchical models for Sample A. The base hierarchical models include only one level-2 predictor (DSIZE, TLST, or TLS1), while the full hierarchical models include both district size and a TLS variable. The generic full hierarchical model can be represented with the following equations:

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{CSIZE})_{ij} + \beta_{2j}(\text{MINORITY})_{ij} + \beta_{3j}(\text{GROWTH})_{ij} + \beta_{4j}(\text{ENROLL})_{ij} + r_{ij}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(\text{DSIZE}) + \gamma_{02}*(\text{TLS}) + u_{0j}$$
$$\beta_{1j} = \gamma_{10} + \gamma_{11}*(\text{DSIZE}) + \gamma_{12}*(\text{TLS}) + u_{1j}$$
$$\beta_{2j} = \gamma_{20} + \gamma_{21}*(\text{DSIZE}) + \gamma_{22}*(\text{TLS}) + u_{2j}$$
$$\beta_{3j} = \gamma_{30} + \gamma_{31}*(\text{DSIZE}) + \gamma_{32}*(\text{TLS}) + u_{3j}$$
$$\beta_{4j} = \gamma_{40} + \gamma_{41}*(\text{DSIZE}) + \gamma_{42}*(\text{TLS}) + u_{4j}$$

As previously explained, the four school-level predictor variables are group-mean centered, the two district-level variables are uncentered, and all level-1 coefficients are allowed to vary randomly.

● **Percent Credentialed Teachers Analyses**

We first examine the variance statistics for the base hierarchical model with only DSIZE. In this model, the residual variance of the intercept is approximately 48.69. Compared to the final level-1 model with no district-level variables, the intercept variance has been reduced by 1.00 (or 2.01%). This indicates that very little of the parameter variation in the mean percent credentialed teachers can be explained by district size. There is still significant unexplained variance in the intercept across districts. The residual variances of the CSIZE-CRED and GROWTH-CRED slopes are not significant in the final level-1 model and remain non-significant in this model. Compared to the final level-1 model, the residual variance in the ENROLL-CRED slope for the base level-1 model is actually slightly greater.[37] The only slope variability which is at least somewhat accounted for by district size is the MINORITY-CRED relationship, which has a reduction in residual variance of 9.97%. This indicates that district size accounts for approximately one tenth of the variability in the relationship between percent minority students and percent credentialed teachers across districts. It should be noted that, in actual terms, the residual variance is reduced from 0.00592 to 0.00533. However, this was enough of a reduction to change the residual variance from significant to not significant.

We then examine the variance statistics for the two base hierarchical models that include only a TLS variable. The residual variance of the intercept is 49.82 in the base model with only TLST and 49.86 in the base model with only TLS1, indicating that, compared to the final level-1 model, the unexplained variance in the intercept is not reduced (and actually slighted increased) with the inclusion of either TLS variable. This suggests that none of the parameter variation in the mean percent credentialed teachers can be explained by the transfer and leave provisions. Similar to the district size base model, the residual variances of the CSIZE-CRED and GROWTH-CRED slopes remain non-significant, and the residual variance of the ENROLL-CRED slope is slightly greater. Accounting for TLST reduces the residual variance in the MINORITY-CRED relationship by 2.87%, and accounting

[37] It is mathematically possible under the maximum likelihood estimation for the residual variance to increase slightly when a nonsignificant predictor is added to the model (Raudenbush & Bryk, 2002).

for TLS1 reduces this variance by 5.41%. However, unlike the district size base model, these reductions do not change the variability of the MINORITY-CRED slope from significant to not significant – in other words, there is still significant variability in this relationship across districts. Consequently, TLS does not appear to account for much (if any) of the variability in the mean percent credentialed teachers or the four level-1 relationships across districts.

For the two full hierarchical models, we note that there still remains significant unexplained residual variance in the intercept and the ENROLL-CRED slope after accounting for district size and TLS. Given that the reliability statistics for each of these is relatively high, we can be fairly certain that the differences in the mean percent credentialed teachers and the differences in the effect of student enrollment on percent credentialed teachers at a school are due to factors other than district size and TLS. The combination of district size and a TLS variable do seem to account for enough of the variability in the MINORITY-CRED slope to make the remaining unexplained variance insignificant. However, as discussed above, it is probably district size rather than TLS which is accounting for most of this reduced residual variance.

Next, we examine the intercepts and coefficients of the level-2 equations. For the base model with only DSIZE, all of the level-2 intercepts are significant, indicating that each of the four school-level variables significantly affects the average school-level percent credentialed teachers at a district, controlling for the other three factors and district size. Additionally, district size has a significant independent effect on the mean percent credentialed teachers. As district size increases by one school, the mean percent credentialed teachers in the district tends to decrease by three hundredths of a percent. District size also has a significant amplifying effect on the relationships between each of the school-level predictors and percent credentialed teachers except the ENROLL-CRED relationship. Therefore, the MINORITY-CRED relationship is even more negative in large districts than small ones, indicating that large districts have a more inequitable distribution of credentialed teachers by percent minority students. High-minority schools are less likely to have many credentialed teachers, and high-minority schools in large districts are even less likely to have credentialed teachers. District size also amplifies the GROWTH-CRED relationship – growing schools have a difficult time staffing their classrooms with credentialed teachers, and growing schools in large districts have an even more difficult time doing so. Finally, the positive CSIZE-CRED relationship is further enhanced when district size is taken into account. Schools with larger average class sizes are more likely to have large percentages of credentialed teachers and this is even more so the case for schools in larger districts.

In the other four hierarchical models (i.e., those with only TLS and those with district size and TLS), the TLS coefficients in the five level-2 equations (for the level-1 intercept and four coefficients) are never significant. This further supports our conclusion that the transfer and leave provisions do not significantly affect the relationships between the percent credentialed teachers at a school and the percent minority students, average class size, student enrollment, or school growth. Additionally, because TLS is never significant in the level-1 intercept term, the transfer and leave provisions do not appear to have a significant independent effect on the mean percent credentialed teachers in a district. If we were building a model to explain the variability in percent credentialed teachers within or between districts, we would be justified in not including TLS. In other words, TLS does not seem to impact the distribution of credentialed teachers, either directly or by changing the differentiating effects of the school-level predictors. We would need to find other district-level predictors to explain the significant unexplained residual variability.

● **Percent Experienced Teachers Analyses**

We first compare the variance statistics for the final level-1 model and the base hierarchical models with only one district-level variable. We find that after accounting for district size, the residual variance of the intercept decreases by 0.59% and the residual variances for the MINORITY-EXP, GROWTH-EXP, and ENROLL-EXP slopes increase. (The residual variance for the CSIZE-EXP slope was not significant in the final level-1 model.) These statistics indicate that district size does not account for much (or in some cases, any) of the variability in the mean percent experienced teachers or the level-1 slopes. Similarly, we find that when TLST or TLS1 is added to the model, the residual variance of the intercept increases and the residual variances for the GROWTH-EXP and ENROLL-EXP slopes increase. TLST does account for approximately 1.54% of the variability in the MINORITY-EXP slope across districts – and likewise TLS1 accounts for approximately 1.75% of this variability. Consequently, TLST and TLS1 each do not account for much (if any) of the variability in the level-1 intercept or slopes.

Next we examine the intercepts and coefficients of the level-2 equations. For the base model with only DSIZE, the four level-2 intercepts are significant, indicating that each of the level-1 predictor variables significantly affects the average school-level percent experienced teachers in a district, accounting for the other three factors and district size. (However, the intercept for the ENROLL coefficient is only significant at a $p<0.10$ level.) District size only has a marginally significant (only at a $p<0.10$ level) independent effect on the mean percent credentialed teachers. District size has a significant amplifying effect on the CSIZE-EXP slope, a marginally significant amplifying effect on the ENROLL-EXP slope, and no significant effect on the MINORITY-EXP and GROWTH-EXP slopes. This helps explain why the inclusion of district size in the base level-2 model (as compared to the final level-1 model) only slightly reduces the residual variance in the level-1 intercept and class size coefficient and does not reduce the residual variance in any of the other three coefficients. District size does not appear to account for much of the differences in percent experienced teachers within or across districts. Although the statistical reasons appear weak for maintaining district size in the full hierarchical model, we keep it in the model based on theoretical considerations. We are interested in how much TLS affects the level-1 intercept and regression coefficients when controlling for district size.

For the base hierarchical models only including a TLS variable in the level-2 equations, TLST and TLS1 do not have a significant effect on the level-1 intercept or coefficients, with one exception: when only TLS1 is included, it has a significant amplifying effect on the CSIZE-EXP slope. This suggests that the positive relationship between average class size and percent experienced teachers is stronger in districts where seniority is determinative in voluntary transfers. We have no persuasive explanation for this finding.

We next examine the full hierarchical models for percent experienced teachers. The DSIZE+TLST model has very few significant coefficients in the level-2 equations. Of note, district size has a significant amplifying effect on the ENROLL-EXP relationship and a significant attenuating effect on the CSIZE-EXP relationship. However these level-1 relationships are not significant in and of themselves. The attenuating effect is particularly interesting – the coefficient for the CSIZE-EXP slope in this model is negative[38] meaning that schools with larger average class sizes tend to have less experienced teachers, but this relationship is not as strong in large districts. Again, we have no persuasive explanation for this finding. For the DSIZE+TLS1 model, the MINORITY-EXP and GROWTH-EXP slopes are significant, but district size does not have a significant effect on any of the level-1 relationships.

For both full hierarchical models, TLST and TLS1 do not have significant independent effects on the mean percent experienced teachers and do not have significant effects on the relationships between the school-level predictors and percent experienced teachers. Once again, if we were building a comprehensive model to explain the variability of percent experienced teachers within and between districts, we would exclude TLS as a predictor variable, because TLS does not appear to account for much, if any, of the variability in the level-1 intercept or slopes across districts. As previously noted, we would likely not include district size in this model as well.

A Note On Possible Misspecifications and Measurement Errors

[38] Note that this in and of itself is interesting because the class size coefficient is usually positive.

Misspecifications and measurement errors may bias the reported level-1 and level-2 intercept and coefficient estimates. One possible misspecification is a failure to include a significant level-1 predictor of the outcome variable that is related to a level-1 predictor already included in the model (Raudenbush & Bryk, 2002). For example, school working conditions may be significantly related to the percent credentialed/experienced teachers at a school and related to the percent minority students. Additionally, the relationship between school working conditions and percent minority students may also vary across districts, and those slopes may vary by district size. However, we are unable to include school working conditions as a variable in our model because adequate measures for such variables are unavailable. If those conditions apply, then our estimates of the effects of district size on the level-1 intercept and regression coefficients would be biased.

Another possible misspecification is the omission of a significant level-2 predictor. Bias results when a level-2 predictor related to a level-1 predictor is not included in the model (Raudenbush & Bryk, 2002). However, because all the level-1 predictors in our analyses are group-mean centered, this omission may not bias the estimates for the related level-1 predictor much. Bias could also occur if we omitted a level-2 predictor that is significant and correlated with one of our other level-2 predictors (Raudenbush & Bryk, 2002). However, this type of misspecification generally leads to an overestimation of the level-2 effect. Because we found minimal significant effects of district size and TLS in our models, an overestimation simply further supports our conclusion that these two predictors do not account for much of the variability in distribution of quality teachers within and across districts.

If there is measurement error with one of the level-1 predictors, the level-1 coefficient estimates and the mean slope may be biased. Similarly, if a level-2 predictor has measurement error, its coefficient and possibly other level-2 coefficients may be biased (Raudenbush & Bryk, 2002). Given that measurements are made at the school level (for example, school administrators complete the CBEDS School Information Form), there are likely to be some reporting errors. Additionally, these errors may be systematic (for example, large schools may tend to incorrectly report data more than small schools), but there is no known evidence for this and no way for us to detect or correct such errors. There may be errors with the TLS variables as well – the two coders may have coded contracts inconsistently or simply coded some provisions incorrectly. But we are unaware of any such systematic errors in coding.

Interesting Findings from Analyses of Samples B, C, D, and E

Sample B is a subset of Sample A – with the same districts minus Los Angeles Unified School District (LAUSD) and the same schools minus charter schools. Samples C, D, and E are subsets of Sample B and therefore do not include charter schools (or schools with missing data for any of the level-1 variables). Sample C includes only elementary school districts, Sample D includes only the unified school districts,[39] and Sample E includes only high school districts. As previously explained, high schools are not included in Samples B, C, or D. However, for Sample E, high schools are included and CSIZE is excluded as a variable for all analyses.

There are differences in the results of the unconditional, random-intercept, and random-coefficient models for each of these samples, but space does not permit a discussion of those differences. Based primarily on theoretical considerations, the specification of the final level-1 models for each of these samples is kept identical to the specification for Sample A. It is also not practical to describe in detail the results from the hierarchical models for each of these samples, so only some of the interesting findings (particularly those which differ from the Sample A findings) are highlighted.

One consistent conclusion emerges from the analyses of all these samples: if we were building a model for the distribution of quality teachers within and across districts, we would be justified in excluding TLS. Occasionally, TLST or TLS1 has a significant amplifying or attenuating effect on a level-1 relationship, however there is no consistent pattern to these effects – and they may likely be no

[39] Note that since Sample D is a subset of Sample B, LAUSD is not included in Sample D.

more than a statistical artifact. In general, TLS does not appear to play a significant (if any) role in the distribution of credentialed or experienced teachers.

- ***Sample B***

INSERT TABLE J HERE

INSERT TABLE K HERE

INSERT TABLE L HERE

- Only the MINORITY-CRED and ENROLL-CRED relationships are consistently significant[40] across all the hierarchical models for Sample B. The other level-1 relationships are rarely (if ever) significant when district size and/or TLS are included in the model. (Note that all the level-1 relationships are significant in the final level-1 model – except the GROWTH-CRED relationship is only significant at a $p<0.10$ level.)
- District size does not have a significant independent effect on the mean percent credentialed teachers in the district for the DSIZE base model and full hierarchical models. However it does have a significant, negative independent effect on the mean percent experienced teachers for these models. This suggests that, when LAUSD is excluded from the sample, large districts tend to have lower mean percent experienced teachers, but not necessarily fewer credentialed teachers on average. (TLS does not have a significant independent effect in any of the hierarchical models.)
- TLS1 significantly attenuates the negative CSIZE-EXP slope in both the model with only TLS1 and the DSIZE+TLS1 model. This suggests that schools with larger average class sizes tend to have less experienced teachers, but this relationship is muted in districts which have determinative seniority language. (Note that in Sample A, the CSIZE-EXP relationship was positive and amplified by TLS1.)

- ***Sample C***

INSERT TABLE M HERE

[40] Significant effects in this section are those at the $p<0.05$ level.

INSERT TABLE N HERE

INSERT TABLE O HERE

- The intercepts of the level-1 coefficients are rarely significant for any of the base or full hierarchical models, suggesting that when district size and/or TLS are taken into account, the relationships between each of the school-level predictors and the percent credentialed/experienced teachers are not significant. The only exception is with the ENROLL-CRED relationship which is significant in some models. (Note only the MINORITY-CRED, MINORITY-EXP, GROWTH-EXP, and ENROLL-CRED relationships are significant in the final level-1 models for Sample C.)
- District size has a significant independent effect on the mean percent credentialed teachers and mean percent experienced teachers in all the hierarchical models, indicating that larger elementary school districts tend to have a lower percentage of quality teachers on average. (TLS does not have a significant independent effect in any of the hierarchical models.)
- The MINORITY-EXP relationship is positive (but non-significant) and TLS has a significant attenuating effect on that relationship, in the TLST Only, DSIZE+TLST, and DSIZE+TLS1 models.[41] This indicates that the slightly positive relationship between the percent minority students and percent experienced teachers is weakened (and possibly reversed) in districts with determinative transfer and leave provisions. (Note that the MINORITY-EXP relationship is negative in the other models for Sample C.)
- Similarly, the GROWTH-EXP relationship is positive (but non-significant) and TLS has a significant attenuating effect on that relationship, in the TLS1 Only and DSIZE+TLS1 models. (Note that the GROWTH-EXP relationship is negative in the other models for Sample C.)

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[41] This finding somewhat parallels the finding of Moe (2005a). We find that the MINORITY-EXP relationship is positive but TLS tends to reverse that relationship, thereby promoting an inequitable distribution of teachers. Moe (2005a) finds that the MINORITY-EXP relationship is negative and TLS further exacerbates that relationship, thereby promoting an inequitable distribution of teachers.

● ***Sample D***

INSERT TABLE P HERE

INSERT TABLE Q HERE

INSERT TABLE R HERE

- The relationships between percent minority students and the outcome variables are consistently significant, suggesting that in unified school districts, schools with more minority students tend to have lower percentages of credentialed and experienced teachers. The other level-1 relationships are only occasionally (if ever) significant across the hierarchical models for Sample D. (Note that all the level-1 relationships are significant in the final level-1 models except the GROWTH-CRED and CSIZE-EXP relationships.)
- District size has a significant independent effect in the mean percent experienced teachers models but not in the mean percent credentialed teachers models. (TLS does not have a significant independent effect in any of the hierarchical models.)
- TLS1 has a significant attenuating effect on the GROWTH-CRED relationship, suggesting that the significant, negative relationship between school growth and the percent credentialed teachers in unified school districts is weakened in districts with determinative transfer and leave provisions.

● ***Sample E***

INSERT TABLE S HERE

INSERT TABLE T HERE

INSERT TABLE U HERE

- The level-1 relationships are rarely significant in the hierarchical models for Sample E. The only level-1 relationship which is significant is the MINORITY-CRED one in the base district size model. (Note that the only relationships which are significant in the final level-1 models are the MINORITY-CRED and MINORITY-EXP ones. This indicates that school size and growth are not significant predictors of the distribution of quality teachers within high school districts.)

- District size and TLS do not have significant independent effects in any of the hierarchical models for both the percent credentialed and percent experienced teachers.
- TLST has a significant attenuating effect on the negative (non-significant) ENROLL-CRED relationship. This suggests that the relationship between school size and percent credentialed teachers is not as negative (or more positive) in districts with stricter transfer and leave contract language.
- Similarly, TLST has a significant attenuating effect on the positive (non-significant) MINORITY-EXP relationship, indicating that the relationship between the percent minority teachers and percent experienced teachers at a school is weaker in districts with more determinative CBA transfer and leave sections.

Discussion

Our HLM analyses of within-district, between school variation in teacher quality provides further evidence of the teacher quality gap that plagues schools with high percentages of minority students. In both the random intercept and random coefficient level-1 models for our largest sample of schools, the relationship between percent minority and percent credentialed/experienced is negative and very significant, controlling for average class size, school enrollment growth, and average student enrollment. This relationship in our largest sample remains consistent, for the most part, even controlling for district-level factors such as TLS and district size. Indeed, district size amplifies that negative relationship between percent minority and percent credentialed teachers, meaning that the quality gap between higher minority and lower minority schools is even greater in larger districts. Although this negative relationship between percent minority and teacher quality was not present or significant in all of our hierarchical models for all of our samples, we find that the negative relationship persists in most of the models. Put simply, our findings support the conventional wisdom that high minority schools have, on average, lower quality teachers. Our HLM analyses also support, for the most part, our theses that school growth and school enrollment are negatively associated with teacher quality.

But our HLM analyses do not provide much, if any, evidence to support the conventional wisdom that seniority preferences either directly create inequality among schools in terms of teacher quality or that such preferences exacerbate the quality gap between higher minority and lower minority schools. We find almost no significant independent effects of the strength of transfer and leave provisions on teacher quality and very few instances in which those provisions amplify or attenuate the relationship between class size, percent minority, enrollment, or enrollment growth on the one hand, and teacher quality on the other. Put simply, our data and analyses do not support our hypothesis that more determinative transfer and leave provisions in CBAs facilitate inequality in teacher quality among schools.

The Operation of Transfer and Assignment Rules on the Ground: Qualitative Analyses

Having found that the transfer and leave provisions of CBAs have no direct effect on the distribution of teachers within and across districts and no meaningful indirect effects on the significant relationships between teacher quality measures and four school characteristics (percent minority students, average class size, student enrollment, and growth), we are compelled to ask: Why not? To explore that question, we asked school district human resource administrators, who negotiate and implement the terms of CBAs on a day-to-day basis, about hiring and transfer practices on the ground. Our aim was to determine whether and how collective bargaining agreements affected those practices which in turn, naturally, affect the distribution of teachers within and across districts.

Our qualitative analysis suggests that, although they comply with the letter of the transfer and assignment rules in CBAs, school district administrators in California are not overly constrained by CBA language in their hiring and transfer decisions because they (1) negotiate for and exercise clauses in CBAs that permit them to make hiring and assignment decisions that are in the districts' and students' "best interests" irrespective of seniority preferences, (2) develop strong working relationships with union leaders that allow them to mutually suspend or work around apparently strong contract language for the best interests of students, and (3) employ strategies to end-run CBAs, such as "hiding" open positions until after the internal post-and-bid process is completed or refusing to choose an insider and re-posting the position after the internal processes are completed. While all administrators reported that they "live within the letter" of the contract, most find that the contractual language and working relationships permit a great deal of discretion in most cases. Consequently, our quantitative and qualitative analyses both suggest that the teacher quality gap is most likely not due to nor exacerbated by the CBA transfer and leave provisions.

Sample and Method

Our qualitative study consisted of 19 semi-structured interviews of human resources administrators in 19 separate school districts throughout California. The interviews each lasted from a minimum of 30 minutes up to 90 minutes or more. Interviews in the San Francisco Bay Area and the northern end of the Sacramento Valley were mostly conducted in person, while those in other regions of the state were conducted by telephone. All interviews were confidential and participants were guaranteed anonymity. Accordingly, no individuals or their school districts will be identified in this report. Participants were asked about recruiting, hiring, transfer, and assignment practices in their districts. A copy of the interview protocol is included in Appendix B.

We chose to interview human resources administrators because, in nearly all school districts with more than three schools, a single administrator who reports directly to the superintendent for purposes of certificated employee management is assigned to manage most aspects of human resources in the district. Such duties include collective bargaining (certificated and classified staff), employee evaluation and discipline, employee grievances, recruitment and interviewing, staff assignment, and, in some instances, managing workers compensation, employee benefits, and payroll. As such, these administrators are most familiar with the day-to-day practices surrounding teacher hiring and assignment. Moreover, nearly every one of the participants in the study had held other administrative (district- and site-level) and teaching posts in their respective school districts. While interviews of site principals, union officials, and teachers may have provided different information in some instances, resource constraints affected our decision to select only one best-situated participant in each district.

We selected school districts to reflect the two district characteristics that we found related to each other: school district size (number of schools) and the strength of the transfer and assignment provisions of the CBAs. Recall that our quantitative analysis demonstrated that there is a positive relationship between school district size and the strength of the transfer and leave provisions. To ensure variation among those related variables, we selected at least one elementary, high, and unified school district from each of the following cells:

	Small District[42]	Large District[43]
Low TLS[44]	A (n=6)	B (n=4)
High TLS[45]	C (n=4)	D (n=5)

Table V provides a descriptive statistical picture of the school districts in the sample.

INSERT TABLE V HERE

Although we only sampled to create variation in the size of the district and the TLS score, we note that there is some variation among the districts in terms of API scores (range: 637-920), percent

[42] A "small" elementary or unified school district is one with 12 or less schools. A "small" high school district is one with 8 or less schools.
[43] A "large" elementary school district is one with 20 or more schools. A "large" high school district is one with 10 or more schools. A "large" unified school district is one with 40 or more schools.
[44] A "low TLS" for all types of school districts is 4 or less.
[45] A "high TLS" for elementary and unified school districts is 7 or more. A "high TLS" for high school districts is 6 or more.

minority (percent African American and Latino) (6%-77%), percent of students receiving free and reduced lunch (5%-90%), percent English Language Learner students (4%-55%), and teacher credential status (84%-99% credentialed) and experience (72%-95% with more than two years experience).

Staffing, Recruitment, and Hiring

To best understand how teachers are hired, transferred, and assigned to schools within school districts and to begin to determine whether and how CBAs affect these processes, we first describe how the "typical" California school district with four or more schools staffs its schools each year. This description is a composite sketch of the process based on our interviews with human resources administrators. While we acknowledge that no school district we sampled staffs its schools exactly this way, all districts we sampled employ most of the following staffing practices.

Each year, beginning some time in January or February, the human resources department (sometimes in collaboration with the business/finance department) of the school district attempts to project the forthcoming school year's staffing needs at each school. Typically, this process involves projecting the enrollment at each school based on historical experience, data from "feeder" school districts into high school districts, and, sometimes, events that may affect district enrollment such as the opening or closing of a significant place of employment or the opening of a new housing subdivision in an area of the district. Districts simultaneously project their staffing needs created by known teacher leaves of absence, retirements, and resignations. For many school districts, it is then a straightforward matter of determining how many and what type of teachers are needed at each school site based on such projected student enrollment and teacher attrition. For some school districts, however, staffing is determined by a complex and standardized formula that uses enrollment projections and average teaching hours and class size ratios to establish a base list of full-time equivalents (FTEs) at each school site. This figure is then modified to account for additional staffing needs for such things as special programs (e.g., class-size reduction in science and advanced placement courses, smaller teacher-student ratios in certain special education classes, etc.). From that formula, each school site is assigned a final FTE list that the site principal uses to determine her hiring needs for the coming year. With either approach, there is a significant amount of give-and-take between the district human resources department and school principals before a final list of staffing needs for each site is created.

By about March or early April of each year, districts typically have at least an initial picture of their staffing needs for the following year and are able, in many cases, to identify specific vacancies that need to be filled. We hasten to add, however, that for many of the districts we sampled, this initial picture can be quite inaccurate because the districts may experience a great deal of teacher turnover (usually through later retirement and resignation announcements) well into the summer months. Indeed, for many of the large districts, the continued loss of teachers beyond the traditional late-Spring hiring season creates tremendous problems in filling positions with high quality teachers.

Some human resource administrators also expressed frustration with the fact that, although they were able to identify specific vacancies that needed to be filled, it was district practice to not post those vacancies until the district's budget (and, necessarily, its budget for staffing) was approved. Due to the vagaries of how the state budgets for its educational spending—although the Governor's budget is submitted in the Winter, it is modified sometimes significantly by the "May Revise," and may be modified by the legislature again—some districts are reluctant to do any hiring until they have a firm understanding of their own fiscal pictures. One large, urban school district, for instance, had traditionally not even begun its hiring until July because of this budgeting issue. Fortunately, the human resources administrator in that district recognized the problem and has been able to begin hiring in the Spring for at least those vacancies created by teacher attrition.

Once specific vacancies are identified, most of the school districts we sampled are required by their collective bargaining agreements to post those vacancies internally for a specific number of days (often 6-10 days). For many—if not most—districts, the internal posting period concludes by April 15 at which time the position is opened up to outsiders.[46] This internal “post and bid” process gives teachers inside the district who wish to transfer at least an informational advantage over those seeking employment from outside the district. That said, the districts we sampled varied widely as to how much this internal posting requirement actually affects administrators’ discretion to hire teachers from the outside. On one end of the spectrum, certain CBAs require only that the vacancies be posted and insiders are given a chance to apply. No preference whatsoever is given to internal candidates. Other CBAs require that the internal candidate be given an interview, but not necessarily a job offer. In many cases, after the job has been posted (or “flown”) to external candidates and after interviews have been conducted, the district need only hire an internal candidate if the external and internal candidates are otherwise equally qualified and suited to the position. On the other end of the spectrum, however, certain CBAs require that an internal candidate be hired if, say, five or more internal candidates with appropriate minimum qualifications apply for the position. Only in the latter case did human resources administrators report that they felt constrained to any significant extent by the CBA.

Internal posting completed, districts are then free to fly the position to outsiders. How districts recruit teachers also varies, but is largely dependent on the ability of the district to attract qualified teachers. Nearly all districts post vacancies to the EdJoin website (http://www.edjoin.org/), a statewide “classified advertising” page for public school employers. For the desirable districts we sampled, their recruiting often went not much further. Most, however, also participate in local teacher recruitment events (job fairs) or hosted their own recruitment events. Nearly all have developed relationships with

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[46] We note that a couple of the districts we sampled have multiple internal posting dates whereby vacancies—when they occur—must be posted internally until certain dates (e.g., April 15, May 15, June 15, and July 15). Those districts are accordingly unable immediately to announce vacancies to external applicants for even those vacancies that are identified after April 15.

local colleges and universities to host teacher interns and recruit from those schools. In a few instances, however, districts actively recruit outside their region, the state, and even the country. This was particularly true for hard-to-staff positions such as bilingual educators, special education instructors, and math and science teachers at the high school level. This also tended to be true for those lower performing districts with higher percentages of low-income and minority children.

The mechanics of the interview and selection process for vacant positions was remarkably similar among the districts we sampled. The district's human resources office was typically charged with reviewing and screening applicants (i.e., "making the first cut") before giving site principals the resumes of the most promising candidates. In most cases, principals were also given the opportunity to review and screen the resumes received and to review those seeking position through EdJoin. Human resources administrators reported that most principals, however, due to their other duties and pressures usually let human resources identify the promising candidates. Interviews of the internal and external candidates were, in all instances, conducted by the principal. In many instances, however, others were included on the interview team including departmental teacher representatives and district administrators. For those teachers who were initially interviewed by principals or human resources administrators at off-site recruitment events, an on-campus interview was typically required before a final offer was made. This was particularly true for the rural districts that wanted to ensure that the prospective hire would be a good fit with not only the school, but also that she would want to live in the community.

The date upon which most (if not all) hiring is complete varied widely among participating districts. Generally, smaller districts tended to hire earlier with one completing its hiring "by the end of the school year" and others completing by mid-July. Larger districts and high school districts with hard-to-staff disciplines often continued hiring through the summer and at least one of the districts reported that it routinely hires well into September. Such late hiring was attributed to, among other things, late resignations and retirements, inefficient budgeting practices, and, to a much lesser extent, internal posting rules of collective bargaining agreements.

In each of the interviews, we asked the human resources administrator whether and how the collective bargaining agreement affected their recruitment and hiring process. In all but two instances, the (surprising) response we received is that the CBA has only modest effects on their practices. Participants were as likely to identify inefficient budgeting practices, the statewide shortage of certain types of teachers (e.g., special education, math, and science), and the mandates of the NCLB (particularly the credentialing requirements for special education teachers) as being as much a hurdle to hiring high quality teachers as the CBAs. Notably, this response was consistent, irrespective of the actual strength of the school district's CBA transfer/leave score.

When asked why CBAs, despite containing provisions that favor internal and senior candidates, have such modest effects on recruitment and hiring, most administrators said that the agreements themselves provided a significant amount of discretion to administrators. As one administrator stated, "Hiring is an administrative prerogative. We have a 'needs of the district' clause in our contract and we'd never bargain that away." A similar sentiment was struck by another administrator who claimed that "Too many districts give up hiring discretion when they are unable to provide salary and benefits in negotiations. That's a mistake. You never get that discretion back." This latter comment also serves as a reminder that administration plays a role in shaping its employment relationship with its teachers and can choose to maintain or give-up its hiring and assignment discretion.

Other administrators noted that it is possible to abide by the terms of even restrictive CBAs, while still accomplishing hiring objectives. As one administrator in a large district with a strong CBA put it, "if you're skilled at staffing, the impact [of the CBA] is minimal." For instance, two administrators specifically stated the importance of documenting why an internal candidate was not chosen for a position. This makes nearly impossible a successful grievance based on the terms of the

CBA. Other administrators identified practices, though compliant with the CBA, that take advantage of "holes" in the CBA, such as asking teachers to not formally announce resignations until after the internal posting date has passed or re-posting positions after the internal posting date, even if minimally qualified with credentials (though clearly less desirable) internal candidates had applied.

Finally, a number of the administrators emphasized the importance of a good working relationship with the teachers' union as the most effective way of accomplishing hiring objectives. In one remarkable case, a growing school district knew that it had to open-up a new school. Naturally, internal candidates would be attracted to the new facility with a relatively suburban student population. Yet the school did not drain talent from other school sites because the administration and teachers union agreed to suspend the terms of the CBA for purposes of staffing that new school and maintaining the right mix of teacher experience and quality at all of its schools. In other instances, human resources administrators involved union leaders in the staffing process in informal ways to get their buy-in for efforts to hire outsiders.

A careful analysis of our interviews, however, does point to at least two ways in which the CBA provisions modestly affect hiring in many school districts: (1) in some instances, the internal posting provisions create timing requirements that delay interviewing and hiring of outside candidates, and (2) in a very few instances, the stringent rules giving hiring preference to insiders prevents individual schools from choosing what they view as better qualified outside candidates. The first rule—internal posting timelines—only modestly affects those districts that can only post positions externally after April 15 because that date is traditionally the beginning of the major hiring "season" for teachers. Nearly a third of the administrators interviewed, however, commented that the CBA does "slow down" the hiring process to some degree. And those districts with multiple or later internal posting dates reported being placed at a significant disadvantage. To overcome that hurdle, however, some districts hire teachers early in the season for the district as a whole, not to specific placements so that they can hire the best candidates early, while not placing them in a specific vacancy until after the internal posting period elapses and/or other delays in identifying specific vacancies are overcome. The second effect of the CBA hiring provisions—preference for insiders or more senior teachers—was particularly pronounced in two large, urban districts we sampled. In both instances, detailed contract language that required the hiring of insiders under certain circumstances precluded administrators from sometimes considering what they viewed as better qualified outside candidates. Still, this issue was emphasized by only two of the 19 administrators interviewed.

Voluntary Transfers

Nowhere are CBAs more criticized than in their provisions that give teachers seniority preference over more junior teachers in filling vacant positions. According to the conventional wisdom, these provisions have at least two types of deleterious effects. First, teachers with more experience and who are better qualified will leave low-performing and high-minority, high-poverty schools by exercising their seniority rights. Second, principals at all schools—both high and low-performing—may be forced to hire a senior teacher who may be less suited to a particular position than a junior teacher. We did not find either of these effects operating in any significant way in most of our interviews with 19 human resources administrators. The reason is fairly straightforward: even though many of the CBAs identify seniority as a factor in making voluntary transfer and placement decisions, in very few agreements is such language determinative. Rather, seniority may be one of many factors (including relevant experience, certification, special programmatic needs, and the needs of the district) or only comes into play if "all else is equal" among candidates. In other words, CBAs have language that provides administrators with discretion to reject voluntary transfer candidates and they are unafraid to use that language in most instances.

The most common complaints among human resource administrators, however, had to do with the frequent requirement that vacancies first be opened to insiders before allowing outsiders to apply, the less frequent requirement that insiders with seniority be interviewed for open positions, and the rare requirement that an insider with seniority be hired if a certain number of insiders apply for a position. This concern was discussed above and will not be revisited here.

Three of the districts we sampled contradict our general finding and are worth highlighting to better understand those instances in which seniority preferences do affect assignment practices. Two large, urban districts each have very strong seniority provisions that virtually guarantee senior teachers the ability to transfer to "better" schools. In one, a principal who received applications from three inside teachers must select from among those teachers. In the other, the principal must "interview and select" from among the top four senior teachers who apply for a position in the first round of postings, then, in the second round, the principal may not "interview and select," but rather she must select the most senior teacher. So strict is this agreement that union members participate in the "interview and select" process to ensure adherence to the contract. In both cases, a teacher is virtually guaranteed a position she wants over time, irrespective of administration wishes. These district practices, however, are hardly inconsistent with our primary finding: administrators adhere to contract rules, but, where there is discretion (which is most often the case), administrators will use that discretion to assign teachers.

The other exception is anomalous. In one large district with a very weak TLS and very discretionary seniority language, senior teachers nonetheless obtain their placement preferences and usually are placed in vacant positions over junior teachers and outsiders. According to the human resources administrator in that district, the reason is that the union is very strong in the district (indeed, it has stymied efforts to provide significant bonuses to teachers willing to teach in "program improvement" schools) and therefore expects seniority preference, even without the need to negotiate for such rules. Because the culture of the district and the strength of the union have historically meant that senior teachers have their transfer requests granted, current administrators are reluctant to change that practice. Therefore, they interpret the discretionary language in the CBA very restrictively, in order to "play it safe." We had hypothesized that such interpretation of the CBA would be very common in districts, but found, to the contrary, that in most districts, administrators are willing to take full advantage of management discretion.

Involuntary Transfers

Involuntary teacher transfers fall into two main categories: (1) those teachers who are "excessed" or "surplussed" due to a reduction in staff at a particular school, and (2) "administrative transfers" through which poor performing teachers or teachers who are not a "good fit" with the school are transferred to another school.

Seniority prevails in most cases when making decisions about which teachers should be excessed. In other words, virtually all CBAs we reviewed and nearly every one of the human resources administrators we interviewed said that, in the case of reduction of staff at a school site, teachers could volunteer to be placed on the "excess list," but, if there were insufficient numbers of volunteers, the least senior teacher would be excessed first (provided that the teacher was not necessary for the school's programmatic needs).[47] Moreover, administrators reported that excessed teachers would receive preference in filling vacancies at other schools, unless the teacher did not possess the appropriate qualifications or met the programmatic needs of the other schools. This applies when the need to change a teacher's assignment has nothing to do with his or her individual performance, but rather is due to the vagaries of enrollment patterns. Leaving administrators with *carte blanche* to decide which teachers ought to be let go in such an instance would be consistent with practice in much of the non-union private sector, but would seem anathema to unionized public employees.

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[47] We also note that, in the rare instance of teacher terminations due to declining enrollment, the California Education Code, section 44955(b) provides that "the services of no permanent employee may be terminated . . . while any probationary employee, or any other employee with less seniority, is retained to render a service which said permanent employee is certificated and competent to render."

Administrative transfers are a different matter. Administrative transfers are subject to careful documentation, but once the case has been made, principals are free to transfer poor-performing or ill-fitting teachers out of their schools. While human resources administrators nearly uniformly said that such administrative transfers are rare in their districts (a handful a year), some reported that district culture dictated that principals do sometimes use administrative transfers as the *de facto* mechanism to discipline teachers and that principals in the district had to take their "fair share" of the poor-performing teachers, a practice pejoratively referred to as "sharing the lemons." That said, at least one elementary school district with a very strong CBA had an informal policy of never assigning administratively transferred and/or poor performing teachers to its high-poverty schools. Moreover, a couple of districts sampled did not allow any administrative transfers based on poor performance. Rather, principals were required to use the district's peer assistance and review (PAR) program for such cases.

Conclusion: State Policy, Collective Bargaining, and the Quality Gap

The purpose of this study was to find out whether state and school district policies and collective bargaining agreements work to exacerbate or ameliorate the teacher quality gap among schools within and across districts. At the state level, although modest efforts have been made to provide incentives to attract high quality teachers to high-minority, high-poverty, and/or underperforming schools, most policy-making regarding teacher hiring and assignment has been ceded to school boards and administrators and the collective bargaining process in school districts. Conventional wisdom holds that because teacher assignment is a mandatory bargaining item and because unions possess political power and concomitant strength at the bargaining table, most districts will be hamstrung by CBAs with restrictive transfer and leave provisions that grant senior teachers the right to choose the "best" schools, i.e., those without minority and low-performing students. As a result, the CBAs effectively facilitate the quality gap. Moreover, because large, urban districts with restrictive CBAs must endure a lengthy internal post-and-bid process, those districts are placed at disadvantage in hiring quality teachers.

Our quantitative analysis does not support that conventional wisdom. Districts with more determinative transfer and leave provisions—which districts tend to be larger—enjoy a more qualified teaching force, on average. Our regression analysis of the determinants of teacher quality at the district level suggests that the stronger the transfer and leave provision, the greater the percentage of credentialed teachers. In other words, stronger CBAs may attract and retain higher quality teachers. It is possible, however, that there are other uncontrolled contractual and district-level factors that work to attract and retain qualified teachers. Moreover, because of the potentially endogenous relationship between determinative transfer provisions and qualified teachers, we cannot state that determinative transfer language creates a higher qualified teaching force; causation may be working in the opposite direction. Yet the fact that teachers are retained by seniority preferences is appealing. That said, the underlying explanation may be undesirable: the reason teachers are attracted to and retained by those districts is that, after putting in the time, they are virtually guaranteed the best assignments. The corollary is that those districts with strong transfer and leave provisions should experience greater within district inequality in teacher quality.

Yet our HLM analysis of within-district, between-school inequality does not demonstrate that strong CBAs facilitate (or, for that matter, ameliorate) the quality gap. We find what many have found: there is a quality gap between schools and between districts. And that quality gap is between higher minority and lower minority schools and districts. African American and Latino students, on average, are burdened with lower quality teachers. But CBAs do little to make the situation worse.

This is likely due to our qualitative finding that school district administrators either negotiate the flexibility they need into their CBAs or collaborate with teachers and unions to ensure that restrictive CBA language does not work against the interests of students. Granted, in two large, urban districts (of the eight urban districts in our qualitative sample), human resources administrators reported a significant amount of inequality between high-minority, high-poverty schools and more affluent schools in the district. Yet in nearly all of the other districts, administrators reported that the district's formal policies (e.g., modest stipends to teach in "program improvement" schools in one school district, strong BTSA and PAR programs in several districts) and informal practices (e.g., "gentleperson's" agreements among principals to aim for a balance in quality of teachers, suspension of the CBA transfer and assignment provisions for the opening of new schools) resulted in a fair balance among qualified teachers in all schools. Indeed, most administrators reported that none of their schools would be deemed "hard-to-staff" (though a couple expressed concern that the PSAA and NCLB were making it somewhat more difficult to attract the best teachers to the poorest performing schools). All that said, not one administrator stated that the CBA helped to reduce inequality within the district. And none said he or she would prefer to have strong transfer and leave language in the CBA.

Our findings present a challenge for policy-makers. The analyses do not support the adoption of easy fixes such as the abolition of seniority preference (nor do they support the maintenance of such preferences). But they do support the dire need to develop policies and inducements to get high quality teachers into high minority schools and districts. The quality gap indeed exists. And it exists irrespective of collective bargaining agreements.

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APPENDIX A:
Summary of Results of HLM Analyses Using TLS1a and TLS1b

TLS1a and TLS1b are dichotomous variations of the coding for Question 1.

TLS1a

What role does seniority play in voluntary transfer teacher assignments?

c. No seniority language=0
d. Seniority a factor, seniority determinative, or bumping permitted=1

TLS1b

What role does seniority play in voluntary transfer teacher assignments?

e. No seniority language or seniority a factor=0
f. Seniority determinative or bumping permitted=1

TLS1a reflects the hypothesis that administrators may over-interpret the contract provisions such that when seniority should only be *a* factor according to the contract, it is treated as if it is *the* definitive factor in practice. TLS1b reflects the competing hypothesis that administrators tend to utilize ambiguous language in the contract to maximize their discretion in placing teachers. In other words, when seniority is only *a* factor in the contract, administrators treat the contract as if no seniority language exists than definitive seniority provisions. As previously discussed, Moe's (2005a) study employed a regression-based strategy to determine the effects of seniority preference provisions on the distribution of teachers among schools. TLS1a is similar to the coding that Moe (2005a) used, distinguishing between contracts which do and do not have seniority provisions (of any kind) for voluntary teacher transfers.[48]

These analyses parallel the analyses using TLST and TLS1. The two outcome variables are CRED and EXP, and the specification of the final level-1 model remains the same: MINORITY, CSIZE, ENROLL, and GROWTH are included as level-1 predictor variables, and all four coefficients are allowed to vary randomly. Tables V, W, X, and Y present the results of the analyses for each of the

[48] Note a major difference between the coding for TLS1a and Moe's coding is the former only considers voluntary teacher transfers whereas the latter considers both voluntary and involuntary teacher transfers.

outcome variables and for each of the five samples. Specifically, the analyses for Table W include only TLS1a, for Table X include TLS1a and DSIZE, for Table Y include only TLS1b, and for Table Z include TLS1b and DSIZE.

INSERT TABLE W HERE

INSERT TABLE X HERE

INSERT TABLE Y HERE

INSERT TABLE Z HERE

There is no consistent pattern of the effects of seniority on voluntary transfers across samples for either of the dichotomous coding variations. TLS1a is only occasionally significant in both the model including only TLS1a and the model including DSIZE as a control variable as well. For example, TLS1a significantly amplifies the negative MINORITY-EXP relationship after controlling for district size and when only high school districts are considered. Similarly, TLS1b intermittently has a significant effect on the level-1 relationships. For example, TLS1b has a significant amplifying effect on the negative MINORITY-CRED relationship when only TLS1b is included as a level-2 variable and when only elementary school districts are considered. However, these examples are exceptions and do not follow a consistent pattern. More commonly, TLS1a and TLS1b do not have a significant amplifying or attenuating effect on the level-1 relationships. In other words, while there are examples of seniority language further exacerbating the teacher quality gap, we do not find compelling evidence that this is a genuine or consistent effect across the different models we examined.

APPENDIX B:
Interview Protocol

1) Personal information
    a) Please describe your current position and responsibilities.
    b) How long have you been in the school district?
    c) Have you held other positions in the district? Please describe.
    d) Describe other relevant work experience.
2) Hiring practices
    a) How is teacher hiring done in the district?
    b) How are teaching vacancies posted?
    c) Are there any timelines for posting vacancies internally or externally?
    d) Do teachers have to provide notice of continuing employment?
    e) When are your teachers typically hired?
    f) Are there any constraints on the salaries offered to prospective hires?
3) If a teacher wants to transfer to a different school in the district, how does that work in practice?
4) If a principal believes that a teacher would be more successful at a different school in the district, can and how would the principal transfer the teacher?
5) How are teachers assigned among schools in the district?
    a) Does district administration participate in the process?
    b) Do principals participate in the process?
    c) Do representatives of the teachers union participate in the process?
6) How are teachers assigned to specific classrooms within schools?
    a) Is anyone other than the principal involved with the decision?
7) Teacher recruitment
    a) What methods has your district used to attract teachers generally?
    b) What methods does your district use to attract teachers to hard-to-staff schools specifically?
8) Collective bargaining agreement
    a) Does the CBA affect hiring decisions?
    b) Does the CBA affect transfer decisions?
    c) Do administrators—either at the district or site level—find creative ways to fill vacancies with desired prospects or to remove teachers who are not a good fit?

Figure 1
Distribution of Total Transfer/Leave Scores

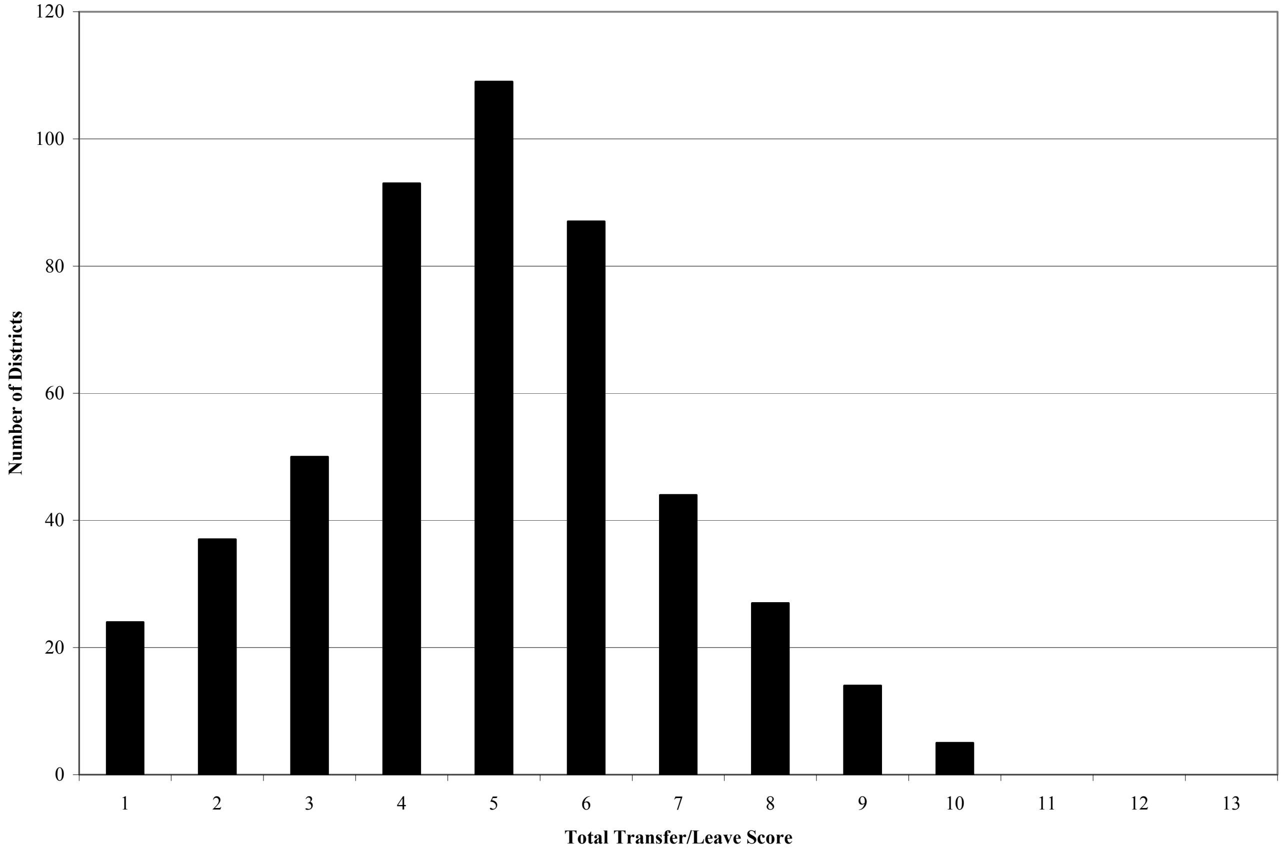

Table A
Correlations of Transfer/Leave Scores (TLS) for Questions 1-6 and Total

	TLS1	TLS2	TLS3	TLS4	TLS5	TLS6
TLS2	.245**					
TLS3	.207**	.463**				
TLS4	.109*	.126**	.075			
TLS5	.140**	.162**	.047	.043		
TLS6	.108*	.073	.028	.129**	-.034	
TLST	.548**	.717**	.636**	.499**	.428**	.252**

* Significant at 0.05; ** Significant at 0.01

Table B
Descriptive Statistics for District-level Variables for Correlation and Regression Analyses

Variables	Coding and Range	Mean	*SD*
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.87	1.952
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed	0.83	0.555
# Schools (SIZE)	(4, 693)	14.66	32.463
Student Enrollment Percent Growth (GROW)	(-19.694, 90.750)	- 0.029	5.687
Median School Enrollment (log) (MENR)	(1.946, 6.907)	5.982	0.880
Median School Average Class Size (MCSZ)	(8.0, 37.0)	28.366	3.610
Median School % Minority Students (MMIN)	(2.489, 99.564)	44.790	27.527
Median School API (MAPI)	(402.0, 948.5)	719.433	84.650
Median School % Proficient-ELA (MELA)	(6.100, 88.650)	41.830	17.181
Median School % Proficient-Math (MMAT)	(8.400, 93.300)	44.755	15.763
Elementary School District (ELEM)	0 = not elementary school district 1 = elementary school district	0.35	0.478
High School District (HIGH)	0 = not high school district 1 = high school district	0.11	0.308
Unified School District (UNI)	0 = not unified school district 1 = unified school district	0.54	0.499
Urban (URB)	0 = not large/mid-size city 1 = large/mid-size city	0.25	0.436
Suburban (SUB)	0 = not urban fringe 1 = urban fringe of large/mid-size city	0.54	0.498
Other (OTH)	0 = urban or suburban 1 = large/small town or rural	0.20	0.401
Average Teacher Salary (log) (SAL)	(10, 11)	10.91	0.097
Per Pupil Expenditures (PPE)	(8.594, 10.242)	8.856	0.188
Teacher Service Days (DAYS)	(166, 190)	184.21	1.910
Adult Population Education (EDU)	(0.489, 92.864)	24.674	17.493
% Credentialed Teachers (CRED)	(57.529, 100.00)	91.905	6.555
% Experienced Teachers (EXP)	(33.632, 100.00)	89.924	6.294

Table C
Correlations of District-level Variables

	TLST	TLS1	SIZE	GROW	MENR	MCSZ	MMIN	MAPI	MELA	MMAT	ELEM	HIGH	URB	SUB	SAL	PPE	DAYS	EDU	CRED
TLS1	.548**																		
SIZE	.113*	.177**																	
GROW	- .069	- .078	.009																
MENR	.052	.056	.134**	- .121**															
MCSZ	.063	.058	.094*	- .019	.693**														
MMIN	.071	.052	.140**	- .015	.283**	.162**													
MAPI	- .030	- .001	- .044	- .015	.130**	.076	- .678**												
MELA	- .096*	- .036	- .096*	- .052	- .090*	- .001	- .787**	.819**											
MMAT	- .064	.002	- .062	- .060	.042	.091*	- .712**	.854**	.940**										
ELEM	.038	.006	- .122**	.087*	.186**	.094*	- .017	.201**	- .015	.037									
HIGH	- .058	- .037	- .066	- .167**	- .273**	- .114**	- .048	- .251**	.208**	.099*	- .254**								
URB	.138**	.085	.214**	- .029	.240**	.177**	.140**	.014	- .038	- .010	.112**	.050							
SUB	- .035	.016	- .089*	- .061	.319**	.262**	.049	.096*	.053	.093*	- .015	- .054	- .639**						
SAL	.028	.032	.070	- .113**	.485**	.430**	- .049	.334**	.337**	.392**	.103*	.128**	.234**	.171**					
PPE	- .060	- .078	- .007	.162**	- .636**	- .705**	- .083	- .136**	- .031	- .128**	- .146**	.049	- .111**	- .273**	- .264**				
DAYS	- .035	- .024	- .045	.030	.032	.019	- .127**	.192**	.198**	.204**	.022	- .008	.090*	- .037	.150**	- .017			
EDU	- .060	- .026	.003	.003	.038	- .018	- .609**	.773**	.828**	.813**	.040	.017	.104*	.034	.371**	.058	.202**		
CRED	.094*	.013	- .101*	- .065	- .164**	- .087*	- .431**	.337**	.276**	.293**	.123**	- .155**	- .071	- .028	.069	.020	.083	.209**	
EXP	- .005	.029	- .067	.050	- .089*	- .010	- .248**	.188**	.200**	.207**	.007	- .001	- .057	.002	.135**	- .020	.033	.153**	.403**

* Significant at 0.05; ** Significant at 0.01

Table D
Theoretical Effects of District Characteristics on Percent Credentialed/Experienced Teachers

Variable	Theoretical Effect	Theoretical Rationale
SIZE	positive or negative	Larger districts (which are often highly bureaucratic) tend to be less attractive to quality teachers. But small districts may not have as many resources to recruit quality teachers (e.g., develop relationships with local teacher education programs or participate in job fairs).
GROW	negative	Higher growth means more teachers are needed, making it more difficult for districts to hire quality teachers.
MENR	negative	The larger the median (i.e., typical) school, the less attractive the district is to quality teachers. Teachers generally prefer smaller schools because they tend to have a greater sense of community, less school bureaucracy, and stronger personal relationships among teachers and students.
MCSZ	positive or negative	Smaller average class sizes may be more attractive to teachers, but larger average class sizes mean less teachers are required for the same number of students, making it easier for districts to hire large percentages of quality teachers.
MMIN	negative	Larger percent minority students at the median (i.e., typical) school is likely to make the district less attractive to quality teachers (whether they are wary of the students themselves or the highly-correlated poor working conditions).
MELA	positive	Higher performing students are usually more attractive to quality teachers.
ELEM	positive	There are usually larger pools of prospective elementary school teachers than junior high or high school teachers.
HIGH	negative	High schools tend to have a particularly difficult time hiring credentialed and experienced teachers, especially in hard-to-staff subject areas like math and science.
URB	positive and negative	Compared to districts in town/rural locations, urban districts have an easier time finding credentialed teachers (positive relationship with credentialed teachers). However, teachers who work in town/rural districts usually stay in the profession (and the district) longer than teachers in urban districts (negative relationship with experienced teachers).
SUB	positive	Suburban districts are usually the most attractive to quality teachers and have the largest pools of prospective teachers.
PPE	positive	Districts that spend more on their students tend to be more attractive to quality teachers because the schools may have better working conditions.
DAYS	negative	The more service days required of teachers, the less attractive the district.
EDU	positive	The higher the percent of college educated adults in the district boundaries, the greater the pool of prospective teachers.

Table E
Regressions Predicting Teacher Quality Measures

	% Credentialed Teachers		% Experienced Teachers	
	Coefficient	Robust Standard Error	Coefficient	Robust Standard Error
Intercept	47.626	39.140	120.904**	44.658
Total TLS (TLST)	0.364*	0.140	0.003	0.160
District Size (SIZE)	- 0.009	0.008	- 0.005	0.009
District Growth (GROW)	- 0.199***	0.050	- 0.011	0.057
Median School Enrollment (MENR)	- 0.262	0.660	- 1.008	0.753
Median School Class Size (MCSZ)	0.047	0.131	- 0.017	0.150
Median School Minority (MMIN)	- 0.125***	0.018	- 0.057**	0.021
Median School % Prof. ELA (MELA)	- 0.015	0.042	- 0.001	0.048
Elementary District (ELEM)	1.193*	0.571	0.280	0.651
High District (HIGH)	- 6.755*	3.240	2.165	3.697
Urban (URB)	0.489	1.096	- 0.095	1.250
Suburban (SUB)	0.687	0.937	0.129	1.069
Per Pupil Expenditures (PPE)	2.578	2.886	- 1.704	3.293
Teacher Service Days (DAYS)	0.145	0.139	- 0.036	0.159
Adult Population Education (EDU)	- 0.039	0.033	0.003	0.037

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Table F
Descriptive Statistics for District-level and School-level Variables for Sample A

Variables	Coding and Range	Mean	*SD*
District-level Variables			
District Size (DSIZE)	(4, 693)	15.55	34.92
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.87	1.96
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed	0.83	0.56
School-level Variables			
Average Class Size (CSIZE)	(1, 49)	29.11	3.56
Percent Minority Students (MINORITY)	(0.17, 100.00)	53.57	29.77
Percent School Growth (GROWTH)	(-83.33, 417.86)	0.18	22.49
Student Enrollment (natural log) (ENROLL)	(0.00, 8.37)	6.05	1.12
Outcome Variables (School-level)			
Percent Credentialed Teachers (CRED)	(0.00, 100.00)	90.96	12.86
Percent Experienced Teachers (EXP)	(0.00, 100.00)	88.44	11.38

Table G
Description of Study Samples

	Districts Included	# of Districts	Schools Included	# of Schools
Sample A	All districts with coded CBAs	484	All schools in those districts except high schools and those with missing data	5199
Sample B	All districts in Sample A except LAUSD	482	All schools in those districts except charter schools and those with missing data	4544
Sample C	All elementary school districts in Sample A	168	All schools in those districts except charter schools and schools with missing data	1366
Sample D	All unified school districts in Sample A except LAUSD	263	All schools in those districts except high schools, charter schools, and schools with missing data	3175
Sample E	All high school districts in Sample A	51	All schools in those districts except charter schools and schools with missing data	396

Table H
Fixed Effects and Variance Components Estimates for the Level-1 Models (Sample A)

	% Credentialed Teachers			% Experienced Teachers		
	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient
Intercept (β_{0j})	92.758***	93.642***	93.669***	89.469***	89.568***	89.592***
95% PVR	(78.600, 106.915)	(79.980, 107.304)	(79.853, 107.486)	(79.667, 99.270)	(79.925, 99.210)	(79.699, 99.485)
Residual Variance	52.176***	48.586***	49.691***	25.008***	24.203***	25.477***
Reliability	0.786	0.834	0.921	0.649	0.716	0.850
Class Size (β_{1j})	--	0.236**	0.140**	--	0.320**	0.210**
95% PVR	--	--	(-0.579, 0.858)	--	--	(-0.671, 1.090)
Residual Variance	--	--	0.134	--	--	0.202
Reliability	--	--	0.116	--	--	0.145
Minority (β_{2j})	--	-0.095***	-0.056***	--	-0.079***	-0.066***
95% PVR	--	--	(-0.207, 0.095)	--	--	(-0.199, 0.066)
Residual Variance	--	--	0.006***	--	--	0.005*
Reliability	--	--	0.191	--	--	0.157
Growth (β_{3j})	--	-0.047***	-0.024**	--	-0.061***	-0.060***
95% PVR	--	--	(-0.124, 0.077)	--	--	(-0.247, 0.127)
Residual Variance	--	--	0.003	--	--	0.009*
Reliability	--	--	0.093	--	--	0.208
Enrollment (nl) (β_{4j})	--	-1.951*	-1.774***	--	-0.940*	-0.906*
95% PVR	--	--	(-8.463, 4.915)	--	--	(-8.442, 6.630)
Residual Variance	--	--	11.646**	--	--	14.783**
Reliability	--	--	0.196	--	--	0.217
Grand-Mean	92.758***	93.642***	93.669***	89.469***	89.568***	89.592***
95% CI	(92.032, 93.483)	(92.928, 94.357)	(92.954, 94.384)	(88.916, 90.021)	(89.023, 90.112)	(89.046, 90.138)
School Variance	102.682	50.060	43.889	105.432	54.734	47.146
Reduction	--	52.622	58.793	--	50.698	58.286
Propor. Reduction	--	0.512	0.573	--	0.481	0.553
District Variance	52.176***	48.586***	49.691***	25.008***	24.203***	25.477***
Reduction	--	3.591	2.485	--	0.805	-0.469
Propor. Reduction	--	0.069	0.048	--	0.032	-0.019
Intraclass Correlation	0.337	0.493	0.531	0.192	0.307	0.351
Deviance	50083.505	35449.410	35068.059	49992.734	35638.756	35328.310
# Parameters	2	2	16	2	2	16
Reduction	--	14634.095	15015.446	--	14353.978	14664.424

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: The random-intercept and random-coefficients models were each compared to the unconditional (one-way random-effects ANOVA) model to calculate reduction and proportion reduction statistics. A negative reduction represents an increase.

Table I
Fixed Effects and Variance Components Estimates for the Hierarchical Models (Sample A)

	% Credentialed Teachers					% Experienced Teachers				
	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1
Intercept (β_{0j})										
Intercept (γ_{00})	94.142***	93.467***	93.576***	93.650***	93.746***	89.817***	89.364***	89.407***	89.446***	89.480***
District Size (γ_{01})	-0.027***	--	--	-0.028***	-0.028***	-0.012~	--	--	-0.012~	-0.013*
TLS (γ_{02})	--	0.041	0.108	0.102	0.496	--	0.046	0.216	0.076	0.422
Residual Variance	48.692***	49.817***	49.857***	48.757***	48.745***	25.328***	25.582***	25.562***	25.416***	25.364***
Reliability	0.919	0.921	0.921	0.919	0.919	0.849	0.850	0.850	0.850	0.849
Class Size (β_{1j})										
Intercept (γ_{10})	0.114*	0.147	0.084	0.144	0.086	0.168**	-0.050	0.042	-0.048	0.046
District Size (γ_{11})	0.001*	--	--	0.001*	0.001	0.001**	--	--	0.001*	0.000
TLS (γ_{12})	--	-0.002	0.063	-0.006	0.036	--	0.050~	0.193*	0.043	0.163~
Residual Variance	0.133	0.135	0.138	0.134	0.139	0.189	0.184	0.178	0.178	0.182
Reliability	0.116	0.117	0.118	0.116	0.119	0.139	0.136	0.134	0.133	0.136
Minority (β_{2j})										
Intercept (γ_{20})	-0.048***	-0.043*	-0.051***	-0.041~	-0.049***	-0.064***	-0.025	-0.048**	-0.023	-0.047**
District Size (γ_{21})	0.000***	--	--	0.000***	0.000**	0.000	--	--	0.000	0.000
TLS (γ_{22})	--	-0.002	-0.005	-0.001	0.000	--	-0.008~	-0.022	-0.008	-0.024
Residual Variance	0.005	0.006***	0.006***	0.005	0.005	0.005**	0.004*	0.004*	0.005**	0.005**
Reliability	0.180	0.188	0.185	0.182	0.182	0.161	0.156	0.155	0.158	0.158
Growth (β_{3j})										
Intercept (γ_{30})	-0.018*	-0.033	-0.019	-0.036	-0.023	-0.057***	-0.057~	-0.042*	-0.057~	-0.042*
District Size (γ_{31})	0.000**	--	--	0.000**	0.000**	0.000	--	--	0.000	0.000
TLS (γ_{32})	--	0.002	-0.006	0.004	0.007	--	-0.001	-0.021	0.000	-0.019
Residual Variance	0.003	0.003	0.003	0.002	0.003	0.010**	0.009*	0.009**	0.010**	0.010**
Reliability	0.091	0.095	0.095	0.088	0.091	0.217	0.212	0.213	0.218	0.219
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.784***	-2.608*	-1.690*	-2.607*	-1.666*	-0.735~	-1.421	-0.926	-1.477	-1.023
District Size (γ_{41})	0.000	--	--	-0.001	0.001	-0.003~	--	--	-0.003*	-0.004
TLS (γ_{42})	--	0.161	-0.091	0.162	-0.145	--	0.103	0.034	0.149	0.349
Residual Variance	12.108***	11.716***	11.738**	12.167***	12.168***	15.255**	15.246**	14.971**	15.265**	15.162**
Reliability	0.201	0.196	0.197	0.201	0.201	0.221	0.221	0.218	0.221	0.220
Grand-Mean	94.142***	93.467***	93.576***	93.650***	93.746***	89.817***	89.364***	89.407***	89.446***	89.480***
95% CI	(93.425, 94.858)	(91.009, 95.925)	(92.091, 95.061)	(91.230, 96.069)	(92.351, 95.141)	(89.231, 90.404)	(87.701, 91.027)	(88.255, 90.559)	(87.786, 91.106)	(88.341, 90.620)
School Variance	43.837	43.883	43.871	43.850	43.844	47.055	47.121	47.128	47.076	47.062
District Variance	48.692***	49.817***	49.857***	48.757***	48.757***	25.328***	25.582***	25.562***	25.416***	25.364***
Intraclass Correl.	0.526	0.532	0.532	0.526	0.526	0.350	0.352	0.352	0.351	0.350
Deviance	35123.559	35095.962	35085.144	35146.785	35135.375	35386.264	35348.940	35336.127	35403.326	35390.899
# Parameters	16	16	16	16	16	16	16	16	16	16

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table J
Descriptive Statistics for District-level and School-level Variables for Sample B

Variables	Coding and Range	Mean	*SD*
District-level Variables			
District Size (DSIZE)	(4, 185)	14.16	16.38
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.87	1.95
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed	0.83	0.55
School-level Variables			
Average Class Size (CSIZE)	(1, 49)	29.23	3.49
Percent Minority Students (MINORITY)	(0.17, 100.00)	50.59	28.73
Percent School Growth (GROWTH)	(-83.33, 400.00)	-0.22	21.45
Student Enrollment (natural log) (ENROLL)	(0.00, 8.04)	6.03	1.13
Outcome Variables (School-level)			
Percent Credentialed Teachers (CRED)	(0.00, 100.00)	92.57	11.42
Percent Experienced Teachers (EXP)	(0.00, 100.00)	88.99	10.94

Table K
Fixed Effects and Variance Components Estimates for the Level-1 Models (Sample B)

	% Credentialed Teachers			% Experienced Teachers		
	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient
Intercept (β_{0j})	93.028***	93.984***	94.005***	89.738***	89.820***	89.836***
95% PVR	(79.000, 107.055)	(80.573, 107.396)	(80.468, 107.542)	(79.916, 99.560)	(89.820, 89.820)	(79.994, 99.679)
Residual Variance	51.221***	46.821***	47.700***	25.112***	24.166***	25.218***
Reliability	0.815	0.887	0.951	0.665	0.739	0.863
Class Size (β_{1j})	--	0.084	0.100*	--	0.165*	0.110*
95% PVR	--	--	(-0.434, 0.634)	--	--	(-0.452, 0.672)
Residual Variance	--	--	0.074	--	--	0.082
Reliability	--	--	0.106	--	--	0.079
Minority (β_{2j})	--	-0.067***	-0.060***	--	-0.090***	-0.076***
95% PVR	--	--	(-0.211, 0.091)	--	--	(-0.204, 0.052)
Residual Variance	--	--	0.006***	--	--	0.004**
Reliability	--	--	0.254	--	--	0.157
Growth (β_{3j})	--	-0.016*	-0.012~	--	-0.055***	-0.050***
95% PVR	--	--	(-0.118, 0.094)	--	--	(-0.229, 0.128)
Residual Variance	--	--	0.003	--	--	0.008**
Reliability	--	--	0.144	--	--	0.205
Enrollment (nl) (β_{4j})	--	-2.305***	-2.612***	--	-1.386**	-1.272**
95% PVR	--	--	(-10.475, 5.251)	--	--	(-8.725, 6.181)
Residual Variance	--	--	16.094***	--	--	14.460***
Reliability	--	--	0.311	--	--	0.219
Grand-Mean	93.028***	93.984***	94.005***	89.738***	89.820***	89.836***
95% CI	(92.320, 93.735)	(93.301, 94.668)	(93.321, 94.689)	(89.190, 90.286)	(89.282, 90.358)	(89.297, 90.376)
School Variance	79.473	28.949	24.535	94.259	46.699	40.999
Reduction	--	50.524	54.938	--	47.559	53.259
Propor. Reduction	--	0.636	0.691	--	0.505	0.565
District Variance	51.221***	46.821***	47.700***	25.112***	24.166***	25.218***
Reduction	--	4.400	3.521	--	0.946	-0.106
Propor. Reduction	--	0.086	0.069	--	0.038	-0.004
Intraclass Correlation	0.392	0.618	0.660	0.210	0.341	0.381
Deviance	42740.874	28876.830	28551.428	43413.746	30611.925	30419.643
# Parameters	2	2	16	2	2	16
Reduction	--	13864.044	14189.446	--	12801.820	12994.103

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: The random-intercept and random-coefficients models were each compared to the unconditional (one-way random-effects ANOVA) model to calculate reduction and proportion reduction statistics. A negative reduction represents an increase.

Table L
Fixed Effects and Variance Components Estimates for the Hierarchical Models (Sample B)

	% Credentialed Teachers					% Experienced Teachers				
	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1
Intercept (β_{0j})										
Intercept (γ_{00})	94.603***	93.941***	93.898***	94.397***	94.461***	90.458***	89.743***	89.629***	90.222***	90.217***
District Size (γ_{01})	-0.039~	--	--	-0.040~	-0.039~	-0.038*	--	--	-0.038*	-0.038*
TLS (γ_{02})	--	0.013	0.128	0.043	0.173	--	0.019	0.245	0.049	0.291
Residual Variance	47.363***	47.813***	47.805***	47.468***	47.457***	24.787***	25.301***	25.270***	24.870***	24.837***
Reliability	0.951	0.951	0.951	0.951	0.951	0.861	0.863	0.863	0.861	0.861
Class Size (β_{1j})										
Intercept (γ_{10})	0.091	0.067	0.029	0.066	0.030	0.110	-0.124	-0.035	-0.112	-0.035
District Size (γ_{11})	0.000	--	--	0.000	0.000	0.001	--	--	0.001	0.000
TLS (γ_{12})	--	0.006	0.078	0.004	0.072	--	0.045~	0.175*	0.043	0.178*
Residual Variance	0.076	0.078	0.079	0.079	0.079	0.080	0.065	0.068	0.068	0.068
Reliability	0.107	0.110	0.110	0.111	0.110	0.077	0.066	0.068	0.068	0.068
Minority (β_{2j})										
Intercept (γ_{20})	-0.039***	-0.055**	-0.059***	-0.040*	-0.043***	-0.048***	-0.035	-0.051**	-0.011	-0.026~
District Size (γ_{21})	-0.001**	--	--	-0.001**	-0.001**	-0.001***	--	--	-0.001***	-0.001***
TLS (γ_{22})	--	-0.001	-0.001	0.000	0.004	--	-0.008~	-0.030~	-0.007~	-0.027~
Residual Variance	0.006***	0.006***	0.006***	0.006***	0.006***	0.003*	0.004**	0.004**	0.003*	0.003~
Reliability	0.244	0.253	0.251	0.245	0.244	0.134	0.153	0.146	0.129	0.125
Growth (β_{3j})										
Intercept (γ_{30})	-0.003	-0.044*	-0.021~	-0.035~	-0.013	-0.030*	-0.052~	-0.024	-0.034	-0.008
District Size (γ_{31})	0.000	--	--	0.000	0.000	-0.001*	--	--	-0.001*	-0.001*
TLS (γ_{32})	--	0.006~	0.011	0.006~	0.012	--	0.000	-0.030~	0.001	-0.026
Residual Variance	0.003	0.003	0.003	0.003	0.003	0.008**	0.008**	0.009**	0.008**	0.008**
Reliability	0.146	0.134	0.140	0.136	0.140	0.196	0.208	0.209	0.200	0.202
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-2.632***	-3.900**	-2.925***	-3.890**	-2.938***	-0.788	-1.462	-1.495*	-1.004	-1.062
District Size (γ_{41})	0.001	--	--	0.000	0.000	-0.016	--	--	-0.016	-0.017
TLS (γ_{42})	--	0.248	0.376	0.247	0.378	--	0.039	0.257	0.044	0.336
Residual Variance	16.430***	15.930	15.917	16.291***	16.322***	14.586**	14.705**	14.444**	14.813**	14.567**
Reliability	0.314	0.309	0.309	0.313	0.313	0.220	0.221	0.219	0.222	0.220
Grand-Mean	94.603***	93.941***	93.898***	94.397***	94.461***	90.458***	89.743***	89.629***	90.222***	90.217***
95% CI	(93.748, 95.458)	(91.584, 96.297)	(92.550, 95.245)	(92.125, 96.668)	(93.136, 95.785)	(89.764, 91.152)	(88.124, 91.362)	(88.462, 90.796)	(88.564, 91.881)	(89.046, 91.388)
School Variance	24.536	24.552	24.573	24.547	24.574	41.023	41.042	41.045	41.051	41.052
District Variance	47.363***	47.813***	47.805***	47.468***	47.457***	24.787***	25.301***	25.270***	24.870***	24.837***
Intraclass Correl.	0.659	0.661	0.660	0.659	0.659	0.377	0.381	0.381	0.377	0.377
Deviance	28596.134	28575.752	28566.277	28617.183	28607.461	30450.258	30441.070	30424.115	30468.539	30451.499
# Parameters	16	16	16	16	16	16	16	16	16	16

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table M
Descriptive Statistics for District-level and School-level Variables for Sample C

Variables	Coding and Range	Mean	*SD*
District-level Variables			
District Size (DSIZE)	(4, 43)	9.65	6.68
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.99	2.01
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed*	0.85	0.56
School-level Variables			
Average Class Size (CSIZE)	(3, 49)	28.09	2.93
Percent Minority Students (MINORITY)	(0.17, 100.00)	50.60	29.62
Percent School Growth (GROWTH)	(-83.33, 233.33)	0.49	21.08
Student Enrollment (natural log) (ENROLL)	(0.00, 7.78)	6.22	0.94
Outcome Variables (School-level)			
Percent Credentialed Teachers (CRED)	(8.50, 100.00)	93.65	8.82
Percent Experienced Teachers (EXP)	(0.00, 100.00)	88.67	10.56

* None of the districts in this sample has a TLS1=3.

Table N
Fixed Effects and Variance Components Estimates for the Level-1 Models (Sample C)

	% Credentialed Teachers			% Experienced Teachers		
	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient	Uncond. (ANOVA)	Random- Intercept	Random- Coefficient
Intercept (β_{0j})	94.307***	94.417***	94.430***	89.213***	89.738***	89.755***
95% PVR	(82.016, 106.597)	(81.708, 107.127)	(81.563, 107.298)	(78.995, 99.431)	(79.283, 100.194)	(79.195, 100.314)
Residual Variance	39.320***	42.048***	43.099***	27.178***	28.455***	29.026***
Reliability	0.874	0.897	0.952	0.704	0.785	0.873
Class Size (β_{1j})	--	0.051	0.125	--	0.246**	0.204*
95% PVR	--	--	(-1.052, 1.301)	--	--	(-0.559, 0.968)
Residual Variance	--	--	0.360*	--	--	0.152
Reliability	--	--	0.213	--	--	0.069
Minority (β_{2j})	--	-0.046***	-0.048***	--	-0.064***	-0.069***
95% PVR	--	--	(-0.198, 0.102)	--	--	(-0.212, 0.074)
Residual Variance	--	--	0.006*	--	--	0.005*
Reliability	--	--	0.217	--	--	0.131
Growth (β_{3j})	--	-0.018~	-0.004	--	-0.040*	-0.034*
95% PVR	--	--	(-0.146, 0.137)	--	--	(-0.169, 0.101)
Residual Variance	--	--	0.005	--	--	0.005
Reliability	--	--	0.199	--	--	0.115
Enrollment (nl) (β_{4j})	--	-2.352***	-2.487***	--	-0.738	-1.042
95% PVR	--	--	(-9.203, 4.228)	--	--	(-8.775, 6.692)
Residual Variance	--	--	11.740~	--	--	15.568**
Reliability	--	--	0.226	--	--	0.174
Grand-Mean	94.307***	94.417***	94.430***	89.213***	89.738***	89.755***
95% CI	(93.295, 95.318)	(93.382, 95.453)	(93.397, 95.463)	(88.276, 90.149)	(88.830, 90.646)	(88.849, 90.660)
School Variance	37.539	23.729	18.809	80.170	41.264	36.849
Reduction	--	13.810	18.730	--	38.905	43.321
Propor. Reduction	--	0.368	0.499	--	0.485	0.540
District Variance	39.320***	42.048***	43.099***	27.178***	28.455***	29.026***
Reduction	--	-2.727	-3.779	--	-1.277	-1.848
Propor. Reduction	--	-0.069	-0.096	--	-0.047	-0.068
Intraclass Correlation	0.512	0.639	0.696	0.253	0.408	0.441
Deviance	10393.925	8508.399	8385.416	11419.801	9116.454	9082.859
# Parameters	2	2	16	2	2	16
Reduction	--	1885.526	2008.509	--	2303.346	2336.942

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: The random-intercept and random-coefficients models were each compared to the unconditional (one-way random-effects ANOVA) model to calculate reduction and proportion reduction statistics. A negative reduction represents an increase.

Table O
Fixed Effects and Variance Components Estimates for the Hierarchical Models (Sample C)

	% Credentialed Teachers					% Experienced Teachers				
	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1
Intercept (β_{0j})										
Intercept (γ_{00})	96.009***	94.665***	94.502***	95.964***	96.166***	91.533***	89.863***	89.423***	91.327***	91.287***
District Size (γ_{01})	-0.160*	--	--	-0.160*	-0.161*	-0.173*	--	--	-0.175*	-0.172*
TLS (γ_{02})	--	-0.047	-0.084	0.010	-0.176	--	-0.022	0.395	0.044	0.277
Residual Variance	42.166***	43.400***	43.357***	42.455***	42.411***	27.869***	29.218***	29.154***	28.052***	28.023***
Reliability	0.951	0.952	0.952	0.951	0.951	0.869	0.873	0.874	0.869	0.870
Class Size (β_{1j})										
Intercept (γ_{10})	-0.023	0.035	-0.045	-0.046	-0.190	0.245	-0.090	0.088	-0.052	0.083
District Size (γ_{11})	0.012	--	--	0.010	0.012	-0.003	--	--	-0.006	-0.001
TLS (γ_{12})	--	0.017	0.189	0.009	0.185	--	0.055	0.128	0.064	0.150
Residual Variance	0.375**	0.358**	0.364**	0.374**	0.379**	0.155	0.119	0.168	0.119	0.164
Reliability	0.218	0.212	0.214	0.218	0.219	0.070	0.056	0.075	0.056	0.074
Minority (β_{2j})										
Intercept (γ_{20})	-0.018	-0.029	-0.030~	-0.006	0.002	-0.018	0.032	-0.026	0.068	0.024
District Size (γ_{21})	-0.002*	--	--	-0.002*	-0.003*	-0.003	--	--	-0.003	-0.003
TLS (γ_{22})	--	-0.004	-0.022	-0.003	-0.021	--	-0.020**	-0.052~	-0.019*	-0.051*
Residual Variance	0.006*	0.005*	0.006*	0.005*	0.006*	0.005**	0.003*	0.005*	0.004*	0.005**
Reliability	0.212	0.208	0.213	0.206	0.209	0.133	0.085	0.116	0.098	0.119
Growth (β_{3j})										
Intercept (γ_{30})	-0.010	-0.069~	0.024	-0.069	0.022	-0.029	-0.039	0.016	-0.038	0.020
District Size (γ_{31})	0.000	--	--	0.000	0.000	0.000	--	--	0.000	0.000
TLS (γ_{32})	--	0.013~	-0.032	0.013~	-0.032	--	0.001	-0.057*	0.003	-0.053*
Residual Variance	0.006	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Reliability	0.210	0.195	0.184	0.201	0.192	0.117	0.112	0.123	0.113	0.121
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.874*	-2.997	-3.600**	-2.521	-3.209**	0.019	-0.911	-1.216	-0.443	-0.365
District Size (γ_{41})	-0.044	--	--	-0.052	-0.028	-0.075	--	--	-0.068	-0.061
TLS (γ_{42})	--	0.099	1.247	0.140	1.269	--	-0.014	0.146	0.076	0.181
Residual Variance	11.568	11.382~	11.340	11.186~	11.310	16.402**	16.094**	15.421**	16.889**	16.266**
Reliability	0.225	0.222	0.221	0.219	0.221	0.181	0.178	0.174	0.184	0.180
Grand-Mean	96.009***	94.665***	94.502***	95.964***	96.166***	91.533***	89.863***	89.423***	91.327***	91.287***
95% CI	(94.420, 97.599)	(91.212, 98.117)	(92.725, 96.279)	(92.365, 99.562)	(94.209, 98.124)	(89.921, 93.146)	(87.185, 92.540)	(87.387, 91.458)	(88.045, 94.609)	(89.237, 93.338)
School Variance	18.778	18.824	18.886	18.824	18.860	36.735	37.072	36.711	36.935	36.637
District Variance	42.166***	43.400***	43.357***	42.455***	42.411***	27.869***	29.218***	29.154***	28.052***	28.023***
Intraclass Correl.	0.692	0.697	0.697	0.693	0.692	0.431	0.441	0.443	0.432	0.433
Deviance	8414.942	8400.334	8389.356	8433.771	8422.742	9105.243	9094.622	9081.742	9121.160	9108.713
# Parameters	16	16	16	16	16	16	16	16	16	16

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table P
Descriptive Statistics for District-level and School-level Variables for Sample D

Variables	Coding and Range	Mean	*SD*
District-level Variables			
District Size (DSIZE)	(4, 185)	18.13	20.58
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.86	1.93
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed*	0.83	0.54
School-level Variables			
Average Class Size (CSIZE)	(1, 46)	29.29	3.70
Percent Minority Students (MINORITY)	(1.80, 100.00)	50.73	28.39
Percent School Growth (GROWTH)	(-77.56, 400.00)	-0.54	20.95
Student Enrollment (natural log) (ENROLL)	(0.00, 8.04)	6.01	1.13
Outcome Variables (School-level)			
Percent Credentialed Teachers (CRED)	(0.00, 100.00)	92.30	11.88
Percent Experienced Teachers (EXP)	(0.00, 100.00)	89.08	10.82

* None of the districts in this sample has a TLS1=3.

Table Q
Fixed Effects and Variance Components Estimates for the Level-1 Models (Sample D)

	% Credentialed Teachers			% Experienced Teachers		
	Uncond. (ANOVA)	Random- Intercept	Random-Coefficient	Uncond. (ANOVA)	Random-Intercept	Random-Coefficient
Intercept (β_{0j})	92.856***	93.827***	93.862***	90.005***	89.953***	89.978***
95% PVR	(79.371, 106.341)	(80.568, 107.086)	(80.553, 107.170)	(80.922, 99.087)	(81.229, 98.678)	(81.033, 98.924)
Residual Variance	47.336***	45.763***	46.103***	21.474***	19.813***	20.830***
Reliability	0.822	0.878	0.951	0.681	0.703	0.851
Class Size (β_{1j})	--	0.091	0.109*	--	0.135~	0.072
95% PVR	--	--	(-0.394, 0.612)	--	--	(-0.530, 0.675)
Residual Variance	--	--	0.066	--	--	0.095
Reliability	--	--	0.124	--	--	0.115
Minority (β_{2j})	--	-0.072***	-0.064***	--	-0.097***	-0.079***
95% PVR	--	--	(-0.220, 0.093)	--	--	(-0.210, 0.051)
Residual Variance	--	--	0.006***	--	--	0.004**
Reliability	--	--	0.298	--	--	0.193
Growth (β_{3j})	--	-0.016~	-0.016~	--	-0.061***	-0.056***
95% PVR	--	--	(-0.103, 0.072)	--	--	(-0.249, 0.137)
Residual Variance	--	--	0.002	--	--	0.010**
Reliability	--	--	0.123	--	--	0.254
Enrollment (nl) (β_{4j})	--	-2.283***	-2.648***	--	-1.585**	-1.364**
95% PVR	--	--	(-10.618, 5.321)	--	--	(-8.770, 6.042)
Residual Variance	--	--	16.535***	--	--	14.279**
Reliability	--	--	0.354	--	--	0.257
Grand-Mean	92.856***	93.827***	93.862***	90.005***	89.953***	89.978***
95% CI	(91.941, 93.771)	(92.957, 94.698)	(92.995, 94.728)	(89.327, 90.682)	(89.313, 90.594)	(89.337, 90.620)
School Variance	88.845	30.964	26.402	94.373	48.595	42.169
Reduction	--	57.882	62.444	--	45.777	52.203
Propor. Reduction	--	0.651	0.703	--	0.485	0.553
District Variance	47.336***	45.763***	46.103***	21.474***	19.813***	20.830***
Reduction	--	1.574	1.233	--	1.661	0.644
Propor. Reduction	--	0.033	0.026	--	0.077	0.030
Intraclass Correlation	0.348	0.596	0.636	0.185	0.290	0.331
Deviance	30171.291	20294.223	20054.421	30247.160	21433.069	21265.682
# Parameters	2	2	16	2	2	16
Reduction	--	9877.068	10116.870	--	8814.091	8981.478

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: The random-intercept and random-coefficients models were each compared to the unconditional (one-way random-effects ANOVA) model to calculate reduction and proportion reduction statistics. A negative reduction represents an increase.

Table R
Fixed Effects and Variance Components Estimates for the Hierarchical Models (Sample D)

	% Credentialed Teachers					% Experienced Teachers				
	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1
Intercept (β_{0j})										
Intercept (γ_{00})	94.430***	93.603***	93.569***	94.011***	94.087***	90.703***	89.736***	89.854***	90.276***	90.518***
District Size (γ_{01})	-0.030	--	--	-0.031	-0.031	-0.035*	--	--	-0.036*	-0.035*
TLS (γ_{02})	--	0.053	0.348	0.089	0.423	--	0.049	0.147	0.089	0.226
Residual Variance	45.956***	46.265***	46.252***	46.100***	46.092***	20.260***	20.962***	20.948***	20.388***	20.376***
Reliability	0.951	0.951	0.951	0.951	0.951	0.847	0.852	0.852	0.848	0.848
Class Size (β_{1j})										
Intercept (γ_{10})	0.104	0.085	0.044	0.102	0.052	0.044	-0.099	-0.065	-0.117	-0.087
District Size (γ_{11})	0.000	--	--	0.000	0.000	0.001	--	--	0.001	0.001
TLS (γ_{12})	--	0.004	0.063	0.000	0.055	--	0.034	0.169~	0.031	0.167~
Residual Variance	0.067	0.069	0.067	0.071	0.068	0.092	0.090	0.083	0.088	0.080
Reliability	0.126	0.128	0.125	0.130	0.127	0.113	0.112	0.106	0.110	0.103
Minority (β_{2j})										
Intercept (γ_{20})	-0.042**	-0.070*	-0.070***	-0.050*	-0.051**	-0.043**	-0.072*	-0.060**	-0.038	-0.027
District Size (γ_{21})	-0.001*	--	--	-0.001*	-0.001*	-0.001***	--	--	-0.001***	-0.001***
TLS (γ_{22})	--	0.001	0.007	0.002	0.012	--	-0.002	-0.023	-0.001	-0.021
Residual Variance	0.006***	0.006***	0.006***	0.006***	0.006***	0.003	0.005**	0.004*	0.003	0.003
Reliability	0.290	0.299	0.298	0.291	0.289	0.159	0.197	0.187	0.163	0.154
Growth (β_{3j})										
Intercept (γ_{30})	-0.005	-0.033~	-0.044***	-0.022	-0.034*	-0.032~	-0.055	-0.046*	-0.035	-0.026
District Size (γ_{31})	0.000	--	--	0.000	0.000	-0.001*	--	--	-0.001*	-0.001*
TLS (γ_{32})	--	0.003	0.032**	0.003	0.035**	--	0.000	-0.012	0.001	-0.008
Residual Variance	0.002	0.002	0.002	0.002	0.002	0.009**	0.010**	0.010**	0.010**	0.010**
Reliability	0.131	0.114	0.099	0.127	0.107	0.249	0.260	0.260	0.255	0.256
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-2.801***	-4.355***	-2.701**	-4.449**	-2.823**	-0.885	-1.859	-1.442~	-1.349	-0.919
District Size (γ_{41})	0.004	--	--	0.003	0.004	-0.013	--	--	-0.013	-0.014
TLS (γ_{42})	--	0.333	0.102	0.329	0.077	--	0.097	0.118	0.095	0.119
Residual Variance	16.874***	16.282***	16.695***	16.605***	17.058***	14.459**	14.458**	14.555**	14.593**	14.718**
Reliability	0.357	0.351	0.355	0.355	0.359	0.259	0.259	0.260	0.260	0.261
Grand-Mean	94.430***	93.603***	93.569***	94.011***	94.087***	90.703***	89.736***	89.854***	90.276***	90.518***
95% CI	(93.388, 95.471)	(90.371, 96.835)	(91.656, 95.482)	(90.971, 97.050)	(92.277, 95.897)	(89.851, 91.554)	(87.725, 91.747)	(88.462, 91.246)	(88.233, 92.318)	(89.119, 91.917)
School Variance	26.390	26.449	26.442	26.402	26.419	42.221	42.163	42.205	42.213	42.248
District Variance	45.956***	46.265***	46.252***	46.100***	46.092***	20.260***	20.962***	20.948***	20.388***	20.376***
Intraclass Correl.	0.635	0.636	0.636	0.636	0.636	0.324	0.332	0.332	0.326	0.325
Deviance	20102.768	20079.908	20063.975	20124.746	20107.899	21301.213	21290.036	21274.553	21321.940	21306.346
# Parameters	16	16	16	16	16	16	16	16	16	16

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001
Note: Bold indicates statistics for the level-1 coefficients.

Table S
Descriptive Statistics for District-level and School-level Variables for Sample E

Variables	Coding and Range	Mean	*SD*
District-level Variables			
District Size (DSIZE)	(4, 28)	8.55	5.41
Total Transfer/Leave Score (TLST)	Actual Range: (1, 10) Possible Range: (1, 14)	4.51	1.83
Transfer/Leave Score for Question 1 (TLS1)	0 = no seniority language 1 = seniority a factor 2 = seniority definitive 3 = bumping allowed*	0.78	0.54
School-level Variables			
Percent Minority Students (MINORITY)	(2.21, 100.00)	43.79	27.89
Percent School Growth (GROWTH)	(-72.08, 166.67)	1.24	25.07
Student Enrollment (natural log) (ENROLL)	(0.00, 8.31)	6.11	1.88
Outcome Variables (School-level)			
Percent Credentialed Teachers (CRED)	(0.00, 100.00)	90.06	13.72
Percent Experienced Teachers (EXP)	(0.00, 100.00)	89.07	11.96

* None of the districts in this sample has a TLS1=3.

Table T
Fixed Effects and Variance Components Estimates for the Level-1 Models (Sample E)

	% Credentialed Teachers			% Experienced Teachers		
	Uncond. (ANOVA)	Random- Intercept	Random-Coefficient	Uncond. (ANOVA)	Random-Intercept	Random-Coefficient
Intercept (β_{0j})	90.159***	89.938***	89.937***	89.313***	89.775***	89.771***
95% PVR	(75.180, 105.138)	(74.748, 105.128)	(72.840, 107.035)	(81.515, 97.110)	(82.382, 97.167)	(79.850, 99.693)
Residual Variance	58.404***	60.060***	76.093***	15.827***	14.225***	25.623***
Reliability	0.742	0.744	0.892	0.461	0.472	0.745
Minority (β_{2j})	--	-0.076	-0.188*	--	-0.096*	-0.093*
95% PVR	--	--	(-1.197, 0.822)	--	--	(-0.560, 0.374)
Residual Variance	--	--	0.265***	--	--	0.057*
Reliability	--	--	0.552	--	--	0.340
Growth (β_{3j})	--	-0.008	-0.030	--	-0.014	-0.042
95% PVR	--	--	(-0.343, 0.283)	--	--	(-0.340, 0.256)
Residual Variance	--	--	0.026***	--	--	0.023*
Reliability	--	--	0.342	--	--	0.331
Enrollment (nl) (β_{4j})	--	1.025~	0.330	--	-0.096	-0.161
95% PVR	--	--	(-6.122, 6.783)	--	--	(-6.820, 6.498)
Residual Variance	--	--	10.839***	--	--	11.543***
Reliability	--	--	0.456	--	--	0.472
Grand-Mean	90.159***	89.938***	89.937***	89.313***	89.775***	89.771***
95% CI	(87.749, 92.570)	(87.497, 92.379)	(87.418, 92.456)	(87.722, 90.903)	(88.284, 91.266)	(88.173, 91.370)
School Variance	134.049	128.054	60.075	129.642	105.195	58.722
Reduction	--	5.996	73.974	--	24.448	70.921
Propor. Reduction	--	0.045	0.552	--	0.189	0.547
District Variance	58.404***	60.060***	76.093***	15.827***	14.225***	25.623***
Reduction	--	-1.657	-17.689	--	1.602	-9.795
Propor. Reduction	--	-0.028	-0.303	--	0.101	-0.619
Intraclass Correlation	0.303	0.319	0.559	0.109	0.119	0.304
Deviance	3239.103	3076.271	2948.044	3186.829	2962.238	2846.483
# Parameters	2	2	11	2	2	11
Reduction	--	162.832	291.059	--	224.591	340.346

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: The random-intercept and random-coefficients models were each compared to the unconditional (one-way random-effects ANOVA) model to calculate reduction and proportion reduction statistics. A negative reduction represents an increase.

Table U
Fixed Effects and Variance Components Estimates for the Hierarchical Models (Sample E)

	% Credentialed Teachers					% Experienced Teachers				
	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1	Only DSIZE	Only TLST	Only TLS1	DSIZE + TLST	DSIZE + TLS1
Intercept (β_{0j})										
Intercept (γ_{00})	90.018***	90.999***	92.154***	90.927***	92.526***	90.991***	92.726***	91.143***	93.011***	92.622***
District Size (γ_{01})	-0.008	--	--	0.019	-0.036	-0.126	--	--	-0.061	-0.142
TLS (γ_{02})	--	-0.235	-2.847	-0.254	-2.901~	--	-0.643~	-1.742	-0.573	-1.905
Residual Variance	77.854***	77.600***	75.723***	79.387***	77.493***	25.382***	24.445***	25.812***	25.254***	25.355***
Reliability	0.894	0.893	0.891	0.895	0.894	0.743	0.736	0.751	0.745	0.747
Minority (β_{2j})										
Intercept (γ_{20})	-0.431*	-0.442	-0.268	-0.529	-0.555~	-0.182~	0.128	-0.005	0.060	-0.097
District Size (γ_{21})	0.023*	--	--	0.020~	0.024*	0.007	--	--	0.014~	0.007
TLS (γ_{22})	--	0.054	0.097	0.026	0.134	--	-0.046	-0.120~	-0.070*	-0.108
Residual Variance	0.247***	0.261***	0.266***	0.255***	0.242***	0.061~	0.048~	0.055~	0.047	0.059
Reliability	0.543	0.549	0.553	0.546	0.540	0.350	0.317	0.340	0.316	0.349
Growth (β_{3j})										
Intercept (γ_{30})	-0.013	-0.093	-0.091	-0.077	-0.089	-0.049	-0.035	-0.082~	-0.039	-0.118
District Size (γ_{31})	-0.001	--	--	-0.004	0.000	0.001	--	--	0.002	0.003
TLS (γ_{32})	--	0.014	0.083	0.021	0.083	--	-0.001	0.064	-0.003	0.070
Residual Variance	0.027***	0.026***	0.024***	0.026***	0.026***	0.024*	0.024*	0.026**	0.025*	0.025**
Reliability	0.350	0.342	0.335	0.342	0.342	0.334	0.338	0.350	0.343	0.347
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-0.724	-1.591	-0.233	-1.850	-1.318	-0.306	-1.209	0.359	-1.215	0.299
District Size (γ_{41})	0.099	--	--	0.070	0.099	0.001	--	--	-0.002	0.004
TLS (γ_{42})	--	0.410*	0.693	0.290	0.762	--	0.249	-0.749	0.195	-0.850
Residual Variance	11.145***	10.410***	10.921***	11.184***	11.271***	11.679***	11.692***	12.201***	11.823***	12.123***
Reliability	0.462	0.448	0.458	0.461	0.464	0.474	0.475	0.488	0.479	0.486
Grand-Mean	90.018***	90.999***	92.154***	90.927***	92.526***	90.991***	92.726***	91.143***	93.011***	92.622***
95% CI	(85.092, 94.944)	(86.229, 95.768)	(88.696, 95.611)	(85.626, 96.228)	(88.005, 97.048)	(87.681, 94.301)	(89.395, 96.057)	(88.816, 93.469)	(89.501, 96.522)	(89.398, 95.847)
School Variance	60.038	60.366	60.096	60.547	60.069	58.799	58.691	57.023	57.900	57.370
District Variance	77.854***	77.600***	75.723***	79.387***	77.493***	25.382***	24.445***	25.812***	25.254***	25.355***
Intraclass Correl.	0.565	0.562	0.558	0.567	0.563	0.302	0.294	0.312	0.304	0.307
Deviance	2964.394	2955.021	2943.636	2971.293	2959.854	2866.474	2854.934	2840.532	2872.120	2860.328
# Parameters	11	11	11	11	11	11	11	11	11	11

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001
Note: Bold indicates statistics for the level-1 coefficients.

Table V
Descriptive Statistics of Districts Included in Qualitative Analyses

District	Type of District	TLS	Base API	# Schools	% Minority	% F/R Lunch	% ELL	# Teachers	% Cred. Teachers	% Exp. Teachers
A	Unified	10	700-800	> 40	50-75%	50-75%	> 25%	> 1,000	90-95%	80-85%
B	Unified	10	< 700	> 40	50-75%	50-75%	10-25%	> 1,000	< 90%	80-85%
C	Unified	4	700-800	> 40	50-75%	25-50%	> 25%	> 1,000	90-95%	< 80%
D	Elementary	8	< 700	20-40	> 75%	> 75%	> 25%	500-1000	90-95%	< 80%
E	High	10	< 700	20-40	> 75%	25-50%	> 25%	> 1,000	> 95%	80-85%
F	Elementary	9	> 800	20-40	< 25%	< 25%	< 10%	500-1000	> 95%	80-85%
G	Elementary	3	700-800	10-20	25-50%	25-50%	10-25%	500-1000	90-95%	80-85%
H	High	5	< 700	10-20	25-50%	< 25%	10-25%	> 1,000	< 90%	85-90%
I	High	6	700-800	10-20	25-50%	< 25%	< 10%	500-1000	90-95%	85-90%
J	Unified	7	700-800	10-20	25-50%	25-50%	10-25%	500-1000	90-95%	80-85%
K	Elementary	7	< 700	10-20	50-75%	> 75%	> 25%	< 500	> 95%	> 90%
L	Elementary	3	700-800	10-20	25-50%	25-50%	> 25%	< 500	90-95%	80-85%
M	Elementary	8	< 700	10-20	50-75%	50-75%	10-25%	< 500	> 95%	< 80%
N	Unified	3	700-800	10-20	25-50%	50-75%	< 10%	< 500	> 95%	> 90%
O	High	4	700-800	< 10	25-50%	25-50%	10-25%	< 500	> 95%	85-90%
P	Unified	7	700-800	< 10	25-50%	< 25%	< 10%	< 500	> 95%	> 90%
Q	High	4	> 800	< 10	< 25%	< 25%	10-25%	< 500	90-95%	< 80%
R	High	6	< 700	< 10	50-75%	< 25%	10-25%	< 500	> 95%	80-85%
S	High	3	700-800	< 10	25-50%	25-50%	10-25%	< 500	90-95%	85-90%
	Mean	6.15	735.2	20.5	47%	39%	22%	844	94%	83%

Note: Statistics are reported as ranges rather than exact numbers to maintain the confidentiality of the districts which participated in the qualitative portion of this study.

Table W
Fixed Effects and Variance Components Estimates for the Hierarchical Models Using TLS1a Only

	% Credentialed Teachers					% Experienced Teachers				
	Sample A	Sample B	Sample C	Sample D	Sample E	Sample A	Sample B	Sample C	Sample D	Sample E
Intercept (β_{0j})										
Intercept (γ_{00})	93.043***	93.629***	94.772***	92.858***	92.492***	89.126***	89.450***	89.515***	89.434***	90.860***
TLS1a (γ_{02})	0.825	0.495	-0.451	1.313	-3.527	0.614	0.509	0.318	0.711	-1.482
Residual Variance	49.693***	47.749***	43.339***	45.961***	75.380***	25.475***	25.221***	29.185***	20.853***	26.091***
Reliability	0.921	0.951	0.952	0.951	0.891	0.850	0.863	0.874	0.851	0.752
Class Size (β_{1j})										
Intercept (γ_{10})	0.044	-0.043	-0.129	-0.026	--	0.020	-0.085	-0.114	-0.074	--
TLS1a (γ_{12})	0.125	0.187*	0.330	0.173~	--	0.251*	0.263**	0.410~	0.202~	--
Residual Variance	0.136	0.068	0.353**	0.058	--	0.194	0.072	0.140	0.085	--
Reliability	0.117	0.099	0.210	0.113	--	0.141	0.071	0.064	0.108	--
Minority (β_{2j})										
Intercept (γ_{20})	-0.057***	-0.061***	-0.039*	-0.074***	-0.224	-0.051**	-0.059***	-0.039	-0.068**	0.055
TLS1a (γ_{22})	0.002	0.001	-0.012	0.013	0.049	-0.021	-0.023	-0.040	-0.016	-0.198*
Residual Variance	0.006***	0.006***	0.006*	0.006***	0.270***	0.005*	0.004**	0.005**	0.004*	0.049
Reliability	0.192	0.255	0.218	0.298	0.554	0.158	0.155	0.128	0.194	0.324
Growth (β_{3j})										
Intercept (γ_{30})	-0.023	-0.017	0.011	-0.034**	-0.076	-0.038~	-0.017	0.010	-0.034	-0.063
TLS1a (γ_{32})	0.000	0.007	-0.019	0.024~	0.068	-0.029	-0.043~	-0.056	-0.028	0.042
Residual Variance	0.003	0.003	0.005	0.002	0.025***	0.009*	0.009**	0.005	0.010**	0.027*
Reliability	0.095	0.144	0.198	0.117	0.338	0.214	0.209	0.122	0.259	0.355
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.822*	-3.219***	-4.154**	-2.799**	-0.740	-1.051	-1.523*	-1.209	-1.481~	-0.138
TLS1a (γ_{42})	0.054	0.779	2.073	0.221	1.423	0.159	0.272	0.052	0.133	-0.047
Residual Variance	11.701	15.867	10.681	16.644	10.547	15.098	14.562	15.347	14.513	12.296
Reliability	0.196	0.308	0.212	0.355	0.451	0.220	0.220	0.173	0.260	0.488
Grand-Mean	93.043***	93.629***	94.772***	92.858***	92.492***	89.126***	89.450***	89.515***	89.434***	90.860***
95% CI	(91.366, 94.719)	(92.097, 95.161)	(92.728, 96.815)	(90.698, 95.019)	(88.714, 96.270)	(87.784, 90.467)	(88.112, 90.788)	(87.112, 91.919)	(87.881, 90.987)	(88.546, 93.174)
School Variance	43.891	24.561	18.878	26.441	60.215	47.093	40.981	36.807	42.173	57.364
District Variance	49.693***	47.749***	43.339***	45.961***	75.380***	25.475***	25.221***	29.185***	20.853***	26.091***
Intraclass Correl.	0.531	0.660	0.697	0.635	0.556	0.351	0.381	0.442	0.331	0.313
Deviance	35079.562	28559.987	8387.088	20061.473	2942.918	35334.007	30422.248	9081.422	21271.964	2840.475
# Parameters	16	16	16	16	11	16	16	16	16	11

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table X
Fixed Effects and Variance Components Estimates for the Hierarchical Models Using TLS1a and District Size

	% Credentialed Teachers					% Experienced Teachers				
	Sample A	Sample B	Sample C	Sample D	Sample E	Sample A	Sample B	Sample C	Sample D	Sample E
Intercept (β_{0j})										
Intercept (γ_{00})	93.504***	94.268***	96.536***	93.452***	92.738***	89.346***	90.123***	91.488***	90.223***	92.190***
District Size (γ_{01})	-0.027***	-0.039~	-0.163*	-0.029	-0.024	-0.012~	-0.037*	-0.173*	-0.034*	-0.131
TLS1a (γ_{02})	0.841	0.434	-0.653	1.255	-3.561	0.621	0.431	0.060	0.608	-1.593
Residual Variance	48.680***	47.429***	42.361***	45.847***	77.174***	25.319***	24.805***	28.057***	20.304***	25.956***
Reliability	0.919	0.951	0.951	0.951	0.893	0.849	0.861	0.870	0.848	0.963
Class Size (β_{1j})										
Intercept (γ_{10})	0.023	-0.052	-0.311	-0.024	--	-0.011	-0.102	-0.121	-0.128	--
District Size (γ_{11})	0.001*	0.001	0.014	0.000	--	0.001**	0.001	-0.001	0.002	--
TLS1a (γ_{12})	0.121	0.182*	0.348~	0.158	--	0.242*	0.269**	0.432~	0.222~	--
Residual Variance	0.136	0.071	0.365**	0.061	--	0.182	0.061	0.140	0.078	--
Reliability	0.117	0.102	0.214	0.117	--	0.136	0.063	0.064	0.100	--
Minority (β_{2j})										
Intercept (γ_{20})	-0.052***	-0.040**	-0.004	-0.050**	-0.477	-0.049**	-0.026	0.023	-0.024	-0.032
District Size (γ_{21})	0.000***	-0.001**	-0.003*	-0.001*	0.022*	0.000	-0.001***	-0.004	-0.001***	0.006
TLS1a (γ_{22})	0.004	0.000	-0.014	0.010	0.069	-0.021	-0.028	-0.047	-0.024	-0.192*
Residual Variance	0.005	0.005***	0.006*	0.006***	0.251***	0.005**	0.003~	0.005**	0.003	0.054
Reliability	0.182	0.242	0.213	0.289	0.545	0.161	0.128	0.128	0.153	0.336
Growth (β_{3j})										
Intercept (γ_{30})	-0.019	-0.006	0.009	-0.023	-0.065	-0.035	0.008	0.023	-0.006	-0.091
District Size (γ_{31})	0.000**	0.000	0.000	0.000	0.000	0.000	-0.001*	-0.001	-0.001*	0.002
TLS1a (γ_{32})	0.002	0.004	-0.019	0.022	0.066	-0.028	-0.047*	-0.056	-0.033	0.049
Residual Variance	0.003	0.003	0.005	0.002	0.027***	0.010**	0.008*	0.005	0.010**	0.027**
Reliability	0.092	0.146	0.205	0.127	0.348	0.220	0.202	0.121	0.256	0.356
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.855*	-3.288***	-3.771**	-2.986**	-1.785~	-0.941	-0.944	-0.100	-0.815	-0.291
District Size (γ_{41})	0.000	0.002	-0.022	0.004	0.098	-0.003	-0.016	-0.067	-0.014	0.011
TLS1a (γ_{42})	0.082	0.818	2.021	0.287	1.447	0.228	0.163	-0.131	-0.044	-0.174
Residual Variance	12.168***	16.184***	10.822	16.982***	10.950***	15.362**	14.794**	16.266**	14.920**	12.346***
Reliability	0.201	0.311	0.215	0.358	0.458	0.222	0.222	0.180	0.263	0.489
Grand-Mean	93.504***	94.268***	96.536***	93.452***	92.738***	89.346***	90.123***	91.488***	90.223***	92.190***
95% CI	(91.876, 95.133)	(92.785, 95.750)	(94.323, 98.749)	(91.395, 95.510)	(88.594, 96.882)	(88.011, 90.681)	(88.782, 91.464)	(89.225, 93.751)	(88.653, 91.793)	(89.251, 95.129)
School Variance	43.841	24.562	18.850	26.425	59.976	47.037	41.029	36.686	42.258	57.395
District Variance	48.680***	47.429***	42.361***	45.847***	77.174***	25.319***	24.805***	28.057***	20.304***	25.956***
Intraclass Correl.	0.526	0.659	0.692	0.634	0.563	0.350	0.377	0.433	0.325	0.311
Deviance	35131.408	28601.383	8420.030	20107.074	2959.542	35388.609	30447.508	9106.842	21302.526	2860.551
# Parameters	16	16	16	16	11	16	16	16	16	11

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table Y
Fixed Effects and Variance Components Estimates for the Hierarchical Models Using TLS1b Only

	% Credentialed Teachers					% Experienced Teachers				
	Sample A	Sample B	Sample C	Sample D	Sample E	Sample A	Sample B	Sample C	Sample D	Sample E
Intercept (β_{0j})										
Intercept (γ_{00})	93.749***	94.062***	94.368***	94.011***	90.038***	89.626***	89.856***	89.687***	90.069***	89.927***
TLS1b (γ_{02})	-0.974	-0.691	0.702	-1.862	-2.150	-0.415	-0.242	0.781	-1.094	-4.164
Residual Variance	49.763***	47.780***	43.340***	46.062***	77.764***	25.542***	25.282***	29.207***	20.777***	25.541***
Reliability	0.921	0.951	0.952	0.951	0.894	0.850	0.863	0.874	0.851	0.744
Class Size (β_{1j})										
Intercept (γ_{10})	0.140*	0.106*	0.125	0.112*	--	0.187**	0.104*	0.253*	0.055	--
TLS1b (γ_{12})	0.006	-0.063	-0.015	-0.081	--	0.223	0.120	-0.298	0.197	--
Residual Variance	0.136	0.072	0.376**	0.064	--	0.189	0.079	0.187	0.091	--
Reliability	0.117	0.104	0.219	0.121	--	0.139	0.077	0.082	0.113	--
Minority (β_{2j})										
Intercept (γ_{20})	-0.051***	-0.059***	-0.043***	-0.064***	-0.212*	-0.060***	-0.069***	-0.058***	-0.074***	-0.107*
TLS1b (γ_{22})	-0.028	-0.007	-0.062*	-0.004	0.235	-0.056~	-0.062*	-0.112~	-0.049	0.014
Residual Variance	0.005**	0.006***	0.005*	0.006***	0.268***	0.004*	0.004**	0.005*	0.004*	0.060*
Reliability	0.181	0.255	0.206	0.300	0.553	0.152	0.145	0.122	0.186	0.348
Growth (β_{3j})										
Intercept (γ_{30})	-0.023**	-0.014*	0.002	-0.023**	-0.040	-0.057***	-0.049***	-0.026	-0.058***	-0.050
TLS1b (γ_{32})	-0.008	0.027	-0.072~	0.064**	0.109	-0.027	-0.019	-0.079**	0.011	0.097
Residual Variance	0.003	0.003	0.005	0.002	0.025***	0.009**	0.008**	0.005	0.010**	0.022*
Reliability	0.095	0.140	0.191	0.101	0.340	0.212	0.207	0.117	0.260	0.323
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.730***	-2.583***	-2.464***	-2.630***	0.454	-0.861*	-1.270**	-1.056	-1.335**	-0.017
TLS1b (γ_{42})	-0.336	-0.368	0.237	-0.302	-2.639	-0.049	0.260	0.755	0.146	-4.032
Residual Variance	11.811**	16.210***	12.349~	16.717***	10.789***	15.147**	14.412**	15.780**	14.395**	11.096***
Reliability	0.197	0.312	0.234	0.356	0.455	0.220	0.219	0.177	0.258	0.465
Grand-Mean	93.749***	94.062***	94.368***	94.011***	90.038***	89.626***	89.856***	89.687***	90.069***	89.927***
95% CI	(92.999, 94.499)	(93.343, 94.780)	(93.253, 95.482)	(93.117, 94.904)	(87.391, 92.684)	(89.057, 90.196)	(89.294, 90.418)	(88.726, 90.647)	(89.414, 90.723)	(88.268, 91.585)
School Variance	43.884	24.559	18.784	26.418	60.295	47.130	41.057	36.647	42.218	58.795
District Variance	49.763***	47.780***	43.340***	46.062***	77.764***	25.542***	25.282***	29.207***	20.777***	25.541***
Intraclass Correl.	0.531	0.660	0.698	0.636	0.563	0.351	0.381	0.444	0.330	0.303
Deviance	35077.574	28561.341	8381.302	20055.989	2937.066	35332.157	30424.156	9074.456	21269.708	2833.655
# Parameters	16	16	16	16	11	16	16	16	16	11

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.

Table Z
Fixed Effects and Variance Components Estimates for the Hierarchical Models Using TLS1b and District Size

	% Credentialed Teachers					% Experienced Teachers				
	Sample A	Sample B	Sample C	Sample D	Sample E	Sample A	Sample B	Sample C	Sample D	Sample E
Intercept (β_{0j})										
Intercept (γ_{00})	94.151***	94.620***	95.950***	94.476***	90.227***	89.817***	90.452***	91.461***	90.722***	91.400***
District Size (γ_{01})	-0.027***	-0.038~	-0.161*	-0.026	-0.019	-0.012~	-0.038*	-0.174*	-0.034*	-0.145
TLS1b (γ_{02})	-0.171	-0.370	0.806	-1.476	-2.226	-0.012	0.124	0.919	-0.555	-4.836
Residual Variance	48.806***	47.474***	42.391***	46.012***	79.622***	25.412***	24.868***	28.019***	20.321***	24.455***
Reliability	0.919	0.951	0.951	0.951	0.896	0.850	0.861	0.870	0.848	0.732
Class Size (β_{1j})										
Intercept (γ_{10})	0.119*	0.092	-0.014	0.097	--	0.165**	0.106	0.213	0.041	--
District Size (γ_{11})	0.001*	0.001	0.012	0.001	--	0.001*	0.000	0.002	0.001	--
TLS1b (γ_{12})	-0.077	-0.088	-0.067	-0.121	--	0.134	0.128	-0.307	0.181	--
Residual Variance	0.132	0.073	0.387**	0.061	--	0.188	0.079	0.184	0.092	--
Reliability	0.115	0.104	0.223	0.118	--	0.138	0.077	0.081	0.113	--
Minority (β_{2j})										
Intercept (γ_{20})	-0.046***	-0.039***	-0.018	-0.040***	-0.497**	-0.061***	-0.047***	-0.021	-0.043**	-0.212~
District Size (γ_{21})	0.000**	-0.001**	-0.002*	-0.001**	0.026~	0.000	-0.001**	-0.003	-0.001**	0.008
TLS1b (γ_{22})	-0.020	0.016	-0.055*	0.020	0.355	-0.061~	-0.042	-0.096*	-0.027	0.103
Residual Variance	0.005	0.006***	0.005*	0.006***	0.240***	0.004*	0.003*	0.005*	0.003	0.064~
Reliability	0.181	0.245	0.204	0.291	0.538	0.153	0.130	0.122	0.160	0.353
Growth (β_{3j})										
Intercept (γ_{30})	-0.019*	-0.004	-0.007	-0.007	-0.035	-0.056***	-0.030*	-0.030	-0.034~	-0.073
District Size (γ_{31})	0.000**	0.000	0.001	-0.001	0.000	0.000	-0.001*	0.000	-0.001*	0.002
TLS1b (γ_{32})	0.016	0.037	-0.077~	0.084**	0.105	-0.020	0.001	-0.077*	0.035	0.099
Residual Variance	0.003	0.003	0.005	0.002	0.027***	0.010**	0.008**	0.005	0.010**	0.021*
Reliability	0.091	0.138	0.202	0.102	0.348	0.217	0.199	0.117	0.252	0.315
Enrollment (nl) (β_{4j})										
Intercept (γ_{40})	-1.756***	-2.620***	-1.965*	-2.794***	-0.508	-0.746~	-0.786	-0.054	-0.844	0.123
District Size (γ_{41})	0.001	0.002	-0.038	0.006	0.087	-0.004	-0.018~	-0.074	-0.015	-0.021
TLS1b (γ_{42})	-0.473	-0.533	0.532	-0.635	-2.255	0.566	0.749	1.324	0.501	-3.767
Residual Variance	12.302***	16.784***	12.084	17.412***	11.209***	15.056**	14.345**	16.389**	14.393**	10.822***
Reliability	0.202	0.317	0.231	0.363	0.462	0.219	0.218	0.181	0.258	0.456
Grand-Mean	94.151***	94.620***	95.950***	94.476***	90.227***	89.817***	90.452***	91.461***	90.722***	91.400***
95% CI	(93.412, 94.890)	(93.749, 95.491)	(94.357, 97.542)	(93.418, 95.534)	(85.197, 95.256)	(89.220, 90.414)	(89.752, 91.153)	(89.862, 93.061)	(89.867, 91.577)	(88.318, 94.481)
School Variance	43.858	24.562	18.771	26.394	60.346	47.102	41.070	36.649	42.244	59.901
District Variance	48.806***	47.474***	42.391***	46.012***	79.622***	25.412***	24.868***	28.019***	20.321***	24.455***
Intraclass Correl.	0.527	0.659	0.693	0.635	0.569	0.350	0.377	0.433	0.325	0.290
Deviance	35128.496	28599.668	8414.745	20093.991	2952.891	35386.757	30452.974	9102.413	21302.359	2851.317
# Parameters	16	16	16	16	11	16	16	16	16	11

~ Significant at 0.1; * Significant at 0.05; ** Significant at 0.01; ***Significant at 0.001

Note: Bold indicates statistics for the level-1 coefficients.