TN EDUCATION RESEARCH ALLIANCE

Examining the Human Capital of Formal Teacher Leaders

A Descriptive Analysis

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Abstract

A growing body of work finds that instructional coaches (ICs) and teacher peer observers (POs) improve student learning, implying that policy might leverage these formal teacher leaders for student benefit. However, little is known about the observable characteristics of ICs and POs. Using unique statewide panel data from Tennessee, we describe the human capital (i.e., teaching experience, education level, effectiveness, and observation scores) of ICs and POs and the district and school settings where these formal teacher leaders work. We find that ICs and POs possess more human capital than other classroom teachers, and that these positive differences grow in magnitude as the concentration of economically disadvantaged students in a school rises. The evidence also suggests that ICs are more likely to work in districts with lower-performing teachers while working in schools with higher-performing teachers. Where POs work is mostly a function of district characteristics.

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Introduction

Efforts to increase teachers' leadership opportunities have intensified in recent years, including forms of teacher leadership explicitly focused on instructional improvement (Donaldson et al., 2008; Eckert, Ulmer, Khachatryan, & Ledesma, 2016; Wenner & Campbell, 2017). Instructionally oriented teacher leadership, such as instructional coaching and peer observation, provide school systems a unique opportunity to improve instruction. Recent research indicates that instructional coaches (ICs) and peer observers (POs) can improve teaching quality and student achievement (Kraft, Blazar, & Hogan, 2018; Papay & Johnson, 2012). A meta-analysis of causal evidence finds that the effect of coaching on teaching quality is greater than the difference in instructional quality between early- and late-career teachers and that the impact on student achievement is at least as large as "almost all other school-based interventions" (Kraft, Blazar, & Hogan, 2018, p. 569). Although research on the impact of peer observation is less developed, this nascent literature suggests that POs might also improve the student achievement scores of the observed teacher (Papay & Johnson, 2012; Papay, Taylor, Tyler, & Laski, 2020; Taylor & Tyler, 2012), and increase the student achievement of the observee even further (Burgess et al., 2019).

These studies imply that teachers and students may benefit substantially from policies supporting the recruitment, retention, development, and equitable distribution of ICs and POs; however, it is unclear what information policymakers might use to do so. A large body of research suggests that teacher leaders (i.e., ICs and POs) possess or should possess several characteristics, only some of which are readily observable to those not working with teacher

leaders closely. York-Barr and Duke's (2004) foundational literature review concludes that teacher leaders are experienced, implement high-quality instruction, possess a clear philosophy of education, hold the respect of their colleagues, exhibit creativity and innovation, and more characteristics that are not readily observable. District and state administrators may be able to use information about the first two characteristics to manage ICs and POs because current administrative data typically include teacher experience and instructional quality scores as measured by classroom observation protocols. As district and state administrators increasingly use data on teacher performance and qualifications to make human resource decisions (Cohen-Vogel, 2011; Goldring et al., 2015; Grissom & Bartanen, 2019; Grissom, Kalogrides, & Loeb, 2017), characterizing the human capital of ICs and POs is a critical first step in understanding who fills these roles.

As ICs and POs have been shown to improve student performance outcomes, their strategic management might promote equity in terms of student achievement. Research has established that schools with high concentrations of economically disadvantaged students and traditionally underserved racial/ethnic groups have, on average, less qualified and effective teachers (Clotfelter, Ladd, & Vigdor, 2007; Goldhaber, Lavery, & Theobald, 2015; Kalogrides, Loeb, & Béteille, 2013; Lankford, Loeb, & Wyckoff, 2002). Policy may be able to increase the access of classroom teachers in these settings to ICs or POs, ultimately improving the achievement of low-income and underserved students of color. Nevertheless, no large-scale research has documented the district or school settings where ICs or POs work. We suspect that this is due to data limitations; existing administrative datasets may not be able to identify ICs or POs, preventing policymakers from knowing where these teacher leaders work currently and from crafting policy to affect the distribution of teacher leaders.

The purpose of this study is to better understand the IC and PO characteristics observable to policymakers and the district and school settings where ICs and POs work. We overcome the inability of previous large-scale research to identify ICs and POs using rich administrative and survey data from the state of Tennessee. By linking performance measures and qualifications (i.e., measures of human capital) to these teacher leadership roles, we also identify the observable characteristics of the schools and districts where ICs and POs work. We build on prior work concerning strategic human capital management that has examined decisions to hire, reassign, and retain teachers (Cohen-Vogel, 2011; Goldring et al., 2015; Grissom & Bartanen, 2019; Grissom et al., 2017) by answering three research questions:

1. What is the observable human capital of instructional coaches and peer observers in Tennessee? To what extent does observable instructional coach and peer observer human capital differ from the human capital of classroom teachers in the schools where instructional coaches and peer observers work?
2. To what extent do the differences in human capital between instructional coaches or peer observers and classroom teachers depend on school demographic characteristics?
3. What are the characteristics of the schools and districts where instructional coaches and peer observers work?

Our description of formal teacher roles and subsequent analysis is admittedly at odds to how teacher leadership has been conceptualized in the literature, which has largely been situated within frameworks of distributive and participative leadership (Ogawa & Bossert, 1995; Spillane et al., 2001). In these conceptual models, leadership is defined not by the roles teachers fill, but by the ways in which teacher leaders exert influence over their peers. Rather than exploring the practices or development of teacher leadership, our analysis focuses on two formal teacher

leadership roles. Using the formal appointment of ICs and POs as our starting point, we then explore the observable characteristics of teachers in these roles and the observable school and district settings where these individuals work. Despite our conceptual difference with the broader teacher leadership literature, we believe that our conceptualization adds new and important insights into what is known about teacher leaders and opens the door for policymakers to strategically manage teacher leaders to the benefit of teachers and students.

This study makes three contributions. It is the first to merge two previously disparate strands of research: teacher leadership and strategic human capital management (Odden & Kelly, 2008). It is also the first study identifying teacher leader characteristics observable by state and district policymakers. Finally, no large-scale studies have documented where teacher leaders work according to district and school demographics, which we document below.

The Promise of Teacher Leadership to Improve Teacher Practice

Scholars define teacher leaders as classroom teachers who work outside of their classroom to support other teachers' professional learning (e.g., Wenner & Campbell, 2017). Prior work also argues that teacher leaders are some of the most qualified teachers in their schools. For example, expertise in the areas of instruction, curriculum, and subject matter is considered to be critical for successful instruction-oriented teacher leadership (Hart, 1994; Little, 1988; Smylie & Eckert, 2018; Snell & Swanson, 2000). These areas of expertise might also enhance ICs and POs' ability to work effectively with their peer teachers.

Instructionally oriented teacher leadership aligns with a broader shift in the research on teacher professional development that emphasizes the importance of sustained job-embedded supports focused on improving discrete teaching practices (Desimone, 2009; Desimone & Garet, 2015; Hill, 2007). Kraft and colleagues' (2018) meta-analysis finds instructional coaching to be

associated with half a standard deviation (SD) increase in measures of teachers' instructional practice. The meta-analytic effect of instructional coaching on student achievement was also large compared to other educational interventions—0.18 SD. Teacher peer observers are believed to improve observed teacher's instruction via performance feedback. Although we are unaware of studies linking peer observation with instructional practice, the students of teachers who are observed by their peers do make achievement gains (Papay, Taylor, Tyler, & Laski, 2020; Taylor & Tyler, 2012) as do the students of the peer observer (Burgess et al., 2019). These positive educational benefits to teachers and students suggest that the strategic management of ICs and POs might benefit school systems.

Conceptual Framework: Strategic Human Capital Management

The goal of strategic human capital management in education is to improve student performance outcomes through the recruitment, assignment, and retention of talented educators (Odden & Kelly, 2008). Research on this topic focuses on how different measures of teacher performance inform administrators' hiring and classroom assignment decisions (Cannata et al., 2017; Cohen-Vogel, 2011; Goldring et al., 2015; Grissom et al., 2017). In general, research in this field has shown that school leaders use data from multiple-measure teacher evaluation systems but that their decision-making may not always lead to educationally desirable outcomes (Grissom et al., 2017). By focusing on the distribution of classroom teachers, however, this research has not begun to consider the specific types of data that could be used to manage other groups of educators, including formal teacher leaders.

The strategic management of teacher leaders raises unique challenges for school systems. Teacher leaders have historically been characterized as possessing unique forms of expertise that are not easily recognized outside a school. Further, the authority of teacher leaders is

conceptualized as emerging not from formal qualifications or performance metrics but the collegial respect that is earned from demonstrating expertise (Little, 1988; Ogawa & Bossert, 1995; Snell & Swanson, 2000; Spillane et al., 2001; York-Barr & Duke, 2004). This expertise includes curricular and pedagogical knowledge, rapport- and trust-building, promotion of teacher growth, and clear communication of a philosophy of education (York-Barr & Duke, 2004). To understand how conventional measures of teacher human capital capture the unique expertise held by teacher leaders, we turn to the broader teacher quality literature.

Measuring the Expertise of Teacher Leaders

Given that the success of formal teacher leadership programs depends at least in part on the expertise of those selected to fill these roles, we examine how commonly used characteristics in the teacher quality literature, including experience, education level, effectiveness, and observation scores, apply to ICs and POs. Researchers have convincingly demonstrated that teachers quickly improve their performance in the first few years in the classroom and continue to make more gradual improvements until the end of their careers, underscoring the importance of teacher years of experience (Harris & Sass, 2011; Ladd & Sorensen, 2017; Papay & Kraft, 2013). Teaching experience allows teacher leaders to develop the diverse forms of instructional and pedagogical expertise needed to attentively observe and coach other teachers (Sherrill, 1999). Additionally, Katzenmeyer and Moller (2001) contended that experienced, mid-career teachers are at a professional stage in which they can dedicate time and energy to the development of other, possibly less experienced teachers.

Prior research on the returns to education level is mixed, with differential effects for the major as well as subject and grade level taught (Dee, 2004; Dee & Cohodes, 2008; Harris & Sass, 2011; Lee, 2018; Wayne & Youngs, 2003). Education level also has a more ambiguous

relationship with teacher leadership than experience. For instance, more educated teachers may be more effective, and hence, more likely to be formal teacher leaders. Teachers interested in pursuing teacher leadership may pursue further education to demonstrate their expertise and enhance their chances of being selected for a formal leadership position.

In addition to being more experienced and educated, ICs and POs may also be higher performing, as measured by classroom observation and growth in student test scores. Although researchers measure student growth in different ways (see McCaffrey et al., 2003; Sass et al., 2014), we focus on academic value-added measures because these are the measures used in our study context. Strong quasi-experimental evidence suggests that students taught by teachers with higher value-added scores are more likely to graduate high school, attain better academic outcomes, and earn more in the labor market (Chetty et al., 2014; Jackson et al., 2014). Thus, value-added metrics capture meaningful differences in teacher human capital, despite limitations in the measure (Darling-Hammond, 2015). For ICs and POs, earning a high value-added score might improve their credibility with their peers. That is, as VAM has gained increased currency as a measure of teacher effectiveness, classroom teachers may be more receptive of ICs or POs who have been identified as effective at improving student test scores.

Although classroom observation scores have existed for far longer than value-added measures (Brophy & Good, 1986), research has only recently explored the properties of observation scores as a measure of teacher human capital (Cohen & Goldhaber, 2016). Recent work suggests that teacher observation scores inform teacher recruitment and retention (Goldring et al., 2015; Grissom & Loeb, 2017), implying that these scores capture essential aspects of teacher human capital. For the purposes of the current study, observation scores may also pick up on broader forms of expertise than what is measured by the aforementioned measures of teacher

quality. For instance, the evaluation rubric used in Tennessee includes domains related to expertise in pedagogy, content knowledge, curriculum, as well as promoting a caring and respective environment for students. Highly rated teachers may be much more likely to be perceived as possessing the diverse forms of expertise the teacher leadership literature has described as critical to success in teacher leadership roles.

Examining the Distribution of Teacher Leaders

The presence of ICs and POs in a school is assumed to catalyze teachers' professional development. Yet, if systematic sorting within the IC and PO labor market resembles that of classroom teachers, then the teachers most in need of instructional support may work in schools where ICs and POs also possess low levels of human capital (Clotfelter et al., 2007; Goldhaber et al., 2015; Kalogrides et al., 2013). This phenomenon could be particularly problematic for teacher leadership because teacher leaders often work in schools where they are or were classroom teachers (Wenner & Campbell, 2017). When teacher leaders come from their school, we expect them to be more qualified and perform better than their within-school peers, but not necessarily possess higher absolute levels of human capital than teachers from across the state. To the extent growth in classroom teachers' instructional improvement is greater when supported by ICs or POs with high absolute levels of human capital, a negative sorting of ICs and POs to traditionally underserved schools would inhibit growth in teaching quality.

Study Setting

Our study takes place in Tennessee, from 2012-13 through 2017-18. Tennessee is an ideal study setting because it has been hailed as leader in promoting teacher leadership (Tatter, 2016; Will, 2018). The Tennessee Department of Education (TDOE) and a partnership among TDOE and non-government organizations separately developed guidelines, structures, and

resources promoting teacher leadership (Tennessee Department of Education, n.d.; Tennessee Teacher Leadership Collaborative, 2020). Furthermore, TDOE collects well-defined measures of educator human capital and rich micro-data allowing us to identify ICs and POs. Importantly, neither instructional coaching or peer observation are thinly distributed or ubiquitous, providing us with substantial variation to explore the characteristics of districts and schools with ICs and POs, and the human capital of teachers in the schools where ICs and POs work.

Teacher Leadership in Tennessee

In 2011, the Tennessee Board of Education adopted Teacher Leader Model Standards, which describe the skills and competencies of teacher leadership in Tennessee (Tennessee Department of Education, n.d.). Approximately one year later, TDOE created the Teacher Leadership Network while a coalition of non-government education organizations and TDOE formed the Tennessee Teacher Leader Collaborative (Tennessee Department of Education, n.d.; Tennessee Teacher Leadership Collaborative, 2020). The Network and Collaborative were comprised of district and school administrators and existing and rising teacher leaders to share district-specific instantiations of and supports for teacher leadership. Conversations with TDOE and non-government educational organization leadership suggest that districts "compensated" their teacher leaders in very different ways, ranging from no compensation to partial teaching releases to extra pay. To the extent district (or school) compensation structures affect where ICs or POs work, we control for these structures using district-by-year and school-by-year fixed effects in our regression models (for details, see the Methods section).

Ultimately, the Network and Collaborative captured what was being learned in annual handbooks and action briefs that aligned models of teacher leadership with state improvement goals. For example, the 2014-15 handbooks recommended that TDOE leadership consider how

to incorporate teacher leadership into the Tennessee educator evaluation system and that districts create specific teacher leader roles and apply rigorous teacher leader selection and retention processes (Tennessee Department of Education, 2015). Although the Network and Collaborative considered teacher leadership broadly (e.g., political advocacy, instructional improvement), both organizations specifically discussed models of and support structures for ICs and POs.

Measures of Human Capital

In the early 2010s, the Tennessee Board of Education adopted the Tennessee Educator Acceleration Model (TEAM), a "next-generation" teacher evaluation model (Steinberg & Donaldson, 2016; TN Code § 49-13-105, 2012). Although the Tennessee Department of Education (TDOE) had collected teacher years of experience and education levels before the TEAM system, the evaluation system formally adopted two additional measures of teacher human capital: observation and effectiveness scores.

Observation Scores. TEAM policy required teachers to be evaluated using a standards-based rubric. In broad terms, the rubrics adopted by Tennessee education agencies described teacher performance along the dimensions of instruction, management of the classroom environment, and planning (Tennessee Department of Education, 2016), similar to Charlotte Danielson's Framework for Teaching. Tennessee teacher performance is represented on a scale from one ("Below Expectations") to five ("Above Expectations"). Theoretically, higher-scoring teacher performance is positively related to subsequent student achievement (Kane et al., 2011; Steinberg & Donaldson, 2016). Indeed, previous research based on the TEAM rubric finds a positive correlation between TEAM observation scores and subsequent student achievement scores (Daley & Kim, 2010).

Level of Effectiveness Scores. Observation scores partially determine Tennessee teacher Level of Effectiveness scores (LOE). LOE is also a function of student outcomes called "achievement" scores (e.g., reading achievement scores, graduation rates) and a "growth" score. Tennessee Value-Added Assessment System (TVAAS) scores are the growth scores for teachers of tested subjects. TVAAS scores are continuous measures, but are mapped onto the integers one through five before feeding into teacher LOE. The growth score for teachers of non-tested subjects is based on student growth in a tested subject; teachers of non-tested subjects and their evaluators collaboratively choose the most appropriate test outcomes to use as growth scores. Like the TVAAS score, the outcomes chosen by teachers of untested subjects may be continuous, but are mapped onto the integers one through five before determining LOE.

Licensure. We do not treat licensure as a measure of human capital and therefore it is not included in our analysis. However, Tennessee licensure is effectively a function of teacher experience. While administrators may not know how many years a teacher has worked in education, administrators could easily determine teacher licensure status. All beginning teachers are assigned a three-year Practitioner license. After three full years of experience Practitioners could apply for the six-year Professional license. Thus, teacher licensure effectively signals whether the teacher is early in their career, or not.

Focal Teacher Leadership Roles in Tennessee

Instructional Coaches. ICs have worked in Tennessee schools for many years, but TDOE did not begin collecting information about what educators in these roles did until Spring 2012. TDOE characterized self-identified "instructional coaches," "mentors," "reading or math specialists," "spending at least 50% of their time in these roles" as ICs. We use the same characterization. Through regularly administered statewide surveys, TDOE learned that

Tennessee ICs engaged in a variety of tasks, including supporting teacher development, acting as parent liaisons, disciplining students, and analyzing student data (Tennessee Department of Education, personal communication, 2016). Importantly, TDOE prioritized elementary student learning in reading and literacy throughout the study period. Anecdotal evidence from conversations with TDOE leadership suggests that many districts may have used ICs as a means of improving instruction in these areas.

Teacher Peer Observers. Although ICs have worked in Tennessee schools for decades, the larger-scale introduction of formal POs is a relatively new phenomenon. TEAM policy increased the frequency of formal classroom observations and required the use of standards-based teacher observation rubrics (Teacher and Principal Evaluation Policy, 2013). Research from other settings concludes that such changes substantially increased administrative burdens (Kraft & Gilmour, 2016; Rigby, 2015), which may be why Tennessee policymakers allowed non-school administrators to conduct formal teacher observations (Teacher and Principal Evaluation Policy, 2013).

TEAM educators (i.e., teacher peers) became observers if they attended a two- to four-day summer training and passed an observer certification exam (Alexander, 2016; Teacher and Principal Evaluation Policy, 2013). The length of summer training changed during the study period, starting as a four-day training in the summer of 2013 and becoming a two-day institute by the summer of 2017. Observer training addressed how to accurately score teacher performance using a standards-based rubric and provide useful performance feedback, coaching, and evaluation policy, among other topics. Participants took a certification exam at the end of the training, assessing their scoring accuracy and knowledge of evaluation policy. All POs in the current study are formally certified teacher observers.

Similar to other observers, POs are certified to conduct observations, score teacher performance, and provide post-observation performance feedback. We are confident that all peer observers in the present study at least conducted observations and scored teacher performance. Although TEAM administrative data strongly imply that the POs in our study provided performance feedback[1], we cannot rule out the possibility that school administrators may have provided performance feedback.

Data

We use a rich set of administrative data from Tennessee between the 2012-13 and 2017-18 school years. The data contain variables allowing us to link students to schools to ICs or POs, information about teacher and student demographics, and several measures of human capital. Variables describe student and teacher race/ethnicity and gender, and student economic disadvantage, defined as student eligibility for free or reduced price lunch, and gifted and disability status. Administrative data also contains measures of what we characterize as human capital: years of experience, education level, prior-year observation (i.e., performance) score, and prior-year effectiveness (i.e., LOE) scores. School variables describe total student enrollment, grade band (e.g., middle, high), and school-level measures of student race/ethnicity and economic disadvantage.

Our analyses use different outcomes including a) whether an IC or PO works in a school, b) whether an individual is a classroom teacher or IC, or classroom teacher or PO, c) and our four measures of teacher human capital. In most cases, we treat the remaining variables as

[1] TEAM teacher observation administrative records list an observer identification number, teacher performance scores, the teacher's area of greatest weakness, and include written notes about the verbal feedback provided to teachers during post-observation conferences. Presumably, the observer linked to the observer identification number conducted the observation, generated the scores, and provided the post-observation feedback.

controls, but in some analyses we treat school-level measures of student race/ethnicity and economic disadvantage as moderators.

Identifying Coaches and Peer Observers

Most analyses focus on some combination of two variables; whether an individual is a) a classroom teacher or PO, or b) a classroom teacher or IC. Tennessee's administrative data identifies which individuals are teacher POs. Teacher observation files identify if a teacher was formally observed by a school administrator, or peer or district observer. However, these data do not capture the population of ICs.

We identify ICs using survey data that are annually collected by TDOE. Each spring, TDOE administers a survey to all public educators in the state. During our study period, the survey response rate ranged from 50% to 65%. At the start of each survey, respondents choose the role that they believe best represents their job (e.g., Assistant Principal, Teacher, Counselor). One of the response options was Instructional Coach, which we use to identify coaches. Critically, we use variables in Tennessee survey and administrative data to link self-identified coaches to administrative records.

Panel A of Table 1 lists the percentage of schools with some number of ICs by academic year. During the study period, 20% to 30% of schools had at least one self-identified IC (e.g., approximately 34% of schools in 2012-13 included a IC). Among schools with at least one IC, the majority included only one IC; on average just 5.7% of schools included multiple ICs.

The distribution of POs resembles that of ICs (Panel B Table 1). However, the percentage of schools without POs (roughly 80% to 89%) exceeds those without ICs. Among schools with at least one PO the majority includes only one, and an average of 5.4% of schools included multiple POs.

Moreover, 40% of schools have an IC or PO, 30% an IC only, and 16.5% a PO only. That the sum of the role-specific percentages nearly equals the pooled percentage means that most ICs are not POs.

Generalizability and Sample Bias. Our reliance on self-identification for ICs may raise questions about generalizability and non-response bias. For example, if ICs with relatively low prior-year teacher effectiveness scores do not respond to the annual TDOE survey, the average prior-year effectiveness scores of ICs in our sample will be higher than the population average. Moreover, some instances of non-response may bias our estimates. Suppose that the relationship between IC prior-year effectiveness and the prior-year effectiveness of the teachers in schools where ICs work is quadratic, with the most effective ICs concentrated in schools with the least and most effective teachers, and the least effective ICs working in schools with teachers of moderate effectiveness. If ICs in schools with the most effective teachers did not respond to the annual TDOE survey, our regression analyses may estimate a strong negative relationship between IC and teacher prior-year effectiveness because, in this example sample, IC effectiveness only decreases as teacher effectiveness rises[2].

Methods

RQ1: Coach and Peer Observer Human Capital

We begin to answer this question by calculating the means of teacher characteristics for ICs, POs, and classroom teachers who are neither an IC or PO, then compare these unconditional means. However, unconditional differences do not account for correlations among the measures

[2] We also formally tested for the potential of nonresponse bias by comparing the teacher and school characteristics of survey respondents and non-respondents. Non-respondents were more likely to be Black, male, be less experienced, and work in larger schools with fewer White and more Black students. No differences were observed for the proportion of economically disadvantaged students. Respondents were also slightly more likely have a Level 5 for their effectiveness than non-respondents. See Appendix Table A1 for details.

of human capital or observable differences between schools related to teacher human capital (e.g., negative sorting of effective teachers to schools enrolling a majority of economically disadvantaged students). We control for such correlations by applying Equation 1:

$$1: \quad H_{ijt} = \delta TL_{ijt} + X_{ijt}A + S_{jt}C + \omega_t + e_{ijt},$$

where H_{ijt} represents the: years of experience, education level, prior-year[3] observation scores, or prior-year effectiveness score of teacher *i* in school *j* in year *t*. We create a binary version of prior-year effectiveness scores, assigning scores of 1 – 3 to zero and 4 – 5 to one when this measure is a left-hand side variable. We chose this dichotomization as a score of 3 is "At Expectations," meaning scores greater than 3 are above expectations[4].

The predictor of interest is TL_{ijt}, indicating whether a teacher is an IC or classroom teacher, and the coefficient δ captures the difference in the human capital of an IC relative to classroom teachers conditional on the remaining right-hand side variables. As δ captures a difference in human capital we refer to it as the *relative human capital* of ICs. The vector X_{ijt} contains teacher race/ethnicity, gender, and the three measures of teacher human capital not represented by H_{ijt} (e.g., when H_{ijt} represents years of experience X_{ijt} contains education level, prior-year average observation and prior-year effectiveness scores). School-level averages of the a) four measures of teacher human capital, b) teacher demographics, and c) student race/ethnicity, gender, economic disadvantage, disability status (SWD), and gifted status are within S_{jt}, along with student enrollment numbers and the number of teachers working in the

[3] In all analyses, our use of "prior-year" means that we take the measures of educators and students who were in school *j* in year *t* – 1.

[4] Prior-year effectiveness scores are on an ordinal scale, suggesting we apply ordinal logit estimators. However, many subsequent models apply multiple fixed effects, and econometricians are only beginning to develop consistent ordinal logit fixed effect estimators (Baetschmann et al., 2015; Muris, 2017). Moreover, we are unaware of any ordinal logit fixed effect estimators formally approved by Stata, which we use to implement our analyses.

school. Statewide changes to teacher leadership or human capital are captured by ω_t, and e_{ijt} is the error term. To explore the human capital of POs we re-estimate Equation 1 where TL_{ijt} indicates whether the teacher is a PO or classroom teacher.

Although Equation 1 accounts for correlations among observable teacher and school characteristics, it does not compare ICs and POs to classroom teachers working in the same school and year. Equation 2 applies school-by-year fixed effects, as we are also interested in the human capital of ICs and POs relative to their teacher colleagues in the same school in the same year.

$$2: \quad H_{ijt} = \delta TL_{ijt} + X_{ijt}A + \upsilon_{jt} + e_{ijt}.$$

The use of school-by-year fixed effects (υ_{jt}) effectively absorbs all variation in S_{jt} and ω_t. Standard errors in Equations 1 and 2 are clustered at the school-by-year level.

RQ2: Dependency on School Demographic Characteristics

We explore the extent to which the relative human capital of ICs and POs depends on school-level measures of student race/ethnicity and economic disadvantage. We examine this dependency by calculating the proportion of economically disadvantaged students in each school each year, then find the quartiles of this measure and assign schools to one of the four quartile groupings. Then, we interact the quartile-groupings with TL_{ijt} in Equation 1. The application of quartiles allows us to explore the extent to which dependencies vary across the distribution of the proportion of non-white students in schools without assuming linear dependencies. We then repeat this procedure for the proportion of students of color in school.

RQ3: District and School Characteristics

We begin to explore where ICs work by finding the unconditional differences in school-level characteristics between schools with at least one IC and those with none. We complement

unconditional comparisons with regression-adjusted comparisons to control for correlations among school characteristics by applying Equation 3:

$$3: \quad TL_{jt} = S_{jt}C + \omega_t + e_{jt},$$

where TL_{jt} is a binary variable indicating if at least one IC worked in school *j* in year *t*, while the remaining terms refer to the same quantities as Equations 1 and 2.

As we are also interested in examining the demographic characteristics of the districts where ICs work, we estimate Equation 4:

$$4: \quad TL_{jkt} = D_{kt}B + S_{jkt}C + e_{jkt},$$

where D_{kt} represents district-level average: teacher education level, years of experience, prior-year observation score, prior-year effectiveness score, and demographics, student characteristics (e.g., race, FRPL, SWD), school enrollment, number of teachers employed, and school grade band. Coefficients in *B* (*C*) represent the association between district (school) characteristics and whether at least one IC works in school *j* in year *t*.

Equations 3 and 4 use variation within and between districts and schools. We apply district-by-year fixed effects (ψ_{kt}), which effectively absorbs D_{kt} and compares schools in the same district-by-year to one another. In Equation 3 and both versions of Equation 4 standard errors are clustered at the district-by-year level and school-by-years are the unit of analysis. To explore where POs work we re-estimate Equations 3 and 4 but create TL_{jkt} so it represents whether a teacher is a PO or classroom teacher.

Findings

RQ1: Coach and Peer Observer Human Capital

Unconditional Differences. Table 2 lists the unconditional means of teacher characteristics and human capital by role. There are small descriptive differences across the roles

of a classroom teacher, IC, and PO regarding teacher race and ethnicity. In terms of gender, a larger share of formal ICs are female than either POs or classroom teachers (Panel A, Table 2).

Panel B describes two of our four measures of human capital: years of experience and level of education. The average IC has about four more years of experience than the typical classroom teacher, while the typical PO has three more years of experience than classroom teachers. To understand better the distribution of experience by role, we categorize experience into ranges of 0-2, 3-5, 6-10, 10-20, 21-30, and more than 30. Previous research finds evidence of non-linear returns to teacher experience by applying similar categories (Ladd & Sorensen, 2017; Papay & Kraft, 2013). Panel B shows that larger shares of classroom teachers are in the first five years on the job while the typical IC and PO has between 10 and 20 years of experience. The bottom of Panel B shows that larger shares of ICs and POs hold a Master's or Advanced Degree compared to classroom teachers.

Prior-year observation and prior-year effectiveness scores are listed in Panel C. The prior-year observation score of the average IC and PO is approximately 4.35, or about 0.4 units (0.8 SD) higher than the average classroom teacher. ICs also have a higher prior-year observation score than POs by about 0.1 units (0.2 SD). The prior-year effectiveness score is consistently higher for ICs and POs than classroom teachers. The IC-versus-teacher and PO-versus-teacher contrasts of roughly 0.33 units reflect a 0.40 standard deviation difference. The distribution of prior-year effectiveness scores for each of the three roles is skewed negatively, but more so for ICs and POs. About 30% of classroom teachers have a prior-year effectiveness score below 4, while 16% of ICs and POs are in this category. Moreover, at least half of ICs and POs received a prior-year LOE5 while only 36% of classroom teachers did.

Finally, Panel D lists prior-year standardized-by-year value-added scores, which are only issued to those who taught a tested subject in the prior year. Unsurprisingly, the prior-year TVAAS score of the average classroom teacher is almost zero. The average IC's prior-year TVAAS score is about 0.25 SD above the population mean, while PO scores are about 0.35 above the mean.

Conditional Differences. Conditional differences generated by Equations 1 and 2 resemble the unconditional differences in Table 2. The coefficients in Table 3 generated by Equations 1 and 2 capture the relative human capital of ICs and POs, and all coefficients are positive. Results in columns 1 and 3 compare ICs or POs to observably similar classroom teachers in observably similar schools. Similar ICs (POs) have about four (three) more years of experience and have a 0.20 (0.20) probability point chance of holding an MA or higher (Panels A, B). ICs (POs) also have a 0.13 (0.12) probability point higher chance of receiving an LOE of 4 or 5, and their average prior-year observation scores are 0.45 (0.33) units higher than observably similar classroom teachers (Columns 1, 3, Panels C, D).

Results in columns 2 and 4 are effectively generated by comparing ICs or POs to classroom teachers in the same school in the same year (i.e., Equation 2). Coefficients in columns 2 and 4 are similar to those in columns 1 and 3.

RQ2: Relative Human Capital Dependency on School Demographic Characteristics

We represent the dependencies of IC, PO, and classroom teacher human capital by quartile-groups of economically disadvantaged student enrollment using Figures 1 – 4, which plot the predicted outcomes while holding all control variables at their means. The solid lines in Figures 1 - 4 representing the predicted outcomes for ICs and POs are always above the predicted outcomes for classroom teachers by a statistically significant amount (i.e., non-

overlapping confidence intervals), with one exception (PO relative prior-year observation scores in the first quartile, Figure 3).

Figure 1 shows that IC and PO years of experience increase from the first to second quartile, then effectively plateau (i.e., second – fourth quartile confidence intervals overlap). While classroom teacher years of experience follow a similar pattern, the IC and PO increase from the first to second quartile is substantively larger. Thus, the *relative* experience of ICs and POs increases from the first to second quartile.

The probability a classroom teacher holds an advanced degree remains at approximately 0.58 across all quartiles (Figure 2). Consequently, changes in the education level of ICs and POs will also reflect changes in their *relative* education. Whether or not an IC holds an advanced degree does not appear to be moderated by shares of student economic disadvantage despite the increase from the first to second quartile (i.e., all confidence intervals overlap). POs are more likely to hold an advanced degree as the share of economically disadvantaged students rises from the first to third quartiles. However, only the change from the first to second is statistically significant.

Figure 3 shows that the probability a classroom teacher holds a prior-year effectiveness score above expectations declines steeply as the share of economically disadvantaged students rises, corroborating findings from previous research (e.g., Goldhaber et al., 2015; Kalogrides et al., 2013). Yet, the prior-year effectiveness of ICs and POs remains relatively *constant* across quartile; whether or not ICs or POs are highly effective or not does *not* depend on the concentration of student poverty in a school. Moreover, the sharp decline in classroom teacher prior-year effectiveness across quartiles means that the *relative* effectiveness of ICs and POs grows as the concentration of economically disadvantaged students rises.

The prior-year observation scores of ICs and classroom teachers (left panel, Figure 4) exhibit similar, albeit less pronounced, patterns to their prior-year effectiveness scores. IC prior-year observation scores hover around 4.4 across quartiles, while classroom teacher scores decline steadily (right panel, Figure 4). Thus, IC relative prior-year observation scores grow with shares of student economic disadvantage because lower-performing teachers are sorted into the most poverty-stricken schools. While PO *relative* prior-year observations scores tend to rise as the share of economically disadvantaged students in a school rises, POs in all but the most economically disadvantaged schools have lower levels of prior-year observation scores than ICs (Figure 4).

We also explore whether the share of non-white students in a school acts as a moderator. Similar to the patterns in Figures 1 – 4, ICs and POs always possess higher *relative* human capital in student-race-moderated models. However, the predicted *levels* of IC, PO, and classroom teacher human capital do not support the conclusion that the concentration of non-white students in a school is a moderator (see Appendix Figures A1 – A4).

RQ3: District and School Characteristics

Unconditional Differences. The unconditional differences between schools with and without ICs or POs, shown in Table 4, suggest that where ICs and POs work depends on many school characteristics. School-level proportions of student race/ethnicity are more related to where ICs work than POs. ICs work in schools with smaller shares of White students (-0.12). The descriptive statistics suggest that the lower share of White students in schools with ICs is explained by higher shares of Black students (0.10). The mean differences between schools with and without POs by student race/ethnicity are sometimes statistically significant, but no differences are substantively large (i.e., all absolute mean differences less than 0.03).

ICs and POs also tend to work in schools with higher shares of economically disadvantaged students and students with disabilities, but the latter differences are substantively small (about 0.045 and 0.005, respectively). There are effectively no differences between schools with and without ICs or POs according to shares of gifted students.

There are substantial differences in the school grade bands where ICs and POs work. Fifty-six percent of schools with ICs are elementary schools, while just 12% of schools with ICs are high schools. Although the majority of schools with POs are also elementary schools, elementary schools comprise a smaller share (41%). POs are also dispersed relatively equally across the other three grade bands in the remaining 58% of schools with POs. Consequently, ICs are more likely to work in elementary schools than POs, while POs are more likely to work in high schools or schools with combined grades than ICs. Schools with ICs tend to enroll more students, while schools with and without POs have similar enrollment.

Where ICs and POs work also depends on some school-level teacher characteristics. Schools with ICs or POs tend to employ more teachers (4.6 and 1.9, respectively), and the average classroom teacher in these schools tends to have similar or less human capital than the average teacher in schools without ICs or POs. Both ICs and POs work in schools where the average teacher has fewer years of experience, but the difference is only significant in schools with ICs (-0.30 years). Although the proportion of classroom teachers in a school with a Master's degree is related to whether ICs or POs work there, the differences are substantively unimportant (mean absolute differences of 0.01). The typical (i.e., mean) teacher in schools with ICs or POs also tends to be less effective according to the five-point prior-year LOE effectiveness score. Similarly, ICs and POs work in schools with lower performing teachers as measured by prior-

year average observation scores (about -0.035 units). Finally, there is no evidence that the average teacher in schools with ICs or POs has higher or lower TVAAS scores.

Conditional Differences. Equations 3 and 4 compare schools with and without ICs or POs based on school- and district-level characteristics, partialling out variation shared by the independent variables. Relationships with several school-level average student observables change after adding district-level observables or district-by-year fixed effects. Except for changes in average teacher prior-year observation and prior-year effectiveness scores, controlling for observed and unobserved district-by-year factors leaves average teacher relationships relatively unchanged.

Column 1 lists results from Equation 3 when exploring the schools where ICs work; all coefficients in Table 5 are expressed in probability points. ICs are more likely to work in schools with higher shares of Black students (0.20) and other race students (0.16) relative to shares of White students; smaller shares of gifted students (-0.41); and lower student enrollment (-0.17). ICs are also more likely to work in schools with more teachers (0.01) and lower performing teachers as measured by prior-year observation scores (-0.07). That ICs work in a middle, high, or combined grade school is, respectively, 0.08, 0.26, and 0.07 probability points lower than working in an elementary school.

Adding district-level average student, teacher, and school predictors reveals that district characteristics explain associations with school shares of other race students relative to White students (column 2, Table 5). Comparing schools in observably similar districts also reveals that ICs work in schools with higher shares of economically disadvantaged students (0.13). The association with average teacher prior-year effectiveness is -0.04, net of prior-year observation scores and other observables, meaning that the coefficient essentially captures the association

with effectiveness as measured by achievement and growth scores (see Study Setting). We also see that district characteristics explain the negative association with average teacher prior-year observation scores in column 1; in column 2 an IC is 0.06 probability points *more* likely to work in a school with higher-performing teachers.

Coefficients at the bottom of column 2 reveal which district predictors are responsible for the changes to column-1 estimates. ICs are more likely to work in a school when the district has: higher shares of other race students relative to White students (0.23), higher student enrollment (0.10), and fewer teachers (-0.09). Moreover, a school is more likely to have ICs when the district-level average teacher is more effective in terms of prior-year LOE (0.09), net of variation in prior-year observation scores. However, ICs are more likely to work in schools when district-level average teachers are *lower* performing per prior-year observation scores (-0.42).

Results in column 3 show that district-by-year unobservables account for some of the associations in column 2. When comparing schools within the same district and year, the association between whether ICs work in a school or not and the share of economically disadvantaged students in a school rises slightly (0.16). In contrast, student enrollment (-0.11) and school-level average teacher prior-year observation scores (0.05) attenuate. The most substantial change in associations from columns 2 to 3 concerns shares of gifted students in a school, which becomes a near-zero positive null.

We now turn to results for POs. Comparing observably similar schools with and without POs suggests (column 4, Table 5) that schools with: lower shares of other race students relative to White students (-0.28); higher shares of economically disadvantaged students (0.18), higher shares of gifted students (0.60) tend to have POs, and smaller student enrollment (-0.06) tend to

have POs. POs are also more likely to work in schools with more teachers (0.003) and less effective average teachers (-0.03), controlling for prior-year observation scores.

Column 5 of Table 5 shows that district characteristics account for several of the relationships in column 4. After controlling for district observables, column-4 relationships with school-level student characteristics become insignificant, as does school-level average teacher prior-year effectiveness. However, associations with school student enrollment (-0.10), the number of teachers in a school (0.003) remain relatively unchanged while school-level average teacher experience becomes significant and negative (-0.01).

Coefficients at the bottom of column 5 suggest that whether POs work in a school may depend on several district characteristics. POs are more likely to work in schools within districts with lower shares of other race students relative to shares of White students (-0.75); higher shares of economically disadvantaged students (0.27); and larger district student enrollment (0.16). At the same time, districts with fewer teachers (-0.14), higher shares of teachers with a Master's or higher (0.28), and less effective district-level average teachers as measured by LOE scores (-0.12) are associated with schools having POs, net of variation in prior-year observation scores.

The results in column 6 suggest that unobserved differences between district-by-years explain most of the associations with school-level characteristics in columns 4 and 5; only three relationships remain statistically significant in the district-by-year fixed effect model. When comparing schools in the same district and year, we see that POs are more likely to work in schools with more teachers (0.002), less experienced teachers (-0.01), and teachers with a Master's or more (0.07).

Discussion

In this study, we describe the observable characteristics of two formal types of teacher leaders, instructional coaches (ICs) and peer observers (POs), and the schools and districts where these teacher leaders work. We find that the majority of Tennessee schools include neither ICs nor POs, and that schools with ICs or POs typically include no more than one.

Our findings also corroborate conclusions from prior smaller-scale studies in that teacher leaders (i.e., ICs and POs) are more experienced, possess higher levels of education, and implement higher-quality instruction (e.g., Sherrill, 1999; Smylie & Eckert, 2018; Wenner & Campbell, 2017; York-Barr & Duke, 2004). However, ours is the first to document that ICs and POs are also more effective in terms of composite measures of teacher effectiveness, establishing further the exceptionalism of teacher leaders. Descriptive statistics, and OLS and school-by-year estimates all support these conclusion. Relative to classroom teachers, ICs and POs have about three years more experience and are about 0.20 probability points more likely to possess a Master's or higher. Additionally, ICs and POs are approximately 0.12 probability points more likely to possess a prior-year effectiveness score above expectations and have prior-year observation scores that are higher by about 0.40 units (0.07 SD).

We also explore if IC and PO levels of human capital, and the amount of human capital *relative* to classroom teachers, vary with the share of economically disadvantaged and non-white students in a school. We conclude that the relative human capital of ICs and POs is higher across quartiles of student economic disadvantage and racial/ethnic concentration. We also infer that IC and PO relative years of experience weakly depends on shares of student economic disadvantage and that PO relative education level strongly depends on the concentration of student poverty within schools.

Reflecting patterns from previous research (e.g., Clotfelter et al., 2007; Goldhaber et al., 2015; Kalogrides et al., 2013; Lankford et al., 2002), classroom teacher levels of prior-year effectiveness and performance decline in schools with higher shares of economically disadvantaged students. Nonetheless, the distributions of IC and PO prior-year effectiveness and prior-year performance are not beholden to these same patterns. Instead, IC and PO prior-year effectiveness and prior-year performance do not vary with the concentration of economically disadvantaged students. Consequently, IC and PO *relative* effectiveness and performance increase with the shares of economically disadvantaged students. Given the lack of clear and consistent evidence, we also conclude that neither IC nor PO levels or relative human capital depend on the concentration of students of color in a school.

Finally, we examine the characteristics of the districts and schools where ICs and POs work to understand better the distribution of these teacher leaders. The evidence suggests that several district characteristics are associated with where ICs work. ICs tend to work in districts with higher shares of non-Black students of color relative to white students, higher student enrollment, and fewer teachers. ICs are also more likely to work in districts where the average teacher is more effective in terms of student achievement and growth scores, but lower performing per classroom observations. Nevertheless, explorations of where ICs work *within* a district suggest that they typically work in schools with larger concentrations of economically disadvantaged students and *higher*-performing teachers, in terms of observation scores.

Several district, but few school characteristics are also associated with where POs work. POs tend to work in districts with higher student enrollment and fewer teachers, like ICs. Contrary to the positive net association between where ICs work and district-level average teacher prior-year effectiveness, POs tend to work in districts with less effective teachers in

terms of student growth and achievement scores. POs also work in districts where teachers have higher education levels and where there are lower concentrations of non-Black students of color relative to white students, but higher shares of economically disadvantaged students. However, only three school characteristics are associated with whether POs work in a school or not, and two of the three are substantively unimportant. POs are more likely to work in schools where the average teacher has a Master's or higher, slightly more likely to work in schools with more teachers, and only slightly less likely to work in schools with experienced teachers. Importantly, modeling district-by-year fixed effects and school observables accounted for more than half the variation in where POs work. Collectively, the evidence suggests that where POs work is mostly a function of district characteristics, but we are unable to identify the specific influential district characteristics because we do not observe them.

Implications

The need for interventions aiming to increase teacher access to ICs and POs with high human capital is nuanced. That the majority of Tennessee schools include neither ICs nor POs suggests ample opportunities to expand instructional coaching and peer observation. State policymakers may be able to expand IC and PO positions into new districts by offsetting costs related to either position (e.g., teacher release time). Similarly, districts may be able to adopt career ladders rewarding ICs and POs with financial or non-financial benefits (e.g., class release time).

The evidence suggests that state and local policymakers might target expansion to particular districts if the uniform expansions of ICs is not feasible. While ICs tend to work in districts where teachers have lower prior-year observation scores, the average teacher is also more effective in terms of prior-year student academic achievement and prior-year growth. State

policymakers may be able to target support for IC expansion to districts with lower-performing teachers. Simultaneously, central offices in such districts might establish partnerships with regional universities to aid in the development of aspiring ICs.

School factors are also associated with where ICs work. Combinations of state and local policy might counter the tendency of ICs to work in *schools* where teachers have higher prior-year observation scores and instead sort ICs to schools with lower performing teachers. If policy aims to affect the within-district distribution of ICs in this way, policymakers should attend to unintended side effects. For instance, the evidence suggests that labor market mechanisms already sort ICs to schools with higher concentrations of economically disadvantaged students. Thus, policy aiming to redistribute ICs by teacher observation scores may affect the sorting of ICs to schools with large shares of economically disadvantaged students in undesirable ways.

We suspect that district interventions may be more successful in expanding PO opportunities. District-by-year variation largely accounts for where POs work, but few observable school characteristics explain whether POs work in a school not. These patterns suggest that formal peer observation opportunities are particularly sensitive to district factors (e.g., policy, working conditions). District policy may need to modify collective bargaining agreements, provide local PO training opportunities, and refine teacher evaluation systems to welcome peer observation. As POs are rare in Tennessee, we also believe that district leaders considering formal peer observation might benefit from joining networked improvement communities. The Tennessee state education agency and non-government organizations comprising the Tennessee Teacher Leadership Network are well-positioned to create such a network, which might help POs, principals, and district leaders grapple with challenges presented by peer observation.

Although interventions may be needed to increase teacher access to ICs and POs, policymakers and district leaders may not need to be concerned with increasing access to ICs and POs with *high human capital*. ICs and POs already possess high levels of human capital and work in schools where their human capital exceeds that of classroom teachers. Moreover, there is no evidence that the negative sorting of effective and higher-performing teachers into poverty-stricken schools applies to ICs or POs. Stated differently, less effective and lower-performing teachers, who tend to work in less affluent schools, have access to equally qualified and effective ICs and POs as the more effective and higher-performing teachers who are sorted into more affluent schools.

Finally, a note about the implication to expand IC and PO opportunities into new districts: the implications are based on districts and schools that already offer IC or PO positions. Findings from this sample may not apply to the teachers in districts and schools that did not previously include ICs or POs. For example, the teachers who would become POs in expansion districts may not resemble the POs in this study. Nonetheless, we have no reason to suspect that the mechanisms through which teachers become ICs or POs would differ in substantively important ways in expansion districts.

Limitations and Future Research

Although this study advances research on teacher leadership, it is not without limitations. First, while the formal teacher leadership roles examined in this study emerged as part of a policy climate that encouraged teacher leadership, our analysis did not aim to identify the specific ways in which individual changes in policy altered the landscape of teacher leadership within Tennessee. At the same time, the unique policy climate brought about by a partnership

among the Tennessee Department of Education and a coalition of non-government education organizations may preclude generalizing findings from this study to other locales.

There are also noteworthy limitations related to the analysis. First, identifying ICs relies on self-reports from survey data. These data are subject to nonresponse bias and risk understating the actual frequency of instructional coaches throughout the state. Second, we have no data on the extent to which ICs or POs were differentially compensated when taking on non-instructional duties. While the use of various fixed effects offset these concerns somewhat, richer data on the financial compensation of formal teacher leaders is an essential area of future research. Third, several important unobserved teacher and school characteristics plausibly influence where ICs and POs work. Future qualitative work may be better situated to uncover these important determinants.

More broadly, our analysis was agnostic to the question of how classroom teachers came to be ICs or POs. That is, we focused on the characteristics of these formal teacher leaders once they were in their roles as opposed to predicting which teachers in a school were placed or self-selected into these roles. Future research, possibly from a mixed methods vantage, could probe the mechanisms shaping who becomes a formal teacher leader. Such a study could help to merge distributed perspectives on teacher leadership with our conceptualization of teacher leadership in the context of strategic human capital management.

Finally and perhaps most important is the need to link teacher leader human capital to teacher and student outcomes. For instance, it is outside the scope of this study to explore if the absolute or relative levels of IC and PO human capital are associated with the subsequent performance of coached and observed teachers. Additionally, the literature on teacher career ladders has questioned the extent to which leadership opportunities reduce teacher attrition or

provide a bridge to administrative positions. Future research could examine these critical questions about how formal teacher leadership opportunities influence broader patterns within the teacher labor market. Answering these questions will broaden the understanding of how instructionally oriented teacher leadership, such as instructional coaching and peer observation, provides school systems a unique opportunity to improve instruction and student performance.

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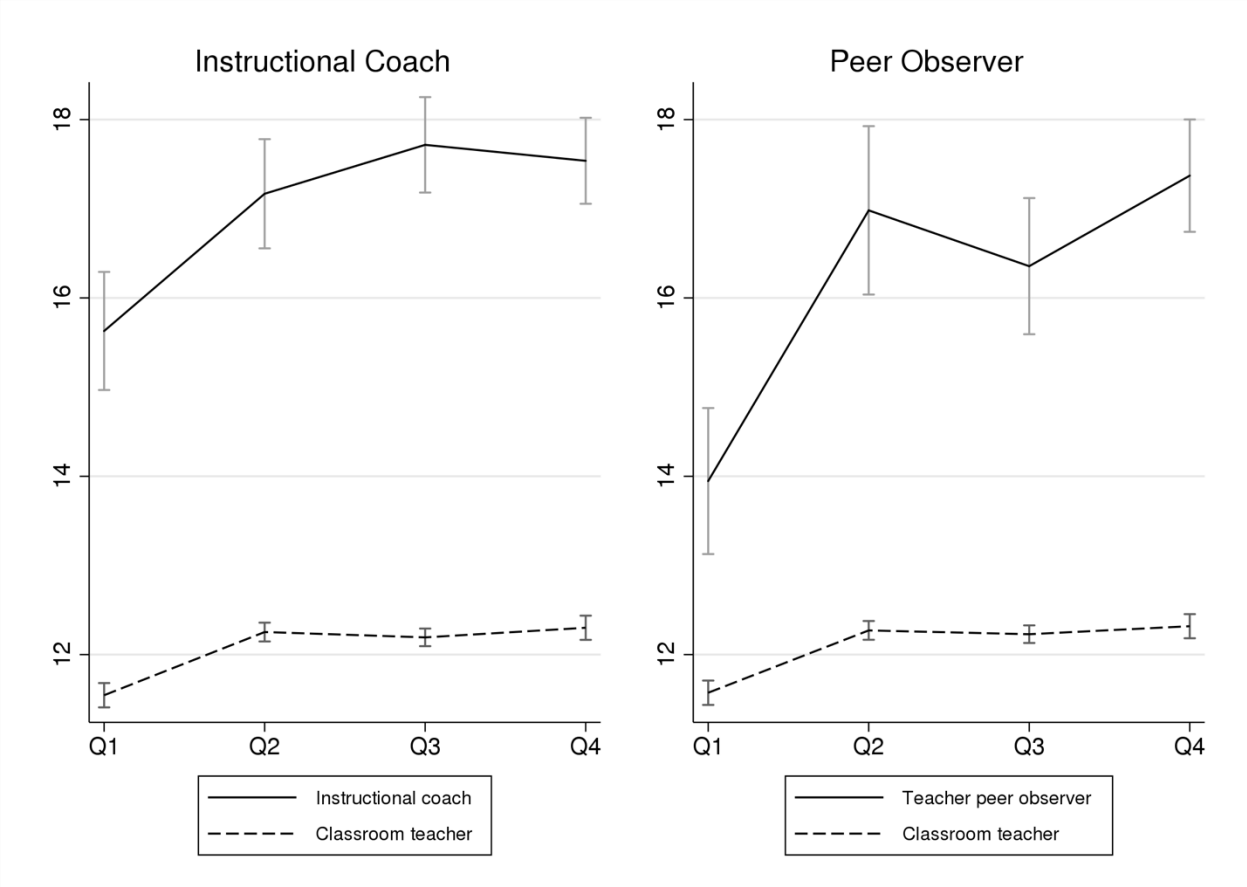
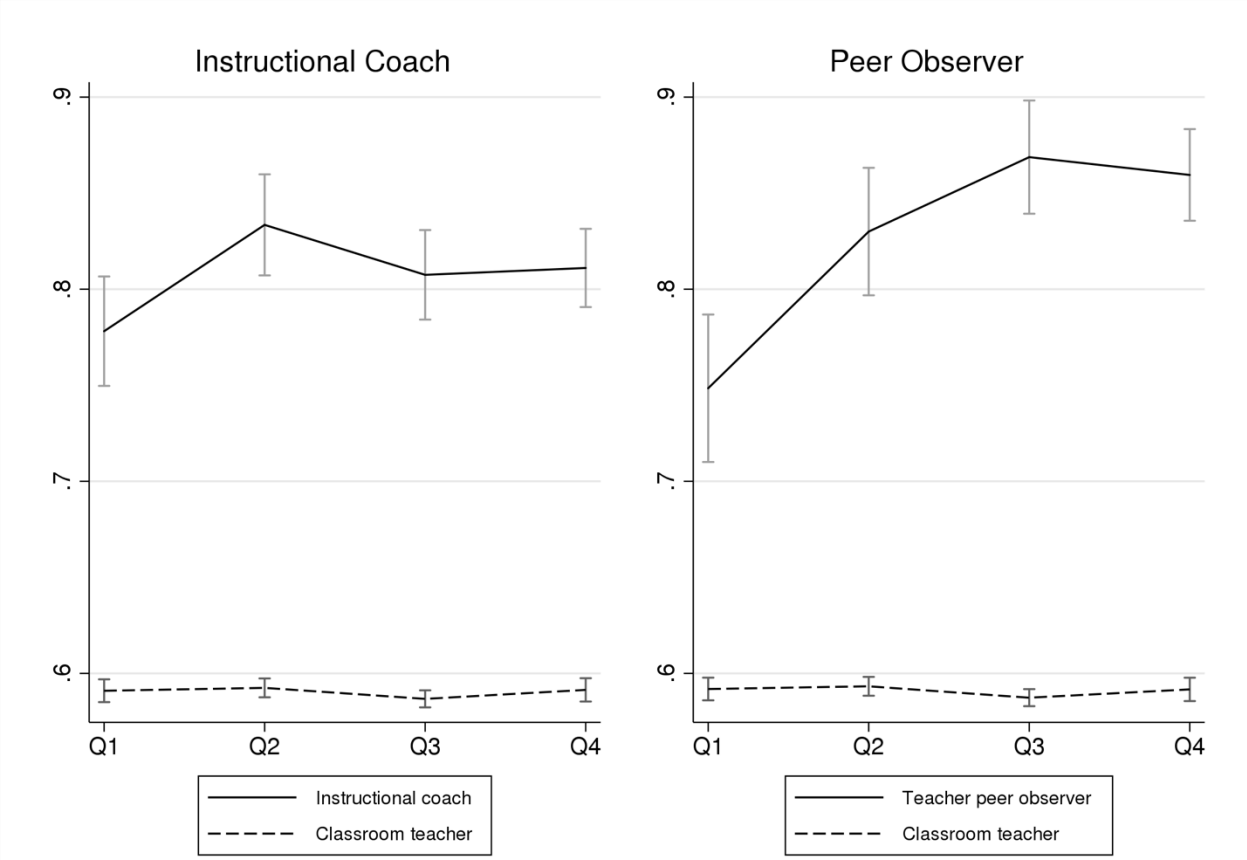
Figures and Tables

Figure 1. Predicted Years of Experience of Formal Teacher Leaders and Classroom Teachers by Economically Disadvantaged Student Enrollment Quartiles



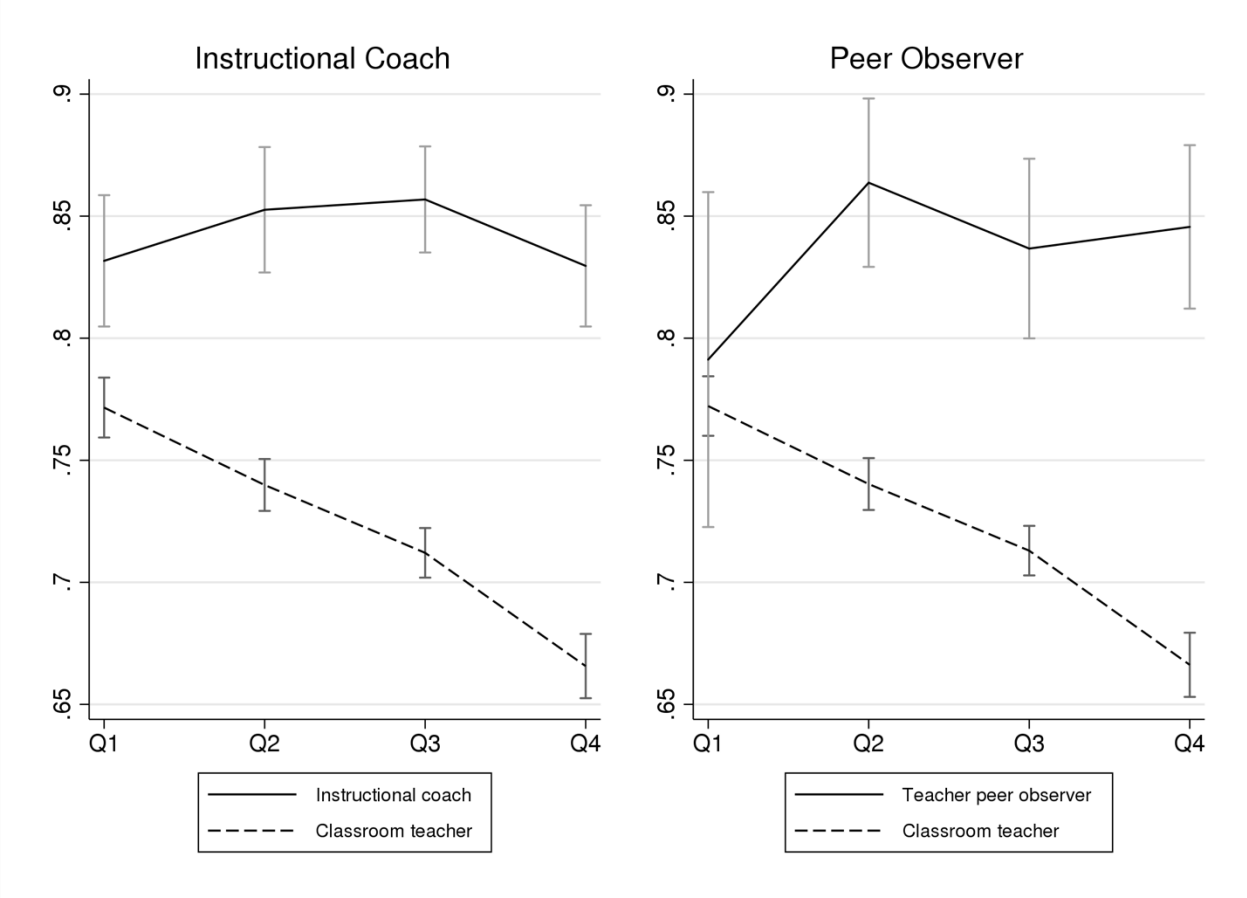
Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure 2. Predicted Advanced Degree of Formal Teacher Leaders and Classroom Teachers by Economically Disadvantaged Student Enrollment Quartiles



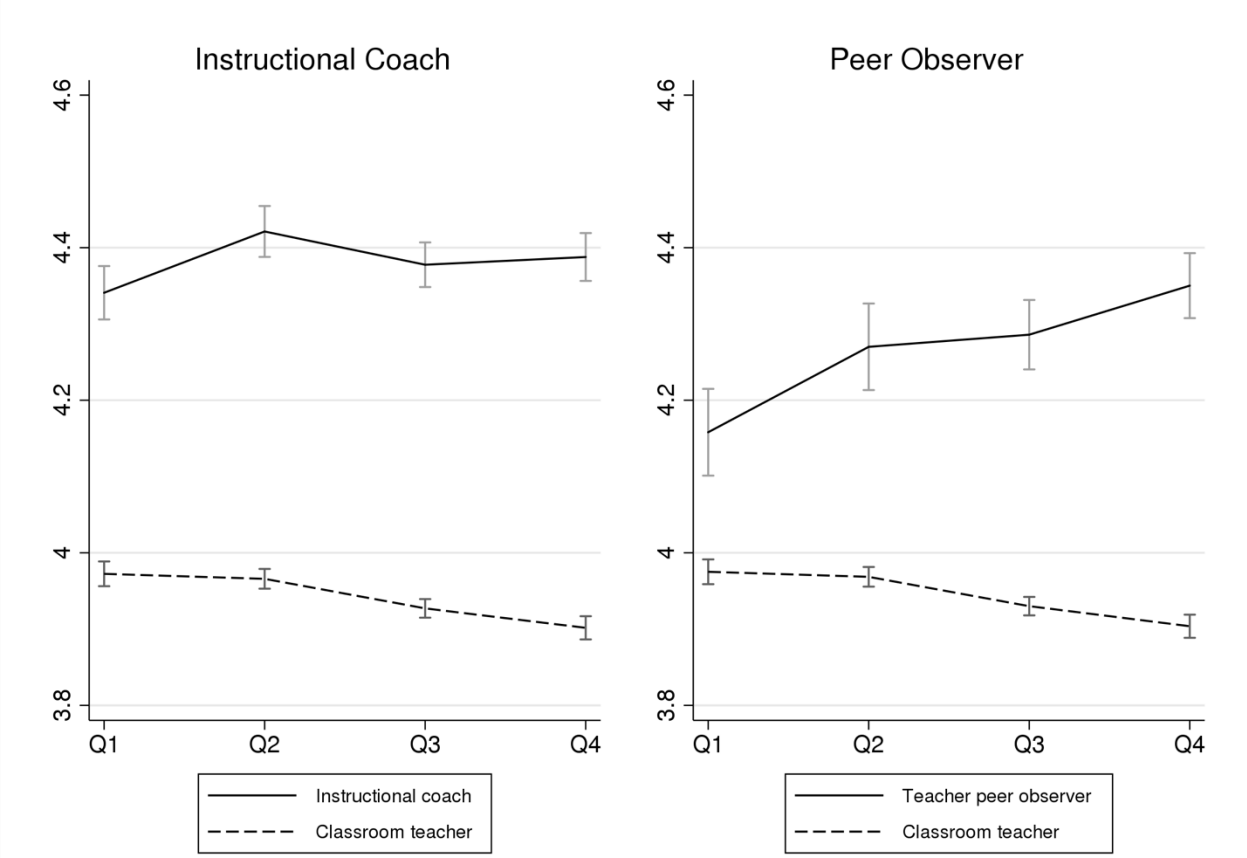
Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure 3. Predicted Prior-Year Effectiveness Score of 4 or 5 of Formal Teacher Leaders and Classroom Teachers by Economically Disadvantaged Student Enrollment Quartiles



Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure 4. Predicted Prior-Year Average Observation Scores of Formal Teacher Leaders and Classroom Teachers by Economically Disadvantaged Student Enrollment Quartiles



Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Table 1. Percentage of Schools in Each Year with Some Number of Instructional Coaches and Peer Observers

Panel A. Instructional Coach

Year	0	1	2	3	4	5+	Total
2013	65.9%	27.0%	5.7%	1.2%	0.2%	0.0%	1887
2014	72.3%	21.9%	4.8%	0.6%	0.3%	0.1%	2081
2015	70.3%	22.5%	5.4%	1.2%	0.5%	0.1%	2188
2016	79.2%	17.5%	2.5%	0.4%	0.1%	0.1%	2264
2017	78.2%	17.2%	3.9%	0.5%	0.0%	0.0%	2246
2018	65.9%	27.0%	5.7%	1.2%	0.2%	0.0%	1922

Panel B. Peer Observer

Year	0	1	2	3	4	5+	Total
2013	87.5%	8.8%	2.3%	0.6%	0.3%	0.5%	1887
2014	88.8%	8.5%	1.3%	0.7%	0.3%	0.4%	2081
2015	88.0%	7.4%	2.0%	1.0%	0.2%	1.3%	2188
2016	81.8%	10.4%	3.8%	1.2%	0.8%	2.0%	2264
2017	80.3%	9.8%	3.7%	2.3%	1.2%	2.7%	2246
2018	87.5%	8.8%	2.3%	0.6%	0.3%	0.5%	1922

Notes. Rows sum to 100%.

Table 2. Comparing ICs and POs to Other Teachers

	Classroom Teacher	Instructional Coach	Peer Observer
Panel A. Teacher Race and Gender			
White	0.87	0.86	0.85
Non-White	0.13	0.15	0.15
Female	0.80	0.93	0.84
Panel B. Years of Experience and Education			
Years of experience	13.04	17.11	15.97
0-2 years experience	0.12	0.02	0.01
3-5 years experience	0.15	0.05	0.07
6-10 years experience	0.21	0.18	0.22
10-20 years experience	0.32	0.43	0.43
21-30 years experience	0.15	0.23	0.19
30+ years experience	0.06	0.09	0.07
Bachelor's or less	0.39	0.19	0.18
Master's degree	0.52	0.62	0.59
Advanced degree	0.09	0.19	0.24
Panel C. Prior-Year Observation and Effectiveness Scores			
Prior average observation score	3.95	4.39	4.29
Prior average level of effectiveness	4.01	4.34	4.32
Prior level of Effectiveness-1	0.00	0.00	0.00
Prior level of Effectiveness-2	0.07	0.02	0.03
Prior level of Effectiveness-3	0.21	0.14	0.13
Prior level of Effectiveness-4	0.36	0.31	0.34
Prior level of Effectiveness-5	0.36	0.53	0.50
Observations	354738	3953	3226
Panel D. Prior-Year Value-Added Scores			
Prior TVAAS score	0.03	0.28	0.38
Observations	93161	504	558

Notes: Cells represent proportions or means.

Table 3. Relative Human Capital of Instructional Coaches and Peer Observers

	Instructional Coach		Peer Observer	
	(1)	(2)	(3)	(4)
Panel A. DV = Years of Experience				
Formal Teacher Leader	4.160***	4.547***	3.131***	3.936***
	(0.143)	(0.143)	(0.203)	(0.191)
Observations	339931	339931	339931	339931
R-squared	0.01	0.08	0.01	0.08
Panel B. DV = MA or Higher				
Formal Teacher Leader	0.198***	0.205***	0.214***	0.234***
	(0.006)	(0.007)	(0.008)	(0.008)
Observations	339835	339835	339835	339835
R-squared	0.01	0.07	0.01	0.07
Panel C. DV = Prior LOE 4 or 5				
Formal Teacher Leader	0.129***	0.148***	0.118***	0.155***
	(0.006)	(0.006)	(0.011)	(0.007)
Observations	339962	339962	339962	339962
R-squared	0.07	0.34	0.07	0.34
Panel D. DV = Prior Avg Observation Score				
Formal Teacher Leader	0.446***	0.497***	0.330***	0.418***
	(0.008)	(0.008)	(0.013)	(0.008)
Observations	339583	339579	339583	339579
R-squared	0.06	0.33	0.06	0.32
Teacher controls	x	x	x	x
School controls	x		x	
Year fixed effects	x		x	
School-by-Year fixed effects		x		x

Notes. Standard errors clustered at the school-by-year level.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4. Comparing Schools with and without Instructional Coaches or Peer Observers

	Instructional Coaches in School			Teacher Peer Observers in School		
	No	Yes	Diff	No	Yes	Diff
Proportion White students	0.72	0.60	-0.12***	0.68	0.66	-0.01
Proportion Black students	0.19	0.29	0.10***	0.22	0.26	0.03**
Proportion other race/ethnicity students	0.09	0.01	0.02***	0.10	0.08	-0.02***
Economically disadvantaged	0.60	0.65	0.04***	0.61	0.66	0.05***
Elementary school	0.44	0.56	0.13***	0.49	0.41	-0.08***
Middle school	0.19	0.18	-0.01	0.19	0.20	0.01
High school	0.20	0.12	-0.08***	0.17	0.20	0.04**
Combined grades	0.17	0.13	-0.03***	0.15	0.18	0.03**
Proportion students with disabilities	0.16	0.16	0.00*	0.16	0.16	0.01*
Proportion gifted students	0.02	0.02	-0.00	0.02	0.02	0.00*
Student enrollment (100s)	0.64	0.70	0.05***	0.66	0.67	0.01
Number of teachers (10s)	39.77	44.36	4.59***	41.05	42.98	1.93*
Average teacher experience	12.27	11.97	-0.30***	12.19	12.08	-0.10
Proportion Master's degree	0.50	0.51	0.01***	0.50	0.49	-0.01**
Prior Average Level of Effectiveness (LOE)	3.88	3.85	-0.03*	3.88	3.78	-0.10***
Proportion prior LOE-1	0.01	0.01	0.00	0.01	0.01	-0.00
Proportion prior LOE-2	0.09	0.10	0.01**	0.09	0.12	0.02***
Proportion prior LOE-3	0.25	0.24	-0.00	0.24	0.27	0.03***
Proportion prior LOE-4	0.32	0.33	0.00	0.33	0.31	-0.02**
Proportion prior LOE-5	0.33	0.32	-0.01*	0.33	0.30	-0.03***
Prior average observation score	3.91	3.87	-0.04***	3.90	3.88	-0.03*
Prior TVAAS score	0.01	-0.00	-0.01	0.01	-0.01	-0.02
Observations	4220	2243		5440	1023	

Notes. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5. School and District Predictors of Having an Instructional Coach or Peer Observer

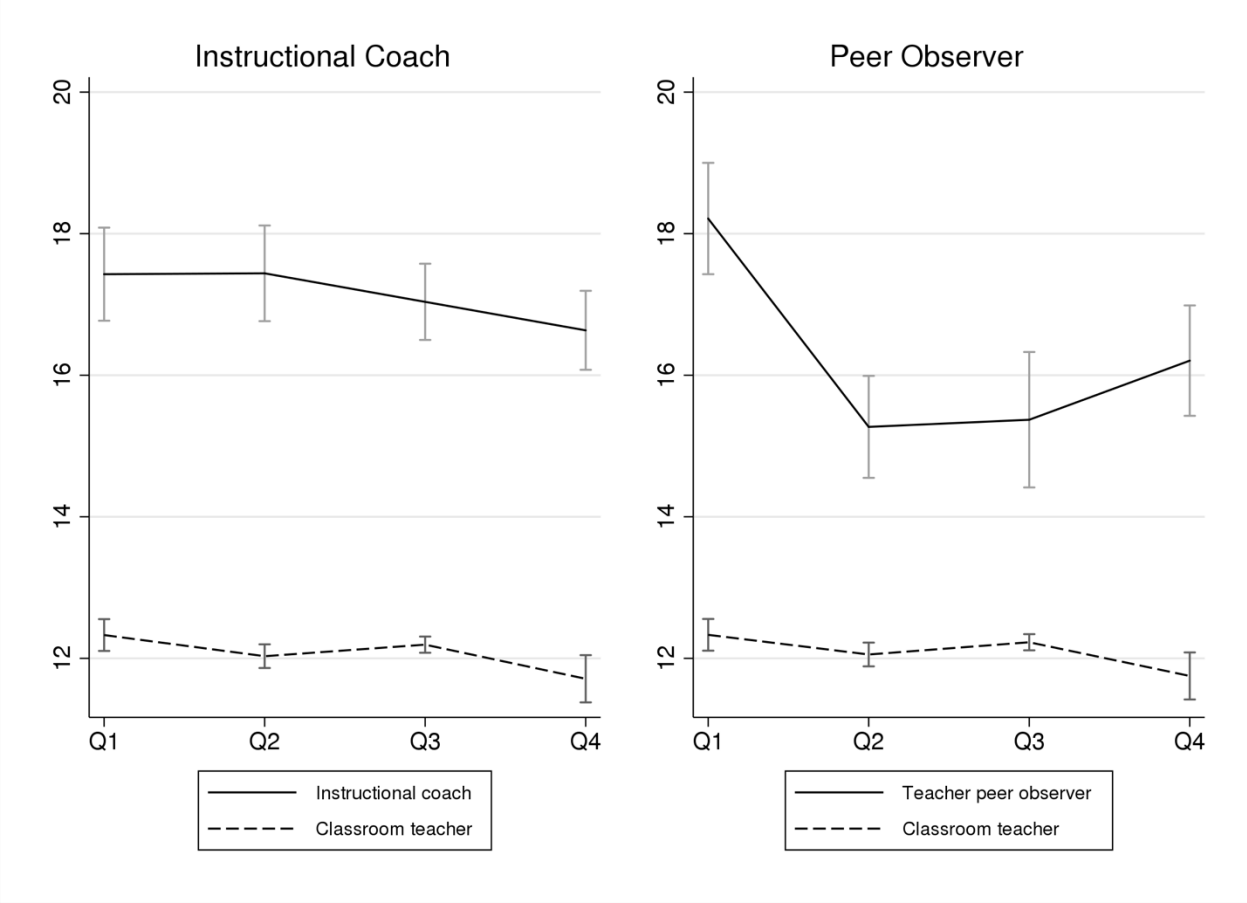
	Instructional Coach in School			Teacher Peer Observer in School		
	(1)	(2)	(3)	(4)	(5)	(6)
Proportion Black students in school	0.204***	0.154***	0.159**	0.027	-0.002	-0.022
	(0.020)	(0.043)	(0.054)	(0.017)	(0.033)	(0.046)
Proportion other race students in school	0.158***	0.055	0.054	-0.275***	-0.027	-0.048
	(0.048)	(0.062)	(0.073)	(0.037)	(0.048)	(0.044)
Economically disadvantaged in school	-0.021	0.132***	0.164**	0.183***	0.024	0.024
	(0.026)	(0.038)	(0.050)	(0.021)	(0.029)	(0.031)
Student enrollment in school (100s)	-0.167**	-0.148**	-0.109*	-0.056*	-0.099**	-0.042
	(0.060)	(0.053)	(0.045)	(0.027)	(0.035)	(0.025)
Number of teachers in school (10s)	0.007***	0.006***	0.006***	0.003***	0.003***	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Middle school	-0.075***	-0.061***	-0.063***	0.011	0.022*	0.018
	(0.013)	(0.013)	(0.016)	(0.011)	(0.011)	(0.010)
High school	-0.264***	-0.230***	-0.222***	-0.002	-0.003	-0.002
	(0.013)	(0.014)	(0.019)	(0.012)	(0.012)	(0.015)
Combined grades	-0.072***	-0.055***	-0.070***	0.008	0.004	-0.006
	(0.014)	(0.014)	(0.019)	(0.012)	(0.012)	(0.016)
Proportion students with disabilities in school	0.060	0.041	0.102	0.051	0.072	-0.018
	(0.051)	(0.051)	(0.069)	(0.046)	(0.046)	(0.048)
Proportion gifted students in school	-0.409**	-0.371*	0.012	0.596***	0.188	0.002
	(0.156)	(0.166)	(0.210)	(0.152)	(0.152)	(0.136)
Average teacher experience in school	-0.002	-0.001	-0.001	-0.002	-0.005**	-0.006***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Proportion Master's degree or higher in school	0.027	0.010	-0.006	0.033	-0.009	0.069*
	(0.033)	(0.039)	(0.038)	(0.028)	(0.033)	(0.033)
Average prior level of Effectiveness (LOE) in school	-0.018	-0.039***	-0.033**	-0.033***	-0.014	-0.010

	(0.010)	(0.011)	(0.012)	(0.008)	(0.009)	(0.009)
Average prior observation score in school	-0.065***	0.061**	0.045*	-0.006	-0.009	-0.001
	(0.018)	(0.021)	(0.021)	(0.014)	(0.016)	(0.013)
Proportion Black students in district		0.013			0.075	
		(0.056)			(0.048)	
Proportion other race students in district		0.229*			-0.753***	
		(0.106)			(0.082)	
Economically disadvantaged in district		-0.166**			0.268***	
		(0.051)			(0.041)	
Student enrollment in district (1000s)		0.104***			0.160***	
		(0.018)			(0.014)	
Number of teachers in district (1000s)		-0.086***			-0.136***	
		(0.017)			(0.012)	
Average teacher experience in district		0.007			0.007*	
		(0.004)			(0.004)	
Proportion Master's degree or higher in district		0.087			0.275***	
		(0.078)			(0.068)	
Average prior level of Effectiveness (LOE) in district		0.086***			-0.121***	
		(0.024)			(0.020)	
Average prior observation score in district		-0.418***			-0.024	
		(0.039)			(0.031)	
Constant	0.543***	1.278***	0.043	0.089	0.379***	0.184***
	(0.063)	(0.101)	(0.089)	(0.052)	(0.085)	(0.054)
Year fixed effect	x	x		x	x	
District-by-year fixed effect			x			x
Observations	10111	10111	10111	10111	10111	10111
R-squared	0.10	0.11	0.28	0.04	0.07	0.52

Notes. Standard errors clustered at the district-by-year level.
* p<0.05; ** p<0.01; *** p<0.001

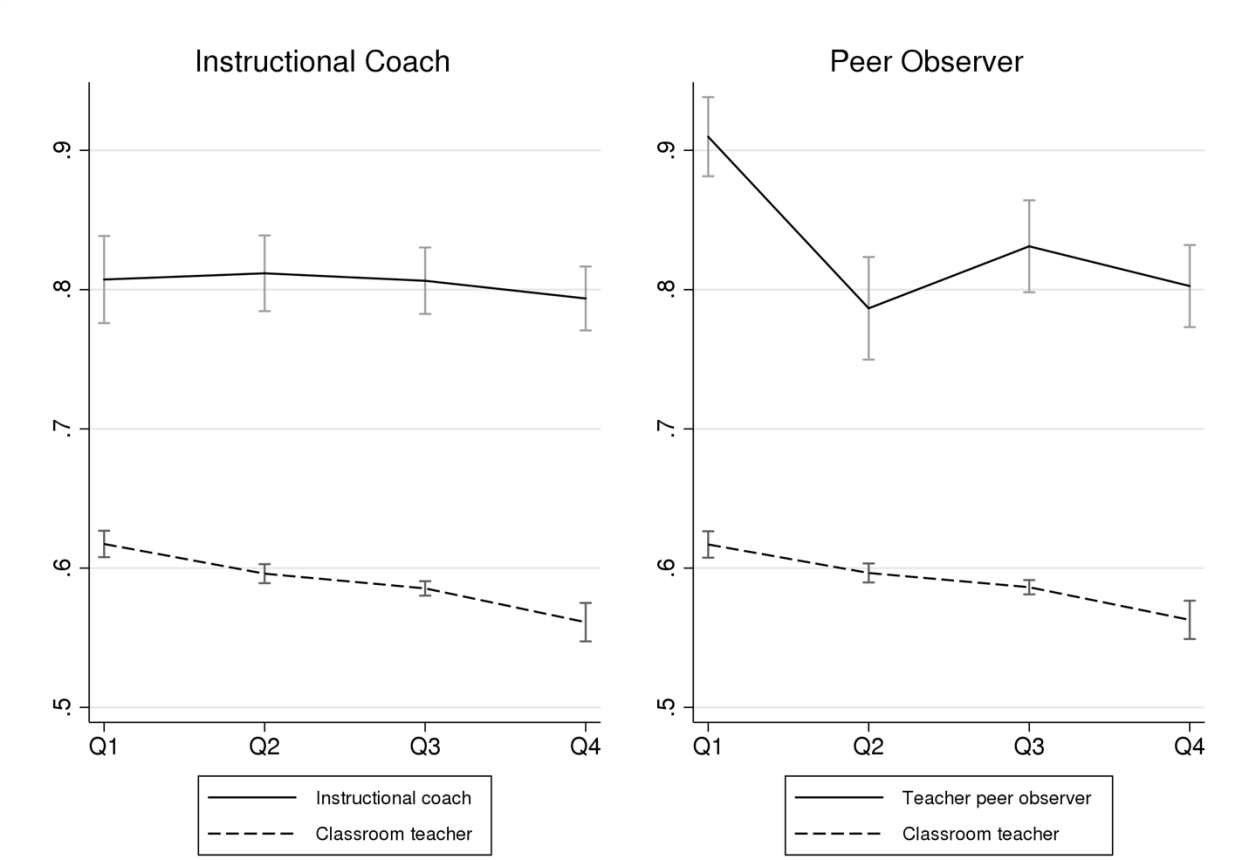
Appendix

Figure A1. Predicted Years of Experience of Formal Teacher Leaders and Classroom Teachers by Racial/Ethnic Minority Student Enrollment Quartiles



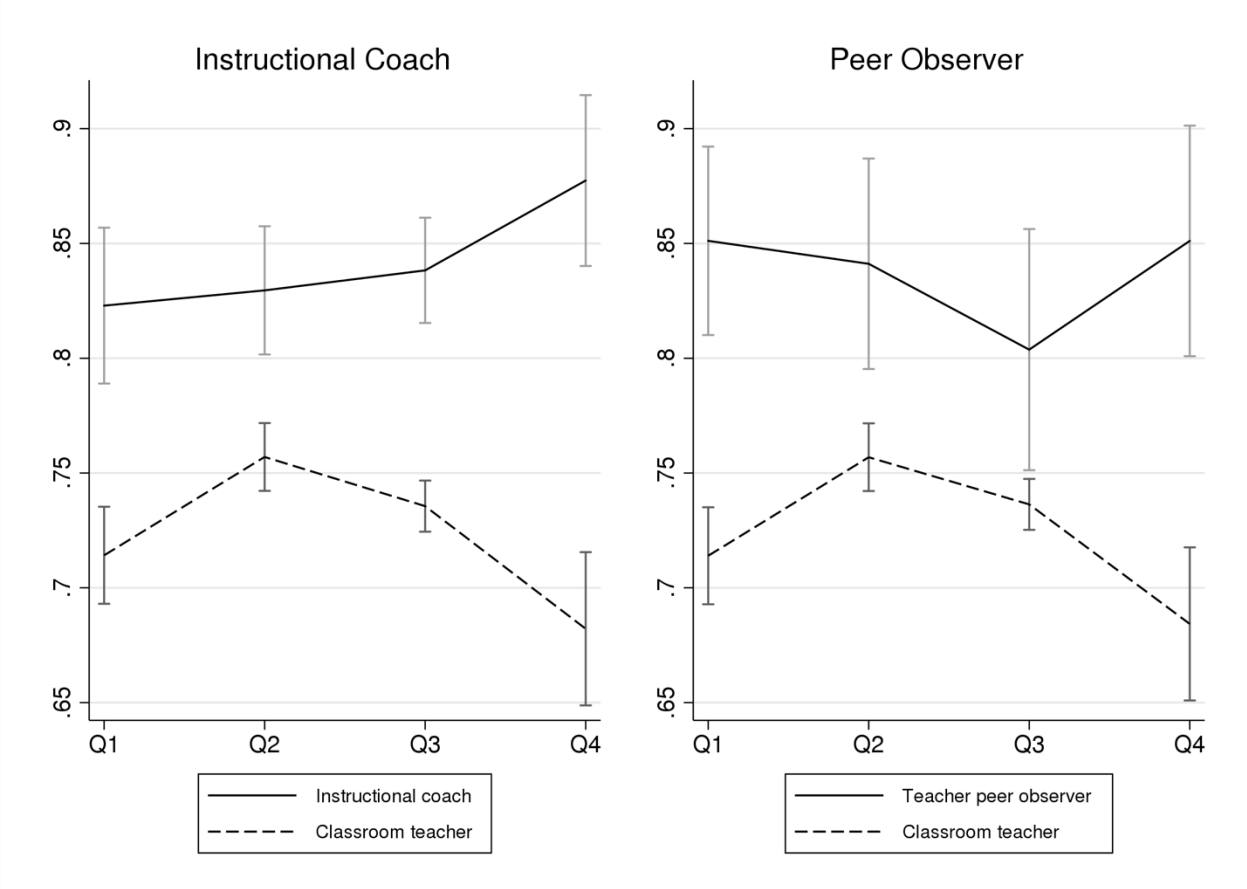
Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure A2. Predicted Advanced Degree of Formal Teacher Leaders and Classroom Teachers by Racial/Ethnic Minority Student Enrollment Quartiles



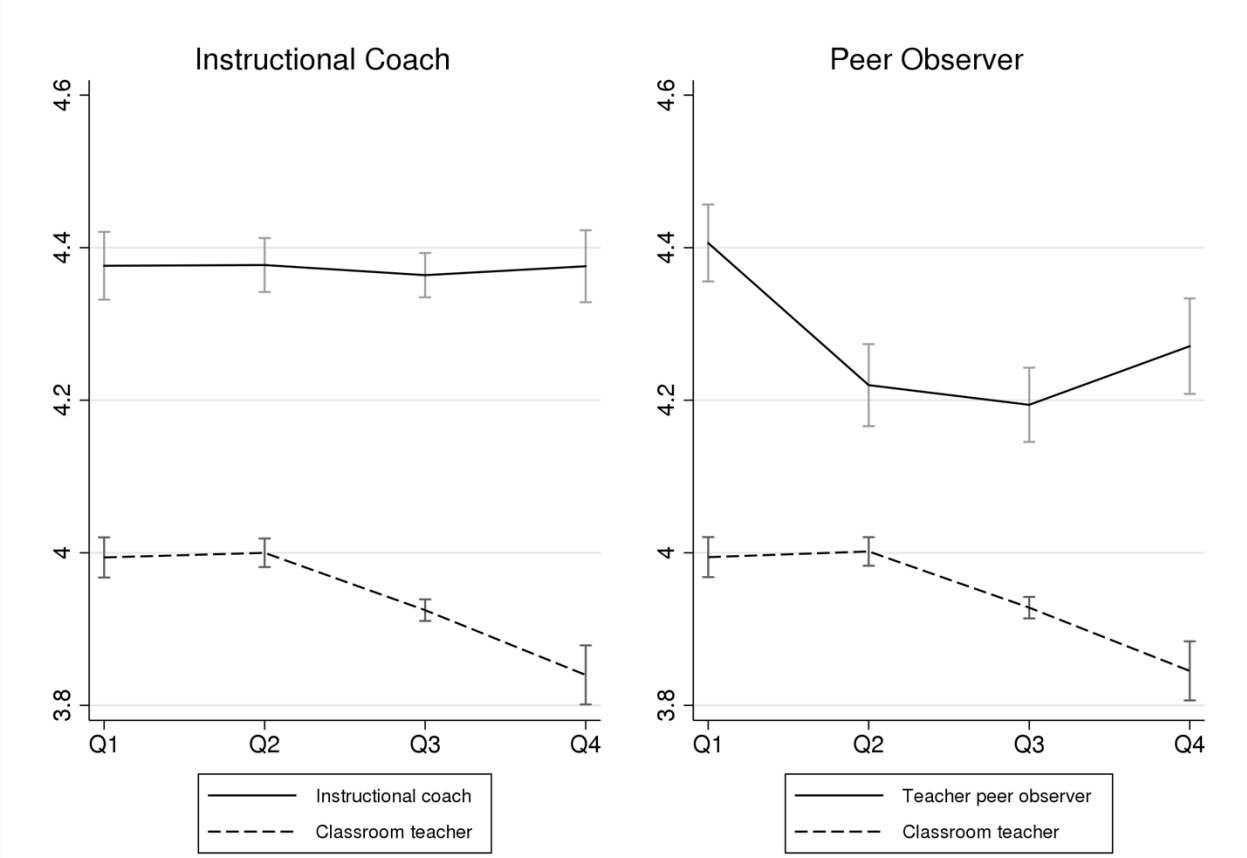
Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure A3. Predicted Prior-Year Effectiveness Score of 4 or 5 of Formal Teacher Leaders and Classroom Teachers by Racial/Ethnic Minority Student Enrollment Quartiles



Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Figure A4. Predicted Prior-Year Average Observation Scores of Formal Teacher Leaders and Classroom Teachers by Racial/Ethnic Minority Student Enrollment Quartiles



Notes: Predictions estimated by from ordinary least squares model with teacher and school controls. Four-group moderator interacted with whether educator is a teacher leader or not. All covariates held at means. Ninety-five percent confidence intervals.

Table A1. Examining the Characteristics of Survey Respondents and Non-Respondents

	Respondents	Non-Respondents
White teacher	0.90	0.85
Black teacher	0.09	0.14
Other race teacher	0.01	0.01
Female teacher	0.83	0.77
0-2 years experience	0.10	0.13
3-5 years experience	0.14	0.16
6-10 years experience	0.20	0.22
10-20 years experience	0.33	0.31
21-30 years experience	0.17	0.14
30+ years experience	0.06	0.05
Bachelor's or less	0.37	0.41
Master's degree	0.53	0.51
Advanced degree	0.10	0.09
Proportion White students	0.69	0.64
Proportion Black students	0.21	0.24
Proportion Hispanic students	0.08	0.09
Proportion other race students	0.02	0.03
Economically disadvantaged	0.55	0.55
Proportion students with disabilities	0.20	0.19
Proportion gifted students	0.02	0.02
Student enrollment (100s)	8.01	8.73
Elementary school	0.45	0.43
Middle school	0.18	0.18
High school	0.23	0.26
Combined grades	0.14	0.13
Prior level of Effectiveness-1	0.00	0.00
Prior level of Effectiveness-2	0.06	0.07
Prior level of Effectiveness-3	0.20	0.21
Prior level of Effectiveness-4	0.36	0.36
Prior level of Effectiveness-5	0.38	0.35
Observations	173977	169074