

Learning by Doing: The Characteristics, Effectiveness, and Persistence of Teachers Who Were Teaching Assistants First

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Background/Context: *In response to a shortage of highly qualified teachers, states and school districts have enacted a number of policy innovations over the last two decades. While researchers have evaluated many of these reforms, little is known about the initial effectiveness of individuals with prior teaching assistant experience. We review existing literature related to teaching assistants and utilize administrative data to examine a number of characteristics of individuals who transition from work as teaching assistants to jobs as regular classroom teachers.*

Study Purpose: *Individuals who become classroom teachers after having prior experience in schools working as teaching assistants may perform differently than other teachers due to additional exposure to classroom practices. The purpose of this study is to identify differences in the characteristics, effectiveness, and persistence of teachers who work as teaching assistants prior to entering the classroom as regular classroom teachers.*

Population: *While the population of focus varies somewhat across research questions, we generally focus on teachers with less than five years of experience working in elementary and middle school grades in all North Carolina public schools from 2005–2006 to 2009–2010. Additional data on teaching assistants employed from 2000–2001 to 2009–2010 in North Carolina public schools allows identification of individuals who had prior experience as teaching assistants in the state.*

Research Design: *Using administrative data records, we utilize quantitative descriptions of teacher characteristics and persistence to identify differences between teachers who entered the classroom with prior teaching assistant experience and other groups of teachers. For effectiveness comparisons, we estimate value-added models to compare the effectiveness of teachers in the identified groups of interest.*

Findings/Results: *Overall, we find that teachers who began as teaching assistants are (1) older, more racially diverse, lower-scoring on licensure exams, and more likely to enter the profession alternatively; (2) more effective in elementary-grades math and reading; and (3) more likely to remain as classroom teachers in North Carolina public schools.*

Conclusions/Recommendations: *These findings indicate that former teaching assistants represent a quality and highly persistent labor source and call for continued research to understand how additional exposure to classrooms benefits early-career teacher performance.*

INTRODUCTION

Teachers' frequent attrition from the profession and preferences for high-quality working environments mean that many states and school districts face a shortage of qualified, effective teachers for hard-to-staff schools and subject areas (Boyd, Lankford, Loeb, Ronfeldt, & Wyckoff, 2011; Ingersoll, 2001; North Carolina Department of Public Instruction, 2012). These shortages exist in both urban and rural environments and lead to a disproportionate number of students (particularly those who are academically at-risk) being taught by teachers who are novice, uncertified, low-scoring on licensure exams, and/or unable to promote expected levels of student achievement growth (Bastian, Henry, & Thompson, 2013; Clotfelter, Ladd, & Vigdor, 2005; Fowles, Butler, Cowen, Streams, & Toma, 2013; Lankford, Loeb, & Wyckoff, 2002).

To address this need for more and better teachers, especially given the research evidence linking high-quality teachers to desired student outcomes, states and school districts have instituted a number of innovations (Chetty, Friedman, & Rockoff, 2011; Hanushek, 2011; Jackson, 2013; Nye, Konstantopoulos, & Hedges, 2004). These include efforts to (1) lower barriers to entry by creating alternative paths into the profession and by establishing reciprocity agreements to facilitate interstate teacher movement (Coggshall & Sexton, 2008; Feistritzer, 2010); (2) attract more highly competitive individuals into teaching by providing merit-based college scholarships (Henry, Bastian, & Smith, 2012; Hirsch, Koppich, & Knapp, 2011); (3) create greater flexibility in teacher preparation program requirements by offering part-time and online courses (Casey, 2013); and (4) better support beginning teachers by providing comprehensive induction programs (Fletcher, Strong, & Villar, 2008; Glazerman et al., 2010; Ingersoll & Smith, 2004; Kelly, 2004; Stanulis & Floden, 2009).

While scholars have evaluated many of these reforms, researchers have yet to investigate another group of individuals who may be particularly effective early career teachers—individuals who have prior teaching assistant (instructional aide) experience. Conceptually, this group of teachers merits attention because research indicates mixed expectations for the effectiveness of teaching assistants. For instance, the additional exposure to classroom practices—planning, management, instruction, and assessment—during their time as teaching assistants may improve both the quality of their teaching and their persistence in the profession. Conversely, we might expect this group to underperform their peers without teaching assistant experience, since these former teaching assistants may possess characteristics, such as lower levels of educational attainment and academic ability, associated with reduced teacher effectiveness (Clotfelter, Ladd, & Vigdor, 2007, 2010; Henry et al., 2012).

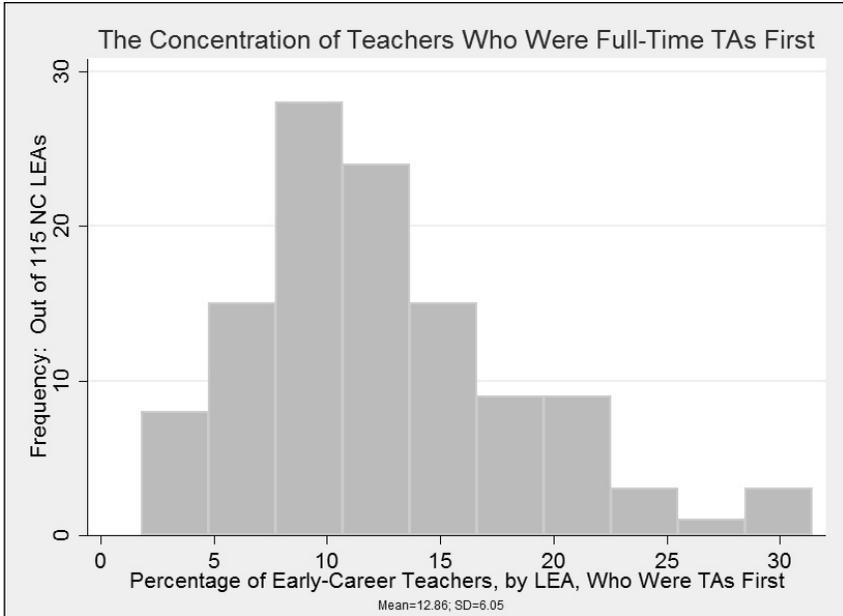
Studying teachers who have prior teaching assistant experience takes on added urgency as this group of teachers comprises a sizable portion of the teacher workforce. For example, Figure 1 shows that in North Carolina public schools (NCPS) during the 2009–2010 school year, those who worked as a full-time teaching assistant prior to becoming a classroom teacher made up nearly 13% of districts’ early-career teachers (those with less than five years of experience). For a few school districts, more than 30% of their early-career teacher workforce had experience as a full-time teaching assistant prior to becoming a classroom teacher.

Therefore, given these theoretical and practical justifications, in the present study we report findings from a comprehensive examination of the characteristics, value-added effectiveness, and persistence of full-time teaching assistants who subsequently became classroom teachers in NCPS. Specifically, we ask the following three questions:

1. What are the individual and workplace characteristics for those who worked as full-time teaching assistants prior to becoming classroom teachers?
2. Do those who worked as full-time teaching assistants prior to becoming classroom teachers generate larger student achievement gains than peers without such an experience?
3. Do those who worked as full-time teaching assistants prior to becoming classroom teachers remain in the profession longer than peers without such an experience?

In comparison to teachers without any teaching assistant experience, we find that teachers who were teaching assistants first are older, more racially/ethnically diverse, score lower on their teacher licensure exams,

Figure 1. The percentage of teachers who worked as teaching assistants first



Note. For the 2009–2010 school year, this figure displays the percentage of teachers with less than five years of experience, by school district, that were teaching assistants prior to becoming classroom teachers.

and are more likely to enter the profession alternatively. Regarding teaching outcomes, those who were first full-time teaching assistants (1) generate larger student achievement gains in elementary grades, with the strongest math effects produced by those who were teaching assistants for a greater number of years, and (2) persist in the profession at higher rates than teachers without any teaching assistant experience. Overall, our results indicate that instructors who were teaching assistants first represent a quality and highly persistent labor source. We posit that any negative selection associated with the academic credentials of these teachers is balanced by the benefits of increased exposure to classrooms. More broadly, our results suggest that additional hands-on exposure to classrooms may improve early-career teacher performance and call for continued research to better understand how exposure aids teachers. Finally, we acknowledge that these value-added and persistence results may not generalize to the full population of teaching

assistants who do not enter the teaching workforce. We address this issue more fully in the discussion.

In the remainder of the present study we first review literature on teaching assistants and describe how their characteristics and experiences in classrooms may influence their performance as teachers. Next, we detail our teaching assistant data, the teacher samples used to answer the research questions, and the methods used to estimate teacher effectiveness. Finally, we present results for each research question and conclude with a discussion of future research directions and potential policy implications.

BACKGROUND

CHARACTERISTICS OF TEACHING ASSISTANTS

Teaching assistants, also known as paraprofessionals, associates, or instructional aides, provide instructional and clerical support for classroom teachers. Nationally, approximately 750,000 individuals worked as a full-time teaching assistant during the 2009–2010 academic year; in North Carolina, nearly 27,000 individuals held this position (U.S. Department of Education, 2013). Typically, candidates must complete a certain amount and type of coursework to become a teaching assistant. In North Carolina, teaching assistant requirements vary by school district, but to be eligible for employment, preferred and/or required qualifications include a (1) high school diploma and (2) an associate's degree or higher or 48 semester hours of college coursework with a minimum 2.0 GPA. Candidates without 48 semester hours of coursework may have the option of demonstrating the ability to assist in the teaching of reading, writing, and math through a state or school district-developed assessment (NCDPI, *Qualifications for Paraprofessionals*). North Carolina also recommends prior classroom experience (such as volunteer work) and content-area coursework.

Regarding their characteristics, teaching assistants tend to differ from their teachers-of-record in several ways. First, teaching assistants are more racially/ethnically and linguistically diverse (Villegas & Clewell, 1998). Importantly, this means that teaching assistants can fulfill a number of functions that benefit diverse student groups, including better understanding their students' cultures, providing academic support for Limited English Proficient students, serving as a racial/ethnic role model in their professional capacity, and communicating with the parents/families of linguistically diverse students (Bernal & Aragon, 2004; Villegas & Clewell, 1998; Whitebook, Kipnis, & Bellm, 2008). Given the

increasing racial/ethnic disparities between the number of students of color and their classroom teachers, turning to teaching assistants as a supply of teachers could provide an opportunity to diversify the teaching profession and to enrich the educational experience of diverse students (Abbate-Vaughn & Paugh, 2009).

Second, in addition to being more diverse, teaching assistants tend to be older than licensed teachers (Villegas & Clewell, 1998). Related to this, teaching assistants typically have financial obligations that require full-time employment, making it challenging for them to attend a traditional education program on a full-time basis. Finally, teaching assistants are generally less well qualified academically. For instance, Sosinsky and Gilliam's five-year study of teaching assistants in early elementary grades found that compared to lead teachers, who held four-year bachelor's degrees, most teaching assistants held only a high school diploma, with some also holding an associate's degree (Sosinsky & Gilliam, 2010). Additionally, many teaching assistants have gaps in their content knowledge, particularly in mathematics, and may have difficulty passing state licensure tests (Abbate-Vaughn & Paugh, 2009; Villegas & Clewell, 1998).

ROLE OF TEACHING ASSISTANTS

Typically found in elementary-grades classrooms, teaching assistants reduce pupil-teacher ratios, increase direct support to students, and assist lead teachers in the completion of many classroom tasks (Sosinsky & Gilliam, 2010). Overall, the role of teaching assistants has evolved in recent decades from one that provides clerical assistance—e.g., duplicating materials, maintaining classroom resources, monitoring students on non-academic tasks—to one that actively engages in classroom instruction (Gaylord, Wallace, Pickett, & Likins, 2002). Activities of the teaching assistant include: developing unit, lesson, and behavior management plans; assisting the teacher-of-record with small group and one-on-one academic instruction; and documenting student progress on classroom assessments (Bernal & Aragon, 2004; Gaylord et al., 2002).

While the instructional activities of teaching assistants have expanded, their role in the classroom may vary according to the age of students, nature of the classroom, and relationship with the lead teacher (Jones, Ratcliff, Sheehan, & Hunt, 2011). For instance, Russell and colleagues found that rather than providing whole-class support, teaching assistants in elementary grades give considerable time to supporting individual students with special behavioral or academic concerns (Russell, Blatchford, Bassett, Brown, & Martin, 2005). In pre-kindergarten classrooms, with smaller class sizes, Sosinsky and Gilliam (2010) found that teaching

assistants interact more with the whole class and fulfill a broader range of roles. Still, the expectations held by and the relationship with the lead teacher often determine the teaching assistant's role. Case study research by Rueda and Monzo (2002) indicated that the teaching assistant role can fall into three blended categories—(1) clerical support: grading papers, preparing materials, running errands; (2) directed teaching: instructing a group of students using the explicit plans of the lead teacher; and (3) apprentice: taking on greater control and responsibility for the planning and direction of instruction. Here, the apprentice role is likened to co-teaching, with the teaching assistant and lead teacher dialoguing about lesson development, execution, and assessment, and then working side by side to deliver instruction.

While not characteristic of every teaching assistant position, the apprentice role may optimize (1) the quality of classroom instruction (Groom, 2006; Jones et al., 2011; Shim, Hestenes, & Cassidy, 2004) and (2) the development of the teaching assistant's instructional skills. Below, we discuss how the characteristics of teaching assistants and this apprentice/co-teaching role may influence the instructional proficiency and persistence of those individuals who were teaching assistants prior to becoming a teacher-of-record.

FACTORS INFLUENCING FORMER TEACHING ASSISTANT PERFORMANCE

In the present study we consider a teaching assistantship as an apprenticeship to observe and practice teaching. This exposure to classrooms provides opportunities for on-the-job learning that may benefit the performance and persistence of those who go on to teach. Conversely, teaching assistants possess characteristics, such as lower levels of educational attainment and academic ability, associated with reduced teacher effectiveness (Abbate-Vaughn & Paugh, 2009; Sosinsky & Gilliam, 2010; Villegas & Clewell, 1998). Below, we detail these competing hypotheses.

Regarding the positive effects of exposure to classrooms during the teaching assistantship, empirical support for this hypothesis comes from Boyd and colleagues (2009), whose research indicates that novice teachers benefit from greater pre-service exposure to school environments similar to those in which they will teach and the academic content they are expected to teach. For example, those first-year teachers who student taught in a congruent grade and/or subject prior to their in-service placement (e.g., an in-service and student teaching placement in fourth grade) generated significantly larger student achievement gains in mathematics than peers without this exposure experience

(Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2009; Henry et al., 2013). Conceptual support for the benefits of exposure comes from Bandura's (1977; see also Hoy & Spero, 2005) self-efficacy model and its focus on vicarious and mastery experiences. For teaching assistants, vicarious experiences would occur as the teacher-of-record models effective teaching practices. Mastery experiences would come through the apprentice model described by Rueda and Monzo (2002), as lead teachers share responsibility and teaching assistants directly take part in—through independent or co-teaching activities—planning, classroom management, instruction, and assessment. Essentially, the lead teacher serves as a mentor, coaching teaching assistants and transferring job-related knowledge so that teaching assistants develop the skills necessary to lead classrooms. Finally, beyond these classroom experiences, serving as a teaching assistant may increase familiarity with school context. This exposure to the “content of context” may allow teaching assistants to better understand the context of districts, schools, students, and collaborating with peers, and be better prepared to succeed in school environments as a teacher-of-record (Hammerness & Matsko, 2012).

While this additional exposure may benefit the performance of teachers who were teaching assistants first, the academic credentials of these individuals may adversely influence their performance. Studies by Sosinsky and Gilliam (2010), Abbate-Vaughn and Paugh (2009), and Villegas and Clewell (1998) all show that teaching assistants, in comparison to teachers-of-record, have lower levels of educational attainment and licensure exam scores. Results in the present study show that teaching assistants who go on to teach also have lower licensure exam scores. Given evidence from North Carolina that, on average, higher-scoring teachers produce larger student achievement gains, particularly in mathematics and science, these former teaching assistants may be less effective than their higher scoring peers (Clotfelter et al., 2007, 2010; Goldhaber, 2007).

DATA AND SAMPLE

TEACHING ASSISTANT DATA

This study draws upon salary data provided by the North Carolina Department of Public Instruction (NCDPI) to identify those who worked as a full-time teaching assistant prior to becoming a teacher-of-record in NCPS. Specifically, two data files facilitated this process: (1) a pay history file, beginning in 1986–1987 and running through 2011–2012, that identified the years in which an individual was paid as a teacher in NCPS;

and (2) a teaching assistant file that identified the 76,295 individuals employed as full-time teaching assistants in the academic years 2000–2001 through 2009–2010.

To identify those individuals who entered classroom teaching with teaching assistant experience, we determined individuals' first (chronological) appearance in each dataset, merged the two datasets together, and flagged those individuals who were paid as teaching assistants prior to being paid as teachers. Of the 76,295 full-time teaching assistants, approximately 9% (6,932 individuals) served as teaching assistants prior to becoming classroom teachers. We refer to these individuals as *TA First*. Another 7% (5,633 individuals) either served in a teaching assistant capacity after having already taught or started teaching in the same year in which they started as a teaching assistant (referred to as *Other TA*). Finally, more than 80% of the full-time teaching assistants (63,730 individuals) never became teachers-of-record in NCPS. Because these individuals do not possess descriptive, value-added, or persistence data as teachers, they are excluded from our analyses.¹

Having classified the full-time teaching assistants, we proceeded to identify the correct teaching experience values for both these former teaching assistants and all other teachers in our research sample. The NCDPI provides an experience variable in the salary data that indicates at what level an individual is paid with regard to the state's single salary structure. Generally, this paid experience variable correctly measures actual *teaching* experience—e.g., paid as a fifth-year teacher in the fifth-year of teaching. However, this is not always the case, since North Carolina credits some types of experience, both outside of educational settings (e.g., employment in industry) and inside of educational settings (e.g., working as a teaching assistant), in the paid experience variable. For instance, an individual may work as a chemist for 10 years and then enter the profession as a high school chemistry teacher with 10 years paid experience but zero years of actual teaching experience. Because the test of our hypothesis—serving as a teaching assistant provides exposure to classrooms and schools that is theorized to improve beginning teacher performance—depends on correctly identifying teaching experience for all the teachers in our analyses, we took two steps to determine teachers' actual classroom teaching experience.

First, upon request, the NCDPI provided data that allowed us to identify those individuals who were credited with experience for non-teaching related work and to determine how many years of paid experience the NCDPI credited them with for this non-teaching related work.² To calculate actual teaching experience, we subtracted each teacher's non-teaching experience credits, if applicable, from her paid experience

value. We made this adjustment for all teachers with non-teaching experience credits and classified these (excluding teachers in the TA First and Other TA categories) individuals into an *Experience Adjustment* category. Second, North Carolina also credits teaching assistant experience in teachers' paid experience—teachers receive one year of paid experience credit for every two years of service as a teaching assistant prior to earning a bachelor's degree and one year of experience credit for every one year of service as a teaching assistant after earning a bachelor's degree (NCDPI, 2010). Therefore, based on individuals' observed teaching assistant experiences and degree information (education data from NCDPI identifies whether and when an individual earned a bachelor's degree), we used this rule to calculate a teaching assistant experience adjustment. We then subtracted this teaching assistant experience adjustment, if applicable, from teachers' paid experience to generate the teaching experience value used in our analyses.³ Because our teaching assistant data starts in the 2000–2001 academic year, our teaching assistant experience adjustment may underestimate actual teaching assistant experience for any teachers with teaching assistant experience prior to 2000–2001. However, because our study period is from 2005–2006 through 2009–2010 (sufficiently after the censoring point of 2000–2001) and we limit our research sample to teachers with less than five years *teaching* experience, this censoring in the teaching assistant data is very unlikely to impact our analyses. Below, we present the samples we used to address each of our research questions.

RESEARCH SAMPLE

Individual and Workplace Characteristics

Given the lack of research on teaching assistants who become teachers, we start our analyses by examining the individual and workplace characteristics of those who were teaching assistants first (TA First) in comparison to the characteristics of (1) Other TA—teachers who had teaching assistant experience concurrent with or subsequent to classroom teaching; (2) Experience Adjustment—teachers without teaching assistant experience who earned non-teaching experience credit; and (3) teachers without any teaching assistant experience or non-teaching experience credit (referred to as *All Other* teachers).

The sample for these descriptive analyses includes all elementary and middle school (grades K–8) teachers in the 2009–2010 academic year with less than five years of teaching experience.⁴ We restrict our focus to these school levels since they are the most likely to employ teaching

assistants and teachers who were formerly teaching assistants. Using personnel and school demographic datasets supplied by the NCDPI, we report on a rich set of individual and workplace characteristics. Our individual teacher characteristics include gender, minority status, age, teacher licensure exam scores, graduate degree status, licensure areas, type of preparation, and whether the teacher instructs in a tested grade/subject. School characteristics include the percentage of minority students and students eligible for subsidized school lunches, the short-term suspension rate, performance composite (the percentage of End-of-Grade exams passed), per-pupil expenditures, and urbanicity.

Teacher Effectiveness

To estimate teacher effectiveness, as measured by adjusted-average student test score gains, we focus on the 2005–2006 through 2009–2010 academic years and tested grade/subject teachers in elementary and middle school grades (3–8) with less than five years of teaching experience. We limited our sample to these early-career teachers because we hypothesize that it is in this period when prior teaching assistant experience will be most beneficial to teacher performance. For these value-added models the key data feature is our use of classroom rosters. These rosters allowed us to match teachers to approximately 93% of the students they taught and account for multiple teachers within a subject year for a given student. Prior and current student score performance is based on the North Carolina third-grade pre-test and end-of-grade mathematics and reading exams in grades 3–8. To account for secular trends we standardized these exams within subject, grade, and year, and included year-fixed effects in our value-added models. Finally, to adjust for factors influencing teacher effectiveness outside the control of our teacher categories, we used the student demographic, classroom roster, personnel, and school data provided by the NCDPI to control for a rich set of student, classroom, and school covariates in these value-added models (shown in Table 1).

Table 1. Covariates Employed in Teacher Effectiveness Analyses

Student Covariates	Classroom and Teacher Covariates	School and Other Covariates
Prior test scores (reading and math)	Class size	School size and school size squared
Classmates' prior test scores (peer ability)	Heterogeneity of prior achievement within the classroom	Suspension rate
Days absent	Advanced curriculum (middle school)	Violent acts per 1,000 students
Structural mobility	Remedial curriculum (middle school)	Per-pupil expenditures
Other between-year mobility	Single-year teacher experience indicators	District teacher supplements
Within-year mobility	Teaching out of field	Racial/ethnic composition
Race/ethnicity		Concentration of poverty
Gender		
Poverty status		
Giftedness		
Disability		
Currently limited English proficiency		
Previously limited English proficiency		
Overage for grade		
Underage for grade		

Teacher Persistence

To assess the persistence of teachers we identified four cohorts of teachers whose first year of teaching occurred in the 2004–2005, 2005–2006, 2006–2007, or 2007–2008 academic years. Next, using teacher pay data provided by the NCDPI for the 2004–2005 through 2011–2012 academic years, we tracked these four cohorts, examining the percentage of teachers returning for a third and then fifth year of teaching in NCPS. For these persistence analyses we compared the retention rates of teachers in our TA First, Other TA, and Experience Adjustment categories to All Other teachers. We used independent sample t-tests to determine whether there were statistically significant differences in the unadjusted persistence rates across the teacher groups.

ANALYSIS PLAN

To determine whether those who served as full-time teaching assistants prior to becoming classroom teachers are more effective—i.e., generate larger adjusted-average student achievement gains—than peers without such an experience, we require an estimation strategy that isolates

teachers' unique contributions to student learning from other influencing factors. Additionally, we prefer an estimation approach that allows us to make statewide effectiveness comparisons between our teacher categories. To meet these criteria, we used an ordinary least squares (OLS) value-added model for our main estimation strategy. The OLS value-added model we employ (1) controls for a rich set of student, classroom/teacher, and school covariates in order to remove the confounding effect of variables that influence student performance and may not be balanced across our teacher categories (shown in Table 1); and (2) adjusts for the nested nature of schooling data by clustering standard errors at the teacher-by-year level.

In our value-added models we designate those teachers who have not had any teaching assistant experience and have not had any adjustments to their level of paid teacher experience as the reference category All Other teachers, and we employ two different variable specifications—an overall model and a dosage model—to estimate the effects of being a full-time teaching assistant prior to classroom teaching. Our overall model includes a single focal covariate, TA First, while our dosage model separates the TA First variable into three covariates—*TA one year*, *TA two/three years*, *TA more than three years*—to test whether the effects of working as a teaching assistant prior to classroom teaching grow or dissipate with additional years of teaching assistant work. To better isolate the effects of working as a teaching assistant prior to teaching, we specify two additional teacher categories: (1) Other TA, those who have served as teaching assistants but either worked as teachers first or started both positions concurrently; and (2) Experience Adjustment, those teachers, excluding those who were teaching assistants, who have had their level of paid teacher experience adjusted by the NCDPI.

Controlling for our rich set of student, classroom/teacher, and school covariates, model coefficients provide estimates for the adjusted-average differences in student achievement gains between our reference category, All Other teachers, and those who worked as full-time teaching assistants first. These adjusted-average differences represent a combination of selection into teaching assistant positions prior to teaching—see the descriptive characteristics in Tables 2 and 3—and the hypothesized benefits, provided by employment as a teaching assistant, of additional exposure to K–12 classrooms. We acknowledge that our TA First estimates may not generalize to our wider population of teaching assistants (the 84% not in the TA First or Other TA categories) who do not enter the teaching profession. However, the purpose of our analysis was not to advocate for a transition of all teaching assistants to classrooms teachers, but rather to determine whether those teaching assistants who do

transition are more or less effective (persistent) than their peers without teaching assistant experience and to explore whether additional exposure to classroom practice benefits early-career teachers.

We used the following equation to estimate adjusted-average student achievement:

$$Y_{ijst} = \beta_0 + \beta_1 Y_{it-n} + \beta_2 TA \text{ First} + \beta_3 Other \text{ TA} + \beta_4 Exp \text{ Adj} + \beta_x X_{ijs} + \beta_z Z_{js} + \beta_w W_s + \varepsilon_{ijs}$$

where Y_{ijst} is the test score for student i , in classroom j , in school s , at time t ;

Y_{it-n} represents a prior test score(s) for student i ;

$TA \text{ first}$ is an indicator variable equal to 1 if the teacher was a full-time teaching assistant prior to classroom teaching;

$Other \text{ TA}$ is an indicator variable equal to 1 if the teacher has been a teaching assistant, but either worked as a teacher prior to becoming a teaching assistant or started both positions concurrently;

$Exp \text{ Adj}$ is an indicator variable equal to 1 if the teacher has had her paid experience variable adjusted (exempting those in the teaching assistant categories);

β_2 , β_3 , and β_4 estimate the average effect of $TA \text{ First}$, $Other \text{ TA}$, and $Exp \text{ Adj}$, respectively, in reference to *All Other* teachers;

X_{ijs} , Z_{js} , and W_s represent a set of student, classroom/teacher, and school covariates;

β_x , β_z , and β_w estimate the average effect of the student, classroom/teacher, and school covariates, respectively; and

ε_{ijs} is a disturbance term representing all unexplained variation in student achievement.

Given research evidence that teachers are non-randomly distributed to schools and that school characteristics, such as teacher collaboration, beginning teacher support, and leadership quality, influence teacher performance, we also specified school fixed-effects models as a robustness check (Clotfelter et al., 2005; Kennedy, 2010; Lankford et al., 2002; Loeb, Kalogrides, & Beteille, 2012). Unlike the coefficients from our OLS value-added models, which provide effectiveness estimates relative to the reference category, statewide, these fixed-effects models include a dichotomous indicator for each school in the analysis and limit effectiveness comparisons to teachers working in the same schools. This approach may be particularly salient if those who were full-time teaching assistants prior to becoming classroom teachers secure employment

in a select sample of schools—e.g., taking jobs in hard-to-staff schools/regions or working as a teaching assistant until a preferred classroom teaching assignment becomes available. When combined, value-added results from the OLS and school fixed-effects models provide a more comprehensive view of teacher effectiveness.

RESULTS

We separate the results section into three parts. First, we compare the individual and workplace characteristics of teachers in the four groups described above: TA First, Other TA, Experience Adjustment, and All Other teachers. Second, we estimate the effectiveness of teachers in the four groups using the analysis plan described above. Finally, we report on the persistence of teachers in the four groups by testing for significant differences in their three- and five-year retention rates in NCPS.

INDIVIDUAL AND WORKPLACE CHARACTERISTICS

For elementary and middle-grades teachers with less than five years of teaching experience, Tables 2 and 3 provide descriptive characteristics for our four categories of teachers in the 2009–2010 academic year. Focusing first on the elementary grades results (Table 2), compared to All Other teachers, TA First teachers are more likely to be from a minority group (22.5%) and older (mean = 37.5 years). TA First teachers also scored more than 20% of a standard deviation lower than All Other teachers on their Praxis II teacher licensure exams; Other TA and Experience Adjustment teachers scored similarly to TA First teachers.⁵ Concerning graduate degrees, those teachers with an experience adjustment had the highest rates of educational attainment. While a majority of teachers across the groups held licensure in elementary grades, TA First and All Other teachers had the highest rates of elementary grades licensure (78.6% and 83.1%, respectively), with TA First teachers slightly more likely than All Other teachers to possess licensure to teach exceptional children. Regarding teacher preparation, TA First teachers had the highest rate of in-state preparation (at either the undergraduate, licensure only, or graduate level) and over 22% entered the profession alternatively—more than double the rate for All Other teachers. Turning to school characteristics, compared to All Other teachers those in the TA First category worked in school environments with a slightly higher percentage of students eligible for subsidized school lunches, but a lower percentage of minority students. Across all four teacher categories, school academic performance was comparable, while schools employing TA First teachers spent more, per pupil, than those employing All Other teachers.

Table 2. Individual and School Characteristics (Elementary Schools)

Characteristics	TA First	Other TA	Experience Adjustment	All Other Teachers
Female	0.934 (0.248)	0.901 (0.298)	0.884 (0.320)	0.905 (0.292)
Minority	0.225 (0.417)	0.247 (0.432)	0.223 (0.416)	0.139 (0.346)
Age	37.54 (9.52)	34.57 (9.84)	37.61 (10.18)	28.01 (6.50)
Standardized Praxis II Scores	0.019 (0.688)	0.020 (0.789)	0.030 (0.881)	0.228 (0.614)
Graduate Degree	0.118 (0.323)	0.159 (0.367)	0.334 (0.472)	0.148 (0.355)
Licensure Areas				
Pre-K	0.075 (0.264)	0.111 (0.314)	0.244 (0.430)	0.102 (0.302)
Elementary	0.786 (0.409)	0.662 (0.473)	0.565 (0.496)	0.831 (0.374)
Exceptional Children	0.158 (0.364)	0.222 (0.416)	0.224 (0.417)	0.114 (0.317)
Preparation				
In-state	0.606 (0.488)	0.479 (0.500)	0.252 (0.434)	0.538 (0.498)
Out-of-State	0.108 (0.311)	0.151 (0.359)	0.383 (0.486)	0.353 (0.478)
Alternative	0.221 (0.415)	0.336 (0.473)	0.325 (0.469)	0.094 (0.292)
Unclassifiable	0.063 (0.244)	0.032 (0.178)	0.038 (0.193)	0.013 (0.115)
Tested Subject	0.343 (0.475)	0.331 (0.471)	0.299 (0.458)	0.388 (0.487)
School Characteristics				
Free & Reduced-Price Lunch	65.62 (23.34)	64.75 (23.98)	65.81 (25.26)	63.55 (25.07)
Minority Percentage	50.21 (28.27)	51.08 (30.13)	54.91 (27.84)	54.85 (27.32)
Short-Term Suspension Rate (per 100 students)	7.64 (10.49)	8.43 (11.44)	9.41 (14.31)	8.36 (11.25)

Characteristics	TA First	Other TA	Experience Adjustment	All Other Teachers
Performance Composite	72.72 (12.17)	72.68 (13.02)	71.31 (12.70)	72.05 (12.32)
Total Per-Pupil Expenditures	9078.66 (2056.59)	8915.66 (1447.44)	9179.67 (1992.93)	8891.53 (1683.65)
Urbanicity				
City	26.50	28.23	31.39	30.46
Suburb	14.46	13.31	12.27	15.14
Town	13.61	9.27	12.27	12.13
Rural	45.43	49.19	44.06	42.27

Note. This table presents individual and school-level characteristics for elementary-grades teachers with less than five years of experience in the 2009–2010 school year.

Middle schools had a higher percentage of male and minority teachers than elementary schools. Table 3 shows that the TA First category has the highest percentage of female teachers, and nearly double the percentage of minority teachers that the All Other teachers category has (33.1% and 18.6%, respectively). As in elementary schools, TA First instructors are older than the group of All Other teachers and score lower on their Praxis II licensure exams. TA First and Other TA teachers score below average while All Other teachers and those in the Experience Adjustment category score well above average. Teachers in the All Other category had higher rates of licensure in math, science, and social studies, while those in the TA First and Other TA groups were particularly likely to have certifications in educating exceptional children. Alternative preparation routes were the primary mode of teacher training for those in the TA First, Other TA, and Experience Adjustment groups—double the alternative entry percentage in the All Other category. In addition, about 60% of TA First and All Other teachers taught a tested subject, compared to approximately 45% in the two other groups. Finally, turning to school characteristics, former teaching assistants (both the TA first and Other TA categories) and those with an Experience Adjustment taught in schools with a higher percentage of students qualifying for subsidized lunches, while those in the Other TA and Experience Adjustment categories taught in schools with a higher percentage of minority students. All four teacher categories taught in schools with comparable academic performance.

Table 3: Individual and Workplace Characteristics (Middle Schools)

Characteristics	TA First	Other TA	Experience Adjustment	All Other Teachers
Female	0.812 (0.390)	0.721 (0.450)	0.704 (0.456)	0.709 (0.453)
Minority	0.331 (0.471)	0.453 (0.500)	0.273 (0.446)	0.186 (0.389)
Age	37.76 (9.29)	36.88 (10.36)	39.31 (8.90)	29.21 (7.67)
Standardized Praxis II Scores	-0.075 (0.807)	-0.229 (0.827)	0.203 (0.767)	0.177 (0.745)
Graduate Degree	0.123 (0.329)	0.163 (0.371)	0.270 (0.444)	0.157 (0.364)
Licensure Areas				
Elementary	0.137 (0.344)	0.134 (0.342)	0.059 (0.236)	0.153 (0.360)
Math	0.165 (0.371)	0.134 (0.342)	0.147 (0.354)	0.251 (0.434)
English/Reading	0.282 (0.450)	0.164 (0.373)	0.132 (0.338)	0.288 (0.453)
Science	0.125 (0.331)	0.082 (0.276)	0.189 (0.391)	0.215 (0.410)
Social Studies	0.179 (0.383)	0.206 (0.406)	0.112 (0.315)	0.289 (0.453)
Exceptional Children	0.350 (0.477)	0.309 (0.464)	0.182 (0.386)	0.121 (0.326)
Preparation				
In-state	0.309 (0.462)	0.244 (0.432)	0.136 (0.343)	0.385 (0.486)
Out-of-State	0.069 (0.255)	0.091 (0.290)	0.153 (0.361)	0.311 (0.463)
Alternative	0.588 (0.492)	0.653 (0.478)	0.690 (0.462)	0.289 (0.453)
Unclassifiable	0.031 (0.176)	0.010 (0.101)	0.019 (0.139)	0.013 (0.114)
Tested Subject	0.573 (0.495)	0.469 (0.501)	0.421 (0.494)	0.600 (0.489)
School Characteristics				
Free & Reduced-Price Lunch	58.02 (20.04)	59.44 (19.89)	59.29 (20.38)	55.69 (20.90)

Characteristics	TA First	Other TA	Experience Adjustment	All Other Teachers
Minority Percentage	49.79 (25.43)	53.75 (25.12)	53.40 (25.08)	50.80 (25.50)
Short-Term Suspension Rate	31.72 (23.99)	28.78 (21.08)	34.87 (31.34)	31.27 (24.31)
Performance Composite	73.72 (11.20)	72.71 (10.79)	72.44 (11.83)	74.08 (11.46)
Total Per-Pupil Expenditures	8243.15 (2637.70)	8443.02 (1388.77)	8462.09 (3184.88)	8004.15 (1588.87)
Urbanicity				
City	25.89	28.71	27.65	28.91
Suburb	12.25	8.91	10.15	13.15
Town	12.06	15.84	16.85	12.86
Rural	49.80	46.53	45.36	45.07

Note: This table presents individual and school level characteristics for middle grades teachers with less than five years experience in the 2009-10 school year.

Teacher Effectiveness

For our overall, OLS value-added model in elementary grades, Table 4 indicates that TA First instructors significantly outperform All Other teachers by 0.013 and 0.020 standard deviation units in mathematics and reading, respectively. While these significant results are not large, approximately 1% to 2% of a standard deviation, this effect size is comparable to findings from other research on early-career teacher credentials (Bastian & Henry, 2014; Kane, Rockoff, & Staiger, 2008). Using school fixed effects to control for time-invariant school characteristics, and to make teacher effectiveness comparisons within schools, reduces the magnitude of the TA First coefficients by approximately one half, and statistical significance only remained for reading. These fixed effects results suggest that TA First instructors secure positions in schools with higher-performing All Other teachers, and thus, the differences in teacher effectiveness between the groups diminished in fixed-effects models. In middle grades, Table 4 shows that TA First teachers performed no differently than All Other teachers in either the OLS or school fixed-effects models. Comparing within schools, teachers in the Other TA category—those who taught before becoming a teaching assistant or started both positions concurrently—underperform All Other teachers in both elementary and middle grades mathematics by 0.029

and 0.062 standard deviation units, respectively. These negative results indicate that poor performance may have been one factor pushing these individuals out of teaching and into teaching assistant positions. Finally, across all school levels and model specifications, there are no statistically significant differences between those teachers with an experience adjustment and All Other teachers.

Table 4: Overall Value-Added Model Results – Elementary and Middle Grades

Focal Variables	Elementary Math		Elementary Reading		Middle Math		Middle Reading	
	OLS	School FE	OLS	School FE	OLS	School FE	OLS	School FE
TA First	0.013* (0.006)	0.007 (0.006)	0.020** (0.004)	0.010* (0.004)	-0.012 (0.010)	-0.011 (0.010)	-0.001 (0.006)	0.004 (0.006)
Other TA	-0.016 (0.015)	-0.029* (0.014)	0.001 (0.010)	-0.004 (0.010)	-0.026 (0.022)	-0.062** (0.020)	-0.017 (0.012)	-0.011 (0.011)
Experience Adjustment	-0.016 (0.011)	-0.019 (0.010)	-0.005 (0.008)	-0.009 (0.008)	-0.007 (0.009)	-0.007 (0.009)	0.002 (0.006)	-0.002 (0.006)
Cases	688,904	688,904	966,129	966,129	431,980	431,980	478,609	478,609

Note: This table reports coefficients from models where all teachers without TA experience or adjustments to the teaching experience variable are the reference group. Standard errors were clustered at the teacher-year level. *Indicates statistical significance at the 0.05 level; ** indicates significance at the 0.01 level.

Because we hypothesized that the effects of first being a teaching assistant may differ by length of time as a teaching assistant—due to increased exposure to classrooms and/or the characteristics of those with teaching assistant tenures of different lengths—we estimated a set of dosage models that divided the TA First teachers into groups based on the number of years they worked as a teaching assistant before becoming a classroom teacher. Here, Table 5 indicates that those who served as teaching assistants for a greater number of years (TA More 3 YR) produced the strongest elementary-grades math effects. In elementary-grades reading models (OLS) TA First teachers across dosage levels are equally effective—approximately 0.020 standard deviation units more effective than the reference group of All Other teachers.

In middle grades, teachers with more than three years of teaching assistant experience significantly underperformed relative to All Other teachers in the school fixed-effects math model. While there were no other statistically significant dosage effects in middle grades, the magnitude of the TA First dosage coefficients generally decreased as the years

of teaching assistant experience increased. This may suggest that, in middle grades, the higher-quality TA First instructors transitioned into teaching positions more quickly.

Taken together, the results from the overall and dosage models indicate that any negative selection effects for the TA First category (recruiting individuals with lower levels of academic ability) are limited and generally, TA First teachers perform as well as or slightly better than peers without teaching assistant experience. Please see Table 6 for the number of unique teachers, by category, included in our value-added models.

Table 5: Dosage Value-Added Model Results – Elementary and Middle Grades

Focal Variables	Elementary Math		Elementary Reading		Middle Math		Middle Reading	
	OLS	School FE	OLS	School FE	OLS	School FE	OLS	School FE
TA_analysis								
TA 1YR	0.004 (0.010)	-0.006 (0.010)	0.018* (0.007)	0.005 (0.007)	0.010 (0.015)	0.009 (0.015)	0.005 (0.009)	0.015 (0.009)
TA 2to3 YR	0.012 (0.009)	0.007 (0.009)	0.022** (0.006)	0.010 (0.007)	-0.027 (0.015)	-0.016 (0.016)	0.004 (0.010)	-0.002 (0.010)
TA More 3 YR	0.024* (0.010)	0.022* (0.010)	0.021** (0.007)	0.014 (0.007)	-0.024 (0.018)	-0.042* (0.020)	-0.024 (0.012)	-0.013 (0.014)
Other TA	-0.016 (0.015)	-0.028* (0.014)	0.001 (0.010)	-0.004 (0.010)	-0.026 (0.022)	-0.062** (0.020)	-0.017 (0.012)	-0.011 (0.011)
Experience Adjustment	-0.016 (0.011)	-0.020 (0.010)	-0.005 (0.008)	-0.009 (0.008)	-0.007 (0.009)	-0.007 (0.009)	0.002 (0.006)	-0.002 (0.006)
Cases	688,904	688,904	966,129	966,129	431,980	431,980	478,609	478,609

Note. This table reports coefficients from models where all teachers without TA experience or adjustments to the teaching experience variable are the reference group. Standard errors were clustered at the teacher-year level. * Indicates significance at the 0.05 level; ** indicates significance at the 0.01 level.

Table 6: Teacher Counts in Value-Added Models

Teacher Category	Elementary Math	Elementary Reading	Middle Math	Middle Reading
TA First	1087	1127	348	451
TA 1 YR	352	363	137	180
TA 2 to 3 YR	419	438	130	181
TA More 3 YR	316	326	81	90
Other TA	193	195	91	129
Experience Adjustment	312	321	347	360
All Other Teachers	8751	8878	3295	3814

Note: This table reports the number of unique teachers, by category, included in our value-added models.

Teacher Persistence

Figure 2 presents the three- and five-year retention rates for teachers in our TA First, Other TA, Experience Adjustment, and All Other teachers categories. Here, those in the TA First category are significantly more likely to persist than All Other teachers—over 85% return for a third year of teaching and nearly 75% return for a fifth year of teaching. Compared to All Other teachers, individuals with an experience adjustment were also significantly more likely to remain in NCPS, while those in the Other TA category were significantly less likely to persist. Overall, these results suggest that increased exposure to classrooms may lead to greater teacher persistence. From a policy perspective, these results indicate that TA First teachers could help save districts and schools from the financial and performance costs associated with high levels of teacher attrition (Alliance for an Excellent Education, 2004; Ronfeldt, Loeb, & Wyckoff, 2013).

DISCUSSION

To address shortages of quality teachers, particularly in hard-to-staff environments, states and school districts have instituted a number of practices to better recruit and retain effective instructors. While the education community knows the efficacy of many of these programs (e.g., competitive scholarships to encourage entry into the profession or high-quality teacher induction), little is known about an additional approach to address the need for quality instructors—hiring teachers with previous experience as teaching assistants. Therefore, using a unique dataset

identifying full-time teaching assistants in NCPS, we investigated the characteristics, value-added effectiveness, and persistence of individuals who were teaching assistants prior to becoming classroom teachers.

Consistent with prior research on teaching assistants, our descriptive analyses revealed that TA First teachers in our sample were older (due to increased time in the labor force as a teaching assistant) and more likely to come from minority groups (Villegas & Clewell, 1998).

This prior work experience in classrooms and schools may improve the instructional quality and persistence of TA First instructors; further, the greater diversity in the TA First population may benefit the minority student populations they serve (Dee, 2004). Compared to the group of All Other teachers, we also found that teachers in the TA First group had lower, on average, Praxis II exam scores and higher rates of alternative entry preparation for teaching. Conversely, these academic and preparation characteristics suggest negative selection effects for TA First instructors (Clotfelter et al., 2007, 2010; Goldhaber, 2007).

Turning to teacher effectiveness, our overall value-added results indicate that TA First teachers in elementary and middle grades are at least as effective (and in some cases slightly more effective—elementary mathematics and reading) as the group of All Other teachers. These value-added results suggest that any negative selection associated with those teachers who first began as teaching assistants is mitigated by the benefits of increased exposure to classrooms and schools during the teaching assistant experience. To further understand these competing hypotheses (negative selection vs. exposure) future research should: (1) compare TA First teachers to All Other teachers with comparable Praxis II performance; (2) explore whether there are initial differences in effectiveness between TA First teachers and their peers without teaching assistant experience that narrow over time (indicating early benefits to exposure); and (3) determine whether effectiveness differences exist between those TA First teachers who had versus did not have their teaching license before beginning work as a teaching assistant.

Our dosage models revealed that: (1) the positive effects of TA First teachers in elementary-grades mathematics were primarily associated with longer teaching assistant experiences; (2) the positive effects of TA First teachers in elementary-grades reading were evenly distributed across dosage levels; and (3) in middle grades, longer service as a teaching assistant was associated with decreased effectiveness, particularly in school fixed-effects mathematics models. The differences in value-added results between elementary and middle grades (both overall and dosage models) may be due to differences in selection into teaching at these school levels—elementary-grades TA First teachers have higher

licensure exam scores (see Tables 2 and 3)—and/or TA First teachers' greater familiarity with elementary grades, since full-time teaching assistants are more likely to work in elementary rather than middle schools.⁶

Regarding teacher retention, TA First teachers persisted in NCPS at the highest rates of any group included in our analyses. Given the substantial costs associated with teacher attrition—financial costs to recruit and train/replace teachers, school instability, and filling vacancies with (generally less effective) novice teachers—these results have implications for teacher hiring. Additional studies are necessary, however, to determine to what extent the increased persistence of TA First teachers is associated with their pre-service exposure to classrooms and schools compared to their observable characteristics (e.g., age, licensure status).

To connect these results to policy, it is important to state the contributions and limitations of this research. In the present study we pursued two objectives: (1) to examine the characteristics, effectiveness, and persistence of TA First teachers (who, as shown in Figure 1, comprise a meaningful percentage of early-career teachers in NCPS); and (2) to contribute to and promote further study on the relationship between pre-service exposure to classrooms and schools and later teacher performance. When considering the implications of our results for policy, we acknowledge that teaching assistants select into teaching, meaning our findings may not generalize to the full population of teaching assistants who do not become classroom teachers. With our results, however, we are not recommending policies that would either convert all teaching assistants into classroom teachers or require service as a teaching assistant prior to becoming a classroom teacher. Rather, we contend that our results have policy significance in three ways.

First, our value-added and persistence analyses show that TA First instructors are a quality—performing as well as or slightly better than All Other teachers—and highly persistent source of teachers. District and school-level hiring agents can use this evidence to improve teacher recruitment practices and inform teacher-hiring decisions. Second, given the persistent challenges of staffing schools in many urban and rural communities, establishing or expanding programs that encourage current teaching assistants to obtain their teaching credentials may represent one effective strategy to help alleviate teacher shortages. Many schools of education already have programs that allow teacher candidates to complete two years of courses at a local community college and then transfer to the four-year institution and complete courses online or face-to-face at regional sites. Importantly, this policy would produce teacher candidates with both significant exposure to classroom settings and the components of traditional teacher education. Finally,

our results suggest that additional pre-service exposure to classrooms and schools benefits early-career teacher outcomes. Building from this analysis, more research evidence is needed to determine the extent to which pre-service exposure influences early-career teacher effectiveness, what types of pre-service exposure carry the most influence, and whether policy options—such as longer and more rigorous student teaching or post-graduation teacher residency programs—improve student outcomes.

NOTES

1. It is possible that some of these individuals will go on to teach in NCPS. However, due to data censoring—teacher pay data is only available through the 2011–2012 school year—we cannot yet identify these individuals.

2. Credit for non-teaching experience comes from non-teaching related work. This dataset does not identify the origins of individuals' non-teaching experience. Please see NCDPI (2010) for the types of non-teaching work that North Carolina credits in paid experience.

3. Teachers in our TA First and Other TA categories could have received either the teaching assistant experience credit only or both the non-teaching experience and teaching assistant experience credits.

4. Since teacher and school demographics do not vary greatly from year to year, we restrict our focus to 2009–2010, the final year of our study period, for these descriptive analyses. Earlier years of data are available upon request.

5. Praxis II scores are standardized by test across all teachers regardless of experience. A score of zero indicates that the teacher scored at the mean for the full sample of teachers taking a specific Praxis II exam. We standardize within test code across teachers and then average Praxis II scores for any teacher having more than one Praxis II score.

6. The NCDPI teaching assistant data do not identify the grade level(s) or subject area(s) in which full-time teaching assistants worked. Therefore, we are unable to examine the match effect between teaching assistant experience at a particular grade level(s) or in a particular subject area(s) and later effectiveness (persistence) as a classroom teacher.

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