Evaluation of Teach For America in Texas Schools

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Executive Summary

Teacher Quality and Student Achievement in Texas

Factors influencing student achievement in America's public schools are numerous. Among the most influential and frequently discussed is teacher quality, which is ultimately measured through gains in student achievement. To fully understand the potential long-term effects of teacher quality on student achievement, it is imperative to examine the teacher programs that aim to provide a supply of high quality teachers to our most high-need schools and students. Since 1991, Teach For America (TFA) has aimed to provide high quality teachers to the most high-need Texas schools who would otherwise not be staffed with teachers of comparable quality. TFA corps members were expected to have a positive and meaningful effect on students' academic achievement relative to what a student would have experienced had the TFA corps member or alumni not been placed in the classroom.

The main purpose of this evaluation was to estimate the effect of TFA corps members and TFA alumni on Texas student mathematics and reading scores as measured by the Texas Assessment of Knowledge and Skills (TAKS) exam in the state of Texas in the 2010-11 school year. As of this writing, this is the first comparative evaluation of TFA to use student-level data from all districts in Texas that employed TFA corps member(s) in the 2010-11 school year and used a strong matched comparison group of students. Comparisons were made on mathematics and reading outcomes between students taught by TFA corps members and novice non-TFA teachers, and between students taught by TFA alumni and veteran non-TFA teachers.

TFA corps members were still in their two-year contract assignment during the 2010-11 school year, while TFA alumni had completed their two-year contract prior to the 2010-11 school year, but continued to work in Texas schools.

The effect of TFA on 2010-11 TAKS mathematics scores of elementary and middle grade students was estimated using 493 campuses (94 TFA and 399 non-TFA) and 11,788 students (5,894 TFA and 5,894 non-TFA). The effect of TFA on 2010-11 TAKS reading scores of elementary and middle school students was estimated using 483 campuses (108 TFA and 375 non-TFA) and 14,354 students (7,177 TFA and 7,177 non-TFA). Student demographics for the campuses revealed that TFA corps members and alumni were teaching in high-need Texas campuses with high percentages of economically disadvantaged and limited English proficient students in the 2010-11 school year.

Effects of TFA on Student Achievement in Texas

Students of TFA Corps Members Score 17 Points Higher on Middle Grade TAKS Mathematics than Students of Novice Non-TFA Teachers

Middle grade students of TFA corps members and alumni scored higher on the 2010-11 TAKS mathematics when compared to middle grade students of non-TFA teachers. The differences were substantial, statistically significant, and largest for students of TFA alumni. Middle grade students taught by TFA corps members scored an average of 17 points higher on the 2010-11 TAKS mathematics than students taught by a novice non-TFA teacher.

The difference between TFA corps members and non-TFA teachers on middle grade TAKS mathematics scores can be translated to an effect size of 0.19. This difference corresponds to more than half a year of additional learning[1] for students of TFA corps members compared to students of novice non-TFA teachers, and could reduce the achievement

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[1] The additional months of learning were based on the average annual gain for middle school grades mathematics which was .31 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).

gap between these students by 24 percent on the grade 8 National Assessment of Educational

Progress (NAEP).[2]

Students of TFA Alumni Score 23 Points Higher on Middle Grade TAKS Mathematics than Students of Experienced non-TFA Teachers

The effect of TFA alumni on middle grade students' 2010-11 TAKS mathematics

scores was approximately 23 points higher than experienced non-TFA teachers. This difference

is almost twice as large as the effect of TFA corps members on middle grade student

mathematics achievement.

The difference between the effect of TFA alumni and experienced non-TFA teachers on

middle grade TAKS mathematics scores translates to an effect size of 0.27. This difference

corresponds to close to a full-year of learning for students of TFA alumni over students of

experienced non-TFA teachers[3], and could reduce the achievement gap between these students

by 34 percent on the grade 8 NAEP[4].

Students of TFA Alumni Score 10 Points Higher on Middle Grade TAKS Reading than Students of Experienced non-TFA Teachers:

The effect of TFA alumni on middle grade students' 2010-11 TAKS reading scores,

relative to experienced non-TFA middle grade teachers, was approximately 10 points higher.

The difference between the effect of TFA alumni and experienced non-TFA teachers on

middle grade TAKS reading scores translates to an effect size of 0.11. This difference

corresponds to approximately half of a year of additional learning for students of TFA alumni

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[2] This is based on an estimated achievement gap of 0.80 standard deviations between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008).
[3] The additional months of learning was based on the average annual gain for middle school grades mathematics which was .31 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).
[4] This is based on an estimated achievement gap of 0.80 standard deviations between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008).

over students of experienced non-TFA teachers[5], and could reduce the achievement gap

between these students by 17 percent on the grade 8 NAEP[6].

The three positive and statistically significant effects of TFA corps members and

alumni on student outcomes must be tempered with reservations about attributing the *entire*

effect to TFA due to limitations of matched comparisons. There were also small positive

effects of TFA corps members and alumni on 2010-11 TAKS elementary grade mathematics,

elementary grade reading, and middle grade reading (for corps members) scores but these

effects were not statistically significant. The lack of statistically significance results could also

be interpreted as students of TFA corps members and alumni performed no worse on these

TAKS content areas than students of non-TFA teachers.

Future Research on TFA Effects in Texas

The positive and statistically significant findings in this study should be replicated in

future research with a richer array of administrative data from the Texas Education Agency to

confirm the stability of these findings, to extend the evaluation to include value added

measures, and to discern how to included high school grades with TAKS measures that are not

vertically equated. Estimating the cost effectiveness of TFA corps members and alumni is

another under-studied area of research in Texas. Previous research has interpreted a TFA effect

as a cost savings associated with having a TFA corps member in the classroom; however, such

investigations have not been focused within the state of Texas. Future research that extends

these studies by examining measures of cost effectiveness of TFA corps members and alumni

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[5] The additional months of learning were based on the average annual gain for middle school grades reading which was .245 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).

[6] This is based on an estimated achievement gap of 0.66 standard deviations between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008).

in Texas schools could provide further understanding of their effect on the academic success of Texas students and the schools where they teach.

Although the present study found significant and meaningful differences on student achievement in Texas schools between TFA corps members (and alumni) and both novice and experienced non-TFA teachers, the study did not investigate effects of teacher certification or teacher degree type on student achievement as the data were not available. Although previous literature is mixed on this topic, some studies have found effects associated with certification route and degree type[7]. Future research should consider controlling for or investigating the differences between certification and degree status of TFA and non-TFA teachers as well as interactions between TFA status and certification and TFA status and degree status.

Finally, future research should also investigate the reason for positive, but not statistically significant, effects of TFA corps members and alumni in mathematics and reading at the elementary grades and reading at the middle grades found in the current study as these findings are consistent with previous research.

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[7] Greenberg, Rhodes, Ye, and Stancavage, 2004.

Study Background

Factors influencing student achievement in America's public schools are numerous, but perhaps the most influential and frequently discussed is teacher quality[8]— ultimately measured through gains in student achievement. Students taught by an effective teacher, are estimated over the duration of a single school year, to advance academically by a full grade level and beyond[9]. Further, differential teacher effectiveness has been found to result in student academic gains that are up to three times that of a student taught by a less effective teacher[10]. For decades, a shortage of high quality teachers across the nation, especially in the most high-need areas, has persisted and been well documented[11]. This shortage has been identified most pervasively within districts and schools serving the highest proportions of at-risk and high-need students[12].

There is growing concern about the shortage of high quality effective teachers[13]. The response to this pervasive issue has been to generate an increase in the supply of available teachers through a range of teacher recruitment initiatives including various traditional and alternative certification and teacher incentive programs. In addition, states and large districts have implemented policies designed to attract teachers to difficult-to-staff, high-need schools[14]. Knowing the importance of high quality teachers and the potential long-term effects of teacher quality on student academic achievement, it is imperative to understand which programs (in addition to traditional routes of certification and entering the teaching profession) can provide

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[8] Rivkin, Hanushek, and Kain, 2005; Sanders and Rivers (1996) found relationships between teacher quality in grade 3 and student outcomes in grade 5.
[9] Hanushek, 1992.
[10] Kane, Rockoff, and Staiger (2008) found a difference of 0.33 standard deviations.
[11] Darling-Hammond, 1984; National Commission on Teaching and America's Future, 1997; Ingersoll, 2001; Ingersoll and Perda, 2010.
[12] Monk, 2007; Clotfelter, Ladd and Vigdor, 2006; Peske and Haycock, 2006.
[13] Borman and Dowling, 2008; Lewis et al., 1999.
[14] Loeb and Miller, 2006.

high quality teachers to our most in-need schools and students. One program designed to supply high quality teachers to those schools and students is Teach For America.

Teach For America

Teach For America (TFA) is a national, nonprofit organization that recruits recent college graduates, from the top colleges and universities in the United States, as well as experienced professionals from the U.S. workforce to commit to two years of teaching in low-income urban and rural public schools across the United States[15]. TFA's mission is "growing the movement of leaders who work to ensure that kids growing up in poverty get an excellent education"[16]. The program does not require traditional teacher preparation (i.e., four year baccalaureate education degree and student teaching assignment) to become a corps member. TFA engages in a thorough corps member selection process. Once selected, TFA recruits receive focused summer training prior to beginning teaching assignments and continued support during their two-year commitment. TFA recruits participate in a five-week summer training prior to beginning their two-year teaching assignment and TFA corps members often obtain certification through alternative means such as a local certification programs.

The TFA model proposes to provide high quality teachers to the most high-need schools that would otherwise not be staffed with teachers of comparable quality. TFA corps members' instructional and pedagogical philosophies and practices, classroom management skills, attitudes towards teaching, and academic ability are hypothesized to have a positive and meaningful effect on students' academic achievement relative to what a student would have experienced had the TFA corps member not been placed in the classroom. TFA corps members receive intensive training and support throughout their two-year teaching commitment to

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[15] TFA, n.d.a.
[16] TFA, n.d.b.

develop these skills and attitudes in addition to their existing academic ability. For example, during training, corps members teach for several hours a day while being observed by an experienced teacher who provides performance feedback and training on development of strategic lesson plans to address specified student learning objectives[17].

Classroom leadership is the foundation of the corps member's training. Leadership training is focused on development of classroom culture that is centered on student achievement and relationship building with students and parents from diverse backgrounds[18]. In addition to summer training, corps members are observed at least four times a year by a mentor who then delivers coaching, instructional demonstration, and other support through discussions with the corps member based on observational data. Although this intensive support ends after corps members complete their two-year assignment, TFA alumni have access to teaching resources as well as support of the TFA community as they continue their professional careers. Since 1990, TFA has used this model to train approximately 54,000 TFA corps members who have been placed in high-need schools in 46 TFA regions in the United States[19]. Four TFA regions are in Texas with more than 1,600 corps members working in 32 districts during the 2010-11 school year[20].

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[17] TFA, n.d.c.
[18] TFA n.d.d.
[19] TFA, n.d.e.
[20] The four Texas regions are Dallas-Fort Worth, Houston, the Rio Grande Valley, and San Antonio.

Prior Research Evidence

Several studies have investigated the impact of TFA on student achievement across the nation[21]. This existing body of work, examining the impact of TFA corps members and alumni on student achievement, is inconclusive[22]; however, focusing on the best evidence to date, a rigorous random assignment evaluation provides a clearer story. Only one rigorous randomized controlled trial has been conducted to date[23]. The randomized controlled trial used a control group (formed by random assignment) and found positive effects of TFA corps members on student academic outcomes. This large-scale random assignment study across grades 1–5 conducted by Decker, Mayer, and Glazerman (2004), showed that students taught by TFA corps members exhibited a higher average mathematics score relative to students taught by novice non-TFA teachers (1–3 years teaching experience). The difference was statistically significant with an effect size of 0.26 standard deviations. For students taught by TFA corps members, research has also found greater gains in mathematics from pre- to post-test[24]. A portion of the sample investigated in this study included TFA corps members, non-TFA teachers and students from Texas; however, since Texas students and teachers were only part of the sample, no inferences can be made with regard to the effect of TFA on student academic outcomes in Texas specifically[25].

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[21] For example see Schoeneberger (2011); Noelle and Gansle, 2009; Helig and Jez, 2010.

[22] While some studies find a greater effect of TFA corps members than non-TFA teachers on students' achievement in mathematics (Noell and Gansle, 2009; Xu, Hannaway, and Taylor, 2011; Decker, Meyer, Glazerman, 2004; Raymond, Fletcher, and Luque, 2001), other studies find a greater effect by non-TFA teachers (Kane, Rockoff, and Staiger, 2008; Darling-Hammond, Holtzman, Gatlin, and Heilig, 2005; Laczko-Kerr and Berliner, 2002) or no statistically significant differences between the two groups (Boyd, Grossman, Lankford, Loeb, and Wyckoff, 2006). See Helig and Jez (2010).

[23] Decker, Mayer, and Glazerman, 2004.

[24] Student mathematics and reading achievement was measured by a pre- and post-test administration of the Iowa Test of Basic Skills.

[25] Readers are cautioned not to generalize national findings to state-level implications nor state research findings to national implications as issues with generalizability are at play (Luke, 2004).

Texas-Specific Studies

Studies of TFA conducted in Texas were reviewed to better understand the current state of research on TFA in Texas. In particular, three evaluations of the effects of TFA corps members on students' academic outcomes in Texas were identified[26]. Two major limitations were found from our review: (1) across the three Texas studies, none controlled for preexisting differences between the TFA and comparison students and (2) only two of four TFA Texas regions were included in this research. Each of the three studies is described next.

Houston Independent School District #1

The first peer-reviewed Texas study examining the effect of TFA corps members on students' academic achievement was conducted between 1996 and 2000 in the Houston Independent School District (Houston ISD). Using student and teacher data obtained from the district, Raymond, Fletcher, and Luque (2001) compared the academic achievement of students taught by TFA corps members to the academic achievement of students taught by *novice* non-TFA teachers who had 1–2 years of teaching experience. The researchers repeated this comparison by substituting *all* non-TFA teachers in the comparison group. The comparisons were made for elementary (grades 4–5) and middle (grades 6–8)[27] grades for both mathematics and reading outcomes on the Texas Assessment of Academic Skills (TAAS) examination.

Elementary students taught by TFA corps members scored higher on TAAS mathematics and reading compared to students taught by *novice* non-TFA teachers. This statistically significant result held when students taught by TFA corps members were compared to students taught by *all* non-TFA teachers[28]. In contrast, middle grade students

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[26] Raymond, Fletcher, and Luque, 2001; Darling-Hammond, Holtzman, Gatlin, and Heilig, 2005; Ware et al., 2011.

[27] Elementary students (*n*=11,321), middle school students (*n*=132,021).

[28] Effects of TFA corps members on elementary students' reading achievement compared to non-TFA teachers (β =.007, *p*<.03) and when compared to novice non-TFA teachers (β=.058, *p*<.02). Effects of TFA corps member on elementary students'

taught by TFA corps members did not score differently on TAAS mathematics and reading

compared to students taught by *novice* non-TFA teachers. However, middle grade students

taught by TFA corps members did score higher on TAAS mathematics than students taught by

all non-TFA teachers[29]. The middle grade results were statistically significant. In both the

elementary and middle grade samples, students taught by TFA corps members exhibited less

variability in TAAS mathematics and reading scores than elementary and middle grade

students taught by non-TFA teachers.

The study showed that there was a difference between elementary grade students taught

by TFA corps members and elementary grade students taught by novice or all non-TFA

teachers on TAAS reading and mathematics. However, the lack of a matched comparison

group formed by statistical matching on multiple academic and demographic characteristics—

at the school and student levels—makes it unclear as to how much of this difference can be

attributed to TFA corps members and how much can be attributed to pre-existing differences

between students of TFA corps members and students of non-TFA teachers.

Houston Independent School District #2

A second peer-reviewed study conducted in Houston ISD used elementary grade

student and teacher-level data from the 1995-96 school year through the 2001-02 school year[30].

Student mathematics and reading outcomes were measured using the TAAS/Texas Learning

Index[31], Stanford Achievement® Test–9th Edition (Stanford–9), and Aprenda®: *La prueba de*

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mathematics achievement compared to all non-TFA teachers ($\beta=.029$, $p<.02$) and compared to novice non-TFA teachers ($\beta=.120$, $p<.02$).

[29] The comparison between students taught by a TFA corps members compared to all non-TFA teachers of middle school mathematics ($\beta=.109$, $p<.02$).

[30] Darling-Hammond, Holtzman, Gatlin, and Heilig, 2005.

[31] Student achievement on the TAAS was dichotomized as either *met TAAS standard* or *did not meet TAAS standard.* The Texas Learning Index score was used to allow for TAAS scores to be compared across grade levels and school years included in the analysis.

logros en español, Tercera edición (Aprenda 3)[32]. The researchers made a number of comparisons between TFA corps members and non-TFA teachers by certification status. However, when controlling for certification status, there were no statistically significant differences between students taught by TFA corps members and students taught by non-TFA teachers.

The findings from this study are further limited by the use of student and teacher data from only one TFA school district in Texas; and, as in the previously reviewed study, the comparison groups of students taught by non-TFA teachers were not matched to the groups of students taught by TFA corps members.

Four Districts in Texas Rio Grande Area

The most recent study on the effect of TFA corps members on Texas students' academic achievement was an organizational report conducted by Ware et al. (2011) using student and teacher data from four Texas school districts[33]. This study found greater gains in reading for students in grades 3–8 taught by TFA corps members compared to their peers taught by novice non-TFA teachers. This study also found greater gains in mathematics for students in grades 9–11 taught by TFA corps members compared to their peers taught by novice, non-TFA teachers including those students who were economically disadvantaged and those who were minority. These gains were statistically significant, however, the Ware et al. (2011) study, like the previous studies in the state of Texas, lacked a comparison group formed by statistical matching[34]. Further, the researchers were able to obtain student-level data from

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[32] Aprenda 3 measures the academic achievement of Spanish-speaking students in their native language and is modeled after the Stanford Achievement Test[®] Series.
[33] McAllen Independent School District (ISD); Houston ISD; IDEA public schools; Donna ISD.
[34] See Helig and Jez, 2010.

only one of the four TFA regions in Texas that employed a TFA corps member in the 2010-11 school year, limiting the extent to which the results can be generalized.

Summary of Prior Research

Results of the three comparative studies conducted in Texas suggest a relationship between Texas students' academic achievement and instruction by TFA corps members. One randomized controlled trial has established a causal relationship; however, this relationship cannot be inferred to students and TFA corps members in Texas because the national sample used in this study was not designed to make such inferences[35]. None of the comparative studies conducted in Texas used a comparison group of students taught by non-TFA teachers that were statistically matched to a group of students taught by TFA corps members[36].

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[35] Decker, Mayer, and Glazerman, 2004.
[36] Comparison groups formed by statistical matching are important in comparative studies to control for possible pre-existing differences on academic outcomes. Without this matched comparison group, it is not clear how much of the difference between the two groups of students (those taught by TFA corps members and those taught by non-TFA teachers) was due to pre-existing differences between groups and how much was due to differences attributable to TFA corps members.

Current Study Description

Each of the studies presented were a practical first step in investigating the effects of TFA corps members (and alumni) on Texas student academic outcomes. This evaluation expands upon the body of research by using more rigorous statistical methods and a broader dataset of Texas students encompassing each of the four TFA regions in Texas. More specifically, the current evaluation takes the next step by using: (1) stronger controls[37] formed by statistical matching to strengthen conclusions about the estimated effects of TFA corps members, (2) a more diverse sample of TFA corps members that include alumni, and (3) a more diverse sample of TFA campuses to which the estimated effects apply. This study's contribution to the research on TFA in Texas will enable more accurate estimations of TFA corps member and alumni effects on student academic outcomes, and extend the applicability of these effects across TFA regions in Texas.

The current study investigates mathematics and reading achievement of students in grades 4–8 across the four TFA regions in Texas and is the first reported evaluation of TFA in Texas (as of this writing) to employ a statistically matched comparison group. Comparisons were drawn between students taught by TFA corps members and novice non-TFA teachers as well as TFA alumni and experienced non-TFA teachers. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year. Additionally, for this evaluation, those corps members who finished their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year are considered TFA alumni. Alternatively, non-TFA teachers who have less than three

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[37] In research on TFA teacher effects in Texas, this would involve a comparison group of students taught by non-TFA teachers that are matched to students taught by TFA corps members and alumni, or a control group of students taught by non-TFA teachers that were randomly assigned to the control group and are statistically the same as the students taught by TFA corps members and alumni.

years of teaching experience are considered novice teachers, while those with greater than three years of experience are considered experienced teachers. The sample for this study included a total of 493 campuses (94 TFA[38] and 399 non-TFA) and 11,788 students (5,894 TFA and 5,894 non-TFA) in the mathematics analytic sample and 483 campuses (108 TFA and 375 non-TFA) and 14,354 students (7,177 TFA and 7,177 non-TFA) in the reading analytic sample.

Research Questions

Three types of questions were investigated for this evaluation: descriptive, confirmatory, and exploratory research questions. Descriptive research questions provide an understanding of the study sample. Next, and of most interest to policy makers, are the confirmatory questions which relate to the impact of TFA on student outcomes. The final exploratory set of questions provides insight into future directions for research. Specific questions addressed in this evaluation are as follows.

Descriptive Research Questions

The main purpose of the descriptive research questions was to provide information concerning the similarities and differences between TFA campuses and non-TFA campuses across the state of Texas. More specifically, the purpose was to describe the extent to which TFA is meeting its commitment to place qualified corps members in high-need schools.

The descriptive research questions are as follows:

1. What are the academic and demographic characteristics of the campuses that employed a TFA corps member or TFA alumni in Texas during the 2010-11 school year?

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[38] A TFA campus is a campus that employed at least one TFA corps member or alumni during the 2010-11 school year.

2. Are there meaningful differences[39] between the academic and demographic characteristics of the campuses that employed TFA corps members or TFA alumni in Texas and campuses that did not employ these TFA corps members or TFA alumni during the 2010-11 school year?

3. A. What percentage of TFA students took only one or two semesters of mathematics with TFA corps members or TFA alumni during the 2010-11 school year?

   B. What percentage of TFA students took only one or two semesters of reading/English language arts with a TFA corps members or TFA alumni during the 2010-11 school year?

4. Are there any meaningful differences between the academic and demographic characteristics of the students that were taught by TFA corps members or TFA alumni and students not taught by these TFA corps members or TFA alumni during the 2010-11 school year?

Confirmatory Impact Research Questions

Answers to confirmatory research questions are the primary evidence for determining the effect of TFA corps members and alumni on their students' academic achievement. The confirmatory impact research questions focus on whether the TFA corps members and TFA alumni had a statistically significant and meaningful effect on student TAKS mathematics or reading[40] scores as compared to non-TFA teachers in the 2010-11 school year. The confirmatory research questions are as follows:

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[39] The meaningfulness of these differences was interpreted using the standardized mean difference.
[40] The reading domain encompasses reading and English language arts courses.

1. What are the mathematics and reading achievement of elementary grade students taught by TFA corps members relative to the achievement of students taught by novice non-TFA teachers?

2. What are the mathematics and reading achievement of middle grade students taught by TFA corps members relative to the achievement of students of taught by non-TFA teachers?

3. What are the mathematics and reading achievement of middle grade students taught by TFA alumni relative to the achievement of students taught by experienced non-TFA teachers?

Exploratory Impact Research Questions

Exploratory impact research questions were posed to examine the effect of TFA corps members and TFA alumni on student subgroups[41]. These questions are designed to examine relationships in the data to inform future research rather than to draw firm policy conclusions. The exploratory research questions are as follows:

1. Did the effect of TFA corps members on students' mathematics and reading achievement vary by Texas TFA region?

2. Did the effect of TFA corps members on students' mathematics and reading achievement differ from the effect of TFA alumni on students' mathematics and reading achievement?

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[41] Examining student subgroups in an impact analysis can reduce statistical power. The reduction in statistical power and potential elevation in Type I error rates resulting from multiple hypothesis testing are noted, but tolerable.

3. What are the mathematics and reading achievement of elementary grade students taught by TFA alumni relative to the achievement of students taught by experienced non-TFA teachers?[42]

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[42] This research question, although similar to the confirmatory questions, was labeled exploratory for two reasons: (1) inadequate statistical power of the analyses due to a small sample size and (2) concerns pertaining to the adjustment necessary for multiple comparisons.

Methods

In this section we discuss the campus, teacher, and student data that were collected with the assistance of the Texas Education Agency (TEA)[43] and TFA. We also discuss the matching process used to create the comparison group of non-TFA campuses with students taught by non-TFA teachers. Finally, we describe the analytic methods used to address the descriptive, confirmatory, and exploratory research questions.

Dataset and Initial Study Sample

Data were obtained from TFA and TEA data sources. Campus-level characteristics were identified using the Academic Excellence Indicator System (AEIS). AskTED, the Public Education Information Management System (PEIMS) and student assessment data were also obtained to identify districts and campuses, teacher characteristics, and student characteristics including academic achievement. These data were used to construct the campus, teacher, and student samples. Each of these samples is described next.

Campus Sample

TFA provided a file of individuals considered for teaching assignments in Texas in the 2010-11 school year. Using this file, TEA identified 316 campuses (hereafter, TFA campuses) in Texas that employed at least one TFA corps member or alumni in the 2010-11 school year. We used this list of 316 TFA campuses to identify comparable campuses that did not employ a TFA corps member or TFA alumni in the 2010-11 school year (hereafter, non-TFA campuses). Comparison campuses were identified through a propensity score matching (PSM) process[44] using 2009-10 campus-level student achievement data and 2010-11 campus-level demographic characteristics. The PSM process resulted in 924 non-TFA comparison campuses. In addition

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[43] For more detail on the data acquisition process, see Appendix A.
[44] Campus data were stratified based on campus grade type (elementary, middle, high) prior to matching.

to these matched comparison campuses, all campuses in the districts where TFA campuses operated and not selected by the campus-level PSM were included as a backup group of non-TFA campuses for matching ($n = 717$)[45]. This resulted in a total of 1,641 non-TFA campuses and 316 TFA campuses.

Teacher Sample

TFA provided a file consisting of 1,749 individuals who had either completed their TFA assignment by the 2010-11 school year, or who were still employed in a Texas school within their two year TFA assignment. This file was submitted to TEA for identification of corps members in Texas. Of the 1,749, we were unable to locate 385 individuals resulting in a potential sample of 1,364 TFA corps members or alumni[46]. We proposed to use student-teacher linkage data to assess the impact of TFA corps members, TFA alumni, and non-TFA teachers; however, TEA raised concerns about teacher confidentiality. Therefore, the data in the current study includes *two teacher variables* at the student level pertaining to TFA corps members, TFA alumni, and non-TFA teachers: (1) a dichotomous indicator designating whether the course the student took in the 2010-11 school year was taught by a TFA corps member at a TFA campus or a non-TFA teacher at a non-TFA campus and (2) years of teaching experience[47]. TEA concerns about teacher confidentiality limited the data set to these two teacher characteristics for TFA corps members, TFA alumni, and non-TFA teachers and exact counts for these groups were not available. These confidentiality concerns also limited the

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[45] This was conducted in case the 924 non-TFA comparison campuses could not provide a sufficient number of the comparable students in the second stage of PSM; student-level matching.

[46] The reason 385 TFA corps members and alumni could not be found in the 2010-11 Texas data is unclear. One explanation may be that a number of these individuals left their teaching position in Texas following the completion of their two-year assignment.

[47] TEA defines years of experience as the number of verifiable completed years (not including current year) of creditable, professional experience as specified in 19 TAC, Chapter 153.

sample to only TFA corps member and alumni at TFA identified campuses as well as non-TFA teachers at non-TFA campuses.

Student Sample

Student-level data consisted of student-level academic records of students taught by TFA corps members and TFA alumni at TFA campuses and student-level academic records of students taught by non-TFA teachers at non-TFA campuses. The student-level records for students taught by TFA corps members and alumni included the *two teacher variables*, data included student demographic characteristics, student course enrollment records for all courses taught by TFA corps members and alumni for the 2010-11 school year, and assessment scores on the Texas Assessment of Knowledge and Skills (TAKS) for the 2009-10 and 2010-11 school years. The student-level records for students taught by non-TFA teachers were the same as those for students taught by TFA corps members and alumni, except the courses were taught by non-TFA teachers at non-TFA campus. This resulted in a total of 27,076 students taught by a TFA corps member or alumni and 320,225 students taught by a non-TFA teacher. See Appendix C for additional details of the student and campus samples.

Variables and Measures

Outcome Variables

Student mathematics and reading achievement. Student mathematics and reading achievement scores were taken from the TAKS. The TAKS is an end-of-year, criterion-referenced assessment of student knowledge and skills as specified in the Texas Essential Knowledge and Skills (TEKS) by grade-level. Subjects tested in TAKS included mathematics,

reading, writing, social studies, and science. For the purposes of this evaluation, we focus the outcomes of interest on TAKS scores for only mathematics and reading[48].

The psychometric properties of the TAKS suggest that the assessment is a reliable and valid measure of student achievement at grades 3 through 11 in all content areas. The TAKS is administered in the spring of each school year to Texas students in grades 3–11. Cronbach's alpha levels of 0.80 are considered acceptable for standardized assessments. The TAKS Technical Digest reports reliability exceeding 0.80 for grades 4–8 TAKS mathematics and reading[49].

Covariate and Matching Variables

Prior student achievement. For each student course record, student TAKS achievement scores from the 2009-10 school year were used as both matching and covariate variables. Depending on content scores by grade level, content areas included were mathematics, reading, science, and social studies.

Student level demographic characteristics. For each student course record, student demographic characteristics were used in matching model and also included as covariate variables in the analysis model if baseline equivalence on a given variable was not satisfactory. The demographic variables include student gender, ethnicity, and limited English proficiency[50].

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[48] The decision to focus solely on the mathematics and reading content areas was based on the fact that students take TAKS mathematics and reading every year from grade 3 to grade 11; students are only tested in TAKS science in grades 5, 8, and 10 and tested in social studies in grades 8, 10, and 11. It is important to note that some students in the analysis sample took Algebra I; however the content of middle grades TAKS mathematics assesses learned knowledge and skills that are primarily focused on pre-Algebra content.

[49] Texas Education Agency and Pearson, 2011.

[50] Among student demographic variables, non-economically disadvantaged students were excluded from the analysis because TFA primarily focuses on economically disadvantaged communities. In addition, students in a special education program were also excluded from the analysis sample because these students took a modified or alternate version of the 2010-11 TAKS or due to data masking.

TFA corps member, TFA alumni, or non-TFA teacher identification and years of experience. For each student course record, a dichotomous indicator was used to designate whether the specific course the student took in the 2010-11 school year was taught by a TFA corps member, TFA alumni, or a non-TFA teacher. In addition, for each student course record, the years of teaching experience for both TFA corps members and non-TFA teachers was used for stratification of data.

Campus level demographic and academic characteristics. Each student record included student demographic characteristics aggregated to the campus level including the rate of students who met state proficiency standards on the TAKS mathematics and reading, size of the campus, and the percentage of teachers that were in their first year of teaching. These campus-level data are based on the entire campus population and were used as a measure of overall contextual factors at the campus level.

Matching Procedure

Propensity Score Matching (PSM) was the matching procedure used in the current study. PSM may be used to conduct quasi-experimental comparisons of student outcomes and seeks to compare a treatment group (students taught by TFA corps member or alumni) to a comparison group (students taught by a non-TFA teacher) on the outcomes of interest (TAKS mathematics and reading scores). To do so, the use of PSM attempts to create two equal groups by matching them on a range of covariates.

In the current study, PSM was conducted at the campus level and then at the student level. The purpose of matching at both levels was to ensure that comparisons made between students at TFA campuses and students at non-TFA campuses were not biased by differences in the measured characteristics for the two types of campuses. After comparable non-TFA

campuses were identified, student-level PSM was also conducted to obtain a comparable sample of students taught by non-TFA teachers in non-TFA campuses. This analysis produces an impact estimate for the effect of TFA corps members and alumni on student mathematics and reading outcomes[51].

Campus-level PSM

A propensity score for each TFA ($n = 316$) and non-TFA campus ($n = 7,881$)[52] in the sample was computed based on campus-level demographic[53] and achievement[54] variables. A logistic regression model—with the demographic and achievement variables as conditioning variables and the dichotomous dependent variable of TFA status[55]—was used to estimate the propensity score for each campus. Three comparison campuses were then selected for each TFA campus using the optimal matching method in MatchIt[56].

Student-level PSM

The student-level PSM process was then conducted to select comparable students taught by a non-TFA teacher in the 2010-11 school year. To be eligible for the comparison group, students had to meet all three of the following criteria:

1. Was a student at an identified matched or within district comparison school.

2. Belonged to the Texas public education system for more than 150 days in the 2010-11 school year.

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[51] For additional information on the use of two-stage PSM see Glazerman, Levy, and Meyers (2003).

[52] The PSM process resulted in 924 non-TFA comparison campuses. In addition to these matched comparison campuses, all campuses in the districts where TFA campuses operated were included as a backup group of non-TFA campuses for matching ($n = 717$). This resulted in a total of 1,641 non-TFA campuses and was conducted in case the 924 non-TFA comparison campuses could not provide a sufficient number of the comparable students in the second stage of PSM; student-level matching.

[53] Campus-level demographic conditioning variables represented the entire campus population and included percentages of students by ethnicity, economically disadvantaged status, special education status, limited English proficiency, and mobility. The size of the campus, the percentage of teachers that are in their first year, and full time equivalents were also included as campus-level demographic conditioning variables.

[54] Campus-level achievement conditioning variables included the rates of 2009-10 student TAKS mathematics and reading meeting the state standards.

[55] "0" for non-TFA campus and "1" for TFA campus

[56] As described in Ho, Imai, King, and Stuart, 2011.

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3. Had taken the 2010-11 school year regular, first administration TAKS (English version) in a given subject.

After eligible students were identified, the data were stratified by grade level because students at each grade level were tested in different TAKS content areas in the 2009-10 school year. Within each stratum, a logistic regression model—with student-level demographic[57] and prior year's achievement[58] variables as conditioning variables—was used to compute the propensity score.

Once student-level propensity scores were computed, a Greedy matching algorithm[59] was used to obtain the optimal match between a student at a particular grade taught by a TFA corps member or TFA alumni and a student at the same grade taught by a comparable novice non-TFA teacher or experienced non-TFA teacher. The matching procedure was implemented within the sample stratified by teacher years of experience, and student grade level as shown in Table 1. Four visual representations of the process to arrive at the analytic sample are presented in Appendix C.

Table 1. Stratification structure used for student-level matching

	TFA Campus		Non-TFA Campus	
Grade	Corps 0 or 1 year	Alumni > 1 year	Novice 0 or 1 year	Experienced > 1 year
4				
5				
6				
7				
8				

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[57] Demographic variables included student gender, ethnicity, economically disadvantaged status, special education status, limited English proficiency, and mobility.

[58] Student-level achievement conditioning variables included the 2009-10 student TAKS mathematics and reading achievement scores as well as achievement scores on all other available TAKS tested content areas for each respective grade level.

[59] See Guo and Fraser, 2010.

Analytic Approach

Descriptive Analyses

To address the descriptive research questions, percentages, averages, and standardized differences were computed to obtain an understanding of the larger sample of TFA and non-TFA campuses and students. When standardized differences were found to be greater than 0.25, the differences were noted as meaningful.

Estimating the Impact of TFA

To address the confirmatory research questions, multilevel modeling was used to estimate the average effect of TFA corps members and TFA alumni on students' 2010-11 TAKS mathematics and reading scores. These effects are defined as the mean score difference between the TFA student group and non-TFA comparison group and were estimated using a multilevel regression model to take into account the nested nature of the data (students nested within campuses).

Although PSM was used to create matched comparison samples for elementary, middle, and high school, the high school sample was excluded from the analyses for two reasons. First, the TAKS assessments for grades 9–11 are not vertically equated across grade-levels and content areas, therefore, these grades could not be combined to create an aggregate high school sample. Second, content knowledge assessed by the TAKS varies across high school grade-levels. Therefore, the use of the TAKS as a pretest score to control for prior achievement would not be as strong a control as when used in the elementary and middle grade samples.

TAKS science and social studies are not tested in every grade in every year. Therefore, the level of confidence we had in estimating the effect of a TFA corps member on students'

science and social studies achievement was diminished. Further, the lack of vertical equating

of TAKS scores in grades 9 through 11 subjects such as mathematics and reading prohibited us

from combining these grade samples as required to address confirmatory research questions in

the science and social studies domains. In contrast, scores for grades 3 through 8 TAKS

mathematics and reading are vertically equated. For this reason, the analysis sample consisted

of elementary (grades 4 and 5) and middle (grades 6 through 8) grades. Grade 3 was excluded

from the analysis sample because prior year achievement data were unavailable[60].

TFA effects were estimated for all students in grades 4 through 8. Analyses were

conducted to address each research question for mathematics and reading outcomes. To

illustrate how teacher effects were estimated, we specify the model that was estimated to

address confirmatory research question 1 and exploratory research question 1 for mathematics.

The remaining research questions were estimated using similar models with minor

modifications to address each specific question. Confirmatory research question 1 for

mathematics was as follows:

> *Q1. What is the mathematics achievement of elementary grade
> students taught by TFA corps members relative to the
> achievement of students of novice non-TFA teachers?*

In the proposed multi-level model, the outcome of the analysis is the 2010-11 TAKS

mathematics scores. The Level 1 model included the 2009-10 TAKS score of the outcome

subject[61] as covariates to take into account the cumulative teaching effect that occurred prior to

2010-11 school year[62]. A TFA campus indicator (0 = student taught by non-TFA teacher, 1 =

student taught by TFA corps member), was also included at Level 2 in the model. This model

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[60] TAKS testing begins at grade 3.
[61] In this illustration this is a mathematics score indicating previous mathematics achievement.
[62] Demographic variables were included as Level 1 covariates when the standardized difference between TFA and non-TFA groups was above 0.05.

was used to address the remaining confirmatory research questions for mathematics and

reading. The multilevel model that was estimated to address this question is as follows:

Level 1: Conditional student-level model

$$Y_{ij} = \beta_{0j} + \beta_{1j}(pre_{ij} - \overline{pre}) + e_{ij}$$

Where,

Y_{ij} is the mathematics achievement score (2011 TAKS) for student i in campus j

β_{0j} is the mean 2011 TAKS scale score for campus j

β_{1j} is the student-level regression coefficient for 2010 TAKS mathematics
achievement score for campus j

$pre_{ij} - \overline{pre}$ is the mean-centered 2010 TAKS scale score for student i in campus j

e_{ij} is a random error associated with student i in campus j; $e_{ij} \sim$ N (0, σ^2).

Level 2: Conditional campus-level model

$$\beta_{0j} = \pi_{00} + \pi_{01}\text{TFA campus }_{j} + r_{0j}$$

$$\beta_{1j} = \pi_{10}$$

Where,

π_{00} is the grand mean TAKS scale score for comparison group

π_{01} is the campus-level coefficient for TFA campus indicator

$TFA\ Campus_j$ is the TFA campus indicator

π_{10} is the campus-level coefficient for 2010 TAKS score

r_{0j} is a random error associated with campus j on student outcomes at intercept; and r_{0j}
$\sim$ N (0, τ_{00}).

The following exploratory research question explores the impact of TFA for each TFA region:

> *Q1. What is the mathematics achievement of students of TFA corps members relative to the achievement of students of novice non-TFA teachers by Texas TFA region?*

To address this research question, three TFA region indicator variables and an interaction terms between the TFA campus indicator and each TFA region indicator variable were added to the model specified in the confirmatory analysis[63].

Level 1: Conditional student-level model

$$Y_{ij} = \beta_{0j} + \beta_{1j}(pre_{ij} - \overline{pre}) + e_{ij}$$
Where,

Y_{ij} is the mathematics achievement score (2011 TAKS) for student i in campus j

β_{0j} is the mean 2011 TAKS scale score for campus j

β_{1j} is the student-level regression coefficient for 2010 TAKS mathematics achievement score for campus j

$pre_{ij} - \overline{pre}$ is the mean-centered 2010 TAKS scale score for student i in campus j

e_{ij} is a random error associated with student i in campus j; $e_{ij} \sim N(0, \sigma^2)$.

Level 2: Conditional campus-level model

$$\beta_{0j} = \pi_{00} + \pi_{01}TFA\ campus_{1j} + \pi_{02}Dallas_j \\ + \pi_{03}Houston_j + \pi_{04}Valley_j + \pi_{05}(TFAcampus_j)(Dallas_j) \\ + \pi_{06}(TFAcampus_j)(Houston_j) + \pi_{07}(TFAcampus_j)(Valley_j) \\ + r_{0j}$$
$$\beta_{1j} = \pi_{10}$$
Where,

π_{00} is the mean TAKS scale score for non-TFA campuses in San Antonio region

π_{01} is the campus-level coefficient for TFA campus indicator

TFA campus $_j$ is the TFA campus indicator

π_{02} is the campus-level coefficient for Dallas-Fort Worth region

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[63] Student-level PSM was conducted separately for exploratory research question 1 so that the analytic sample for this question only included students within the four respective TFA regions in Texas.

$Dallas_j$ is the Dallas-Fort Worth region indicator for campus j

π_{03} is the campus-level coefficient for Houston region

$Houston_j$ is the Houston region indicator for campus j

π_{04} is the campus-level coefficient for Rio Grande Valley region

$Valley_j$ is the Rio Grande Valley region indicator for campus j

π_{05} is the campus-level coefficient for the interaction between TFA campus and Dallas-Fort Worth region

π_{06} is the campus-level coefficient for the interaction between TFA campus and Houston region

π_{07} is the campus-level coefficient for the interaction between TFA campus and Rio Grande region

π_{10} is the campus-level coefficient for 2010 TAKS mathematics achievement score

r_{0j} is a random error associated with campus j on student outcomes at intercept; and r_{0j} $\sim N (0, \tau_{00})$.

Sensitivity Analysis

A sensitivity analysis was conducted to test whether the results from the confirmatory analyses on TAKS mathematics at the middle grades were sensitive to the inclusion of students, who took either one or two semesters of Algebra I, in the analytic sample.

In the main analysis we included students who were taught mathematics for one or two semesters by a TFA corps member in comparison to students taught by a novice non-TFA teacher. In the sensitivity analysis, students who were taught Algebra I for one or two semesters were excluded from the analytic sample. We hypothesized that a middle grade student who took Algebra I would be more academically advanced than a middle grade student who had not taken Algebra I. Although TFA student and non-TFA student groups were comparable in terms of the prior year's TAKS scores and demographic variables, our descriptive analyses showed that the proportion of TFA students taking Algebra I was somewhat higher than that of the comparison students (9 percent and 5 percent, respectively).

This difference raised a concern that TFA students might be somewhat more academically advanced than the comparison students because of their higher Algebra I enrollment rate or at the very least that another unobserved reason for this difference may be occurring that was not controlled for in our matching and analysis models. Therefore, we decided to conduct the sensitivity analysis without Algebra I students to investigate whether the decision to include these students in the main analysis impacted the results. Although the percentage of students taking Algebra I courses was small in the analysis sample, it was important to investigate how sensitive the impact estimates were to the inclusion of these students within the analytic sample.

Comparability of Matched Groups and Pooled Results

The quality of the matched comparison groups was evaluated using standardized mean difference between the TFA and non-TFA groups for each conditioning variable used in the PSM at the campus and student levels. When the absolute value of the standardized mean difference was equal to or below 0.05 standard deviations, we concluded the group balance was achieved for the conditioning variable. When the absolute value of the standardized mean difference was between 0.05 and 0.25 standard deviation units, we concluded that the group balance was acceptable for the conditioning variable, but the variable was included as a covariate in the analytic model to assure that residual differences after matching would not bias the analysis. When the absolute value of the standardized mean difference was greater than 0.25 standard deviation units, we concluded that the group imbalance may be beyond statistical adjusting, but the variable was still included as a covariate in the analytic model. This group imbalance could bias the analysis, and when it occurred was noted as a limitation. The covariates included in the analysis models based on these criteria are shown in Appendix D.

Campus baseline equivalence after campus-level PSM

Table 2 provides baseline equivalence information at the campus level both prior to, and after, the matching process. To evaluate this equivalence, the comparison is between elementary TFA campuses and elementary non-TFA campuses. Prior to the matching process, substantial differences were found for seven of the eight campus characteristics between elementary TFA and elementary non-TFA campuses. After matching, no substantial difference was observed between these types of campuses which suggested that the matching process worked well.

Table 2 shows, prior to the matching process, substantial differences were found for seven of the eight campus characteristics between middle grade TFA and non-TFA campuses. After matching, four substantial differences were observed between these types of campuses in terms of the percentage of economically disadvantaged (0.25), limited English proficient (0.10), African American (0.14), and Hispanic students (0.07) which suggest that the matching process worked well. Although the percentage of these conditioning variables at the campus level are higher for TFA campuses based on 0.05 criteria, they were not necessarily included as covariate to assure that residual differences after matching did not affect the analysis results because this difference was not in the analytic sample. The analytic sample, for each of the confirmatory research questions, could only be identified at student level after student-level matching was completed. The inclusion of covariates based on the standardized mean differences between TFA and non-TFA campuses in the analytic sample for each research question is described at the end of the section entitled, *Non-equivalence at baseline and inclusion of campus and student level covariates in analysis model*.

Table 2. Baseline demographic campus characteristics as a result of campus-level PSM

| | | Campus pre-matching | | | | | Matched comparison | | |
| | | TFA | | non-TFA | | Standardized difference | | | Standardized difference |
Grade type	Campus characteristic	n	Percent	n	Percent	difference	n	Percent	difference
Elementary	Economically disadvantaged	124	92.08	4,425	64.79	0.70	366	90.60	0.05
	African American	124	21.96	4,425	12.49	0.25	366	23.25	0.03
	Hispanic	124	73.54	4,425	50.30	0.49	366	72.41	0.03
	Limited English proficient	124	45.17	4,425	22.70	0.49	366	45.52	0.01
	Student mobility	124	20.30	4,164	17.05	0.08	366	20.77	0.01
	Special education	124	6.02	4,425	8.49	0.10	366	6.25	0.01
	TAKS mathematics (met state standard)	122	83.82	4,146	85.62	0.05	366	82.51	0.03
	TAKS reading (met state standard)	122	84.69	4,146	87.20	0.07	366	83.76	0.03
Middle	Economically disadvantaged	111	88.17	1,548	57.10	0.74	309	78.98	0.25
	African American	111	20.16	1,548	12.19	0.22	309	14.80	0.14
	Hispanic	111	74.78	1,548	44.26	0.65	309	77.83	0.07
	Limited English proficient	111	23.52	1,548	8.19	0.43	309	19.26	0.10
	Student mobility	104	19.05	1,509	15.04	0.11	309	17.73	0.03
	Special education	111	9.20	1,548	9.87	0.02	309	9.62	0.01
	TAKS mathematics (met state standard)	104	78.67	1,503	82.91	0.11	309	78.57	0.00
	TAKS reading (met state standard)	104	84.57	1,503	87.90	0.10	309	83.70	0.02

Notes: Matched comparison column represents matched number of TFA campuses at elementary (*n*=366) and middle grades (*n*=309) non-TFA campuses. TFA = Teach For America; TAKS = Texas Assessment of Knowledge and Skills.

Student baseline equivalence after student-level PSM

Substantial differences were observed between the demographic characteristics of students taught by TFA alumni and the demographic characteristics of students taught by experienced non-TFA teachers for the mathematics and reading analytic samples[64]. Baseline equivalence for the mathematics analytic sample is provided in Table 3 and baseline equivalence for the reading analytic sample is provided in Table 4.

For students in the mathematics analytic sample, after matching, no substantial differences were observed between elementary students taught by TFA corps members and elementary students taught by novice non-TFA teachers or elementary students taught by TFA alumni and elementary students taught by an experienced non-TFA teacher.

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[64] No substantial differences were observed, at the student-level, between the demographic characteristics of students taught by TFA corps members and the demographic characteristics of students taught by novice non-TFA teachers.

In addition, for students in the mathematics analytic sample after matching, no substantial differences were found for the demographic characteristics of middle grade students taught by TFA corps members compared to middle grade students taught by novice non-TFA teachers. However, one substantial difference was found for students in the mathematics analytic sample between middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher in terms of the percentage of students who were identified as limited English proficient (0.07).

The substantial difference suggests that the percentage of limited English proficient students should be included in the analytic model, evaluating the mathematics achievement of middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher, as a covariate to assure that residual differences after matching did not affect the analysis results.

Table 3. Baseline demographic characteristics of elementary and middle grade students, mathematics analytic sample

| | | Student participation status | | | | | | Student participation status | | | | | |
| | | Students of TFA corps members [a] | | Students of novice non-TFA teachers [b] | | Mean difference | Standardized difference | Students of TFA alumni [c] | | Students of experienced non-TFA teachers [d] | | Mean difference | Standardized difference |
Grade type	Characteristic	*n*	Percent	*n*	Percent			*n*	Percent	*n*	Percent		
Elementary	*Gender*												
	Female	289	53.03	289	53.03	0.00	0.00	223	52.72	229	54.14	−1.42	0.03
	Male	256	46.97	256	46.97	0.00	0.00	200	47.28	194	45.86	1.42	0.03
	Race/ethnicity [e]												
	African American	105	19.27	96	17.61	1.65	0.04	59	13.95	62	14.66	−0.71	0.02
	Hispanic	440	80.73	449	82.39	−1.65	0.04	364	86.05	361	85.34	0.71	0.02
	Other	—	—	—	—	—	—	—	—	—	—	—	—
	White	—	—	—	—	—	—	—	—	—	—	—	—
	Economically disadvantaged	529	97.06	530	97.25	−0.18	0.01	418	98.82	418	98.82	0.00	0.00
	Non-economically disadvantaged	16	2.94	15	2.75	0.18	0.01	5	1.18	5	1.18	0.00	0.00
	LEP	55	10.09	56	10.27	−.18	0.01	60	14.18	65	15.37	−1.18	0.03
	non-LEP	490	89.91	489	89.72	0.18	0.01	363	85.82	358	84.63	1.18	0.03
Middle	*Gender*												
	Female	2102	52.18	2155	53.5	−1.32	0.03	457	50.89	454	50.56	0.33	0.01
	Male	1926	47.82	1873	46.5	1.32	0.03	441	49.11	444	49.44	−0.33	0.01
	Race/ethnicity [e]												
	African American	554	13.75	497	12.34	1.42	0.01	62	6.90	58	6.46	0.45	0.02
	Hispanic	3,468	86.1	3,527	87.56	−1.46	0.01	832	92.65	839	93.43	−0.78	0.03
	Other	4	0.10	6	0.15	0.05	0.01	2	0.22	1	0.11	0.11	0.03
	White	2	0.05	2	0.05	0.00	0.00	2	0.22	2	0.22	0.00	0.00
	Economically disadvantaged	3,792	94.14	3,779	93.82	0.32	0.01	877	97.66	875	97.44	0.22	0.01
	Non-economically disadvantaged	236	5.86	249	6.18	−0.32	0.01	21	2.34	23	2.56	-0.22	0.01
	LEP	898	22.29	840	20.85	1.44	0.04	222	24.72	195	21.71	3.01	0.07
	non-LEP	3,130	77.71	3,188	79.15	−1.44	0.04	676	75.28	703	78.29	−3.01	0.07

Note: Students receiving services for special education were excluded from the analysis sample. TFA = Teach For America; LEP = limited English proficient; the elementary sample taught by TFA alumni or experienced non-TFA teachers corresponds to an exploratory research question; all other samples correspond to confirmatory research questions.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

e. Unless otherwise noted, 'other' includes American Indian, Alaskan Native, Asian, Native Hawaiian, other Pacific Islander, and two or more races; Hispanic includes Latino.

Table 4. Baseline demographic characteristics of elementary and middle grade students, reading analytic sample

| | | Student participation status | | | | | Student participation status | | | | | |
| | | Students of TFA corps members [a] | | Students of novice non-TFA teachers [b] | | Mean difference | Standardized difference | Students of TFA alumni [c] | | Students of experienced non-TFA teachers [d] | | Mean difference | Standardized difference |
Grade type	Characteristic	n	Percent	n	Percent			n	Percent	n	Percent		
Elementary	*Gender*												
	Female	417	50.24	405	48.80	1.45	0.03	162	54.36	177	59.40	−5.03	0.10
	Male	413	49.76	425	51.20	−1.45	0.03	136	45.64	121	40.60	5.03	0.10
	Race/ethnicity [e]												
	African American	239	28.80	235	28.31	0.48	0.01	29	9.73	27	9.06	0.67	0.02
	Hispanic	591	71.20	595	71.69	−0.48	0.01	266	89.26	268	89.93	−0.67	0.02
	Other	—	—	—	—	—	—	3	1.01	3	1.01	0.00	0.00
	White	—	—	—	—	—	—	—	—	—	—	—	—
	Economically disadvantaged	794	95.66	798	96.14	−0.48	0.02	291	97.65	290	97.32	0.34	0.02
	Non-economically disadvantaged	36	4.34	32	3.86	0.48	0.02	7	2.35	8	2.68	−0.34	0.02
	LEP	105	12.65	98	11.81	0.84	0.03	43	14.43	40	13.42	1.01	0.03
	non-LEP	725	87.35	732	88.19	−0.84	0.03	255	85.57	258	86.58	−1.01	0.03
Middle	*Gender*												
	Female	2,479	51.96	2,457	51.50	0.46	0.01	669	52.35	671	52.50	−0.16	0.00
	Male	2,292	48.04	2,314	48.50	−0.46	0.01	609	47.65	607	47.50	0.16	0.00
	Race/ethnicity [e]												
	African American	614	12.87	560	11.74	1.13	0.03	184	14.40	173	13.54	0.86	0.02
	Hispanic	4,140	86.77	4,198	87.99	−1.22	0.04	1,026	80.28	1,047	81.92	−1.64	0.04
	Other	12	0.25	7	0.15	0.01	0.02	25	1.96	31	2.43	−0.47	0.03
	White	5	0.10	6	0.13	−0.02	0.01	43	3.36	27	2.11	1.25	0.08
	Economically disadvantaged	4,506	94.45	4,498	94.28	0.17	0.01	1,164	91.08	1,175	91.94	−0.86	0.03
	Non-economically disadvantaged	265	5.55	273	5.72	−0.17	0.01	114	8.92	103	8.06	0.86	0.03
	LEP	916	19.20	880	18.44	0.75	0.02	169	13.22	141	11.03	2.19	0.07
	non-LEP	3,855	80.80	3,891	81.56	−0.75	0.02	1,109	86.78	1,137	88.97	−2.19	0.07

Note: TFA = Teach For America; LEP = limited English proficient; the elementary sample taught by TFA alumni or experienced non-TFA teachers corresponds to an exploratory research question; all other samples correspond to confirmatory research questions.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

e. Unless otherwise noted, other includes American Indian, Alaskan Native, Asian, Native Hawaiian, other Pacific Islander, and two or more races; Hispanic includes Latino. There were no white or other ethnicity students in the elementary sample of students taught by TFA corps members or novice non-TFA teachers, and no white students in the elementary sample of students taught by TFA alumni or experienced non-TFA teachers.

Students in the analytic reading sample after matching are shown in Table 4. No substantial demographic differences were observed between elementary students taught by TFA corps members and elementary students taught by novice non-TFA teachers or elementary students taught by TFA alumni and elementary students taught by an experienced non-TFA teacher.

Similar to the elementary analytic reading sample, after matching, no substantial differences were observed between middle grade students taught by TFA corps members and middle grade students taught by novice non-TFA teachers (see Table 4). However, two substantial differences were observed between middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher; the percentage of students who were White (0.08) and the percentage of students who were identified as limited English proficient (0.07).

These substantial differences suggested that the percentage of students of White and limited English proficient students should be included in the analytic model, evaluating the reading achievement of middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher, as covariates to assure that residual differences after matching did not affect the analysis results.

As shown in Table 5 for elementary and middle grade students in the mathematics sample, two substantial academic differences were found. For students in the mathematics analytic sample, after matching, one substantial academic difference was observed between elementary students taught by TFA corps members and elementary students taught by novice non-TFA teachers—previous reading achievement (0.06). No substantial academic differences were observed between elementary students taught by TFA alumni and elementary students

taught by an experienced non-TFA teacher. Similar to the elementary analytic mathematics sample, after matching, no substantial differences were observed between middle grade students taught by TFA corps members and middle grade students taught by novice non-TFA teachers (see Table 5). However, one substantial difference was observed between middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher—previous mathematics achievement (0.08).

Table 5. Baseline academic characteristics of elementary and middle grade students, mathematics sample

| | | | *Student participation status* | | | | | | | *Student participation status* | | | | | |
| | | | *Students of TFA corps members* [a] | | *Students of novice non-TFA teachers* [b] | | *Mean difference* | *Standardized difference* | | *Students of TFA alumni* [c] | | *Students of experienced non-TFA teachers* [d] | | *Mean difference* | *Standardized difference* |
Grade type	*subtest*	*n*	*Mean*	*SD*	*Mean*	*SD*			*n*	*Mean*	*SD*	*Mean*	*SD*		
Elementary	*Mathematics*	545	630.59	95.45	631.49	93.83	−0.09	−0.01	423	645.27	100.33	643.86	99.18	1.41	0.01
	Reading	545	628.69	95.48	634.04	92.07	−5.35	−0.06	423	629.51	96.22	631.83	89.65	−2.32	−0.02
Middle	*Mathematics*	4,028	708.72	94.53	713.24	92.72	−4.52	−0.05	898	720.80	89.47	728.38	90.01	−7.58	−0.08
	Reading	4,028	706.52	87.72	708.95	88.16	−2.43	−0.03	898	701.22	82.39	705.38	85.44	−4.16	−0.05

Note: TAKS = Texas Assessment of Knowledge and Skills; SD = standard deviation; TFA = Teach For America; the elementary sample taught by TFA alumni or experienced non-TFA teachers corresponds to an exploratory research question; all other samples correspond to confirmatory research questions.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

Table 6. Baseline academic characteristics of elementary and middle grade students, reading sample

Grade type	TAKS subtest		Student participation status						Student participation status					
			Students of TFA corps members [a]		Students of novice non-TFA teachers [b]		Mean difference	Standardized difference		Students of TFA alumni [c]		Students of experienced non-TFA teachers [d]		Mean difference	Standardized difference
		n	Mean	SD	Mean	SD			n	Mean	SD	Mean	SD		
Elementary	*Mathematics*	830	631.49	90.70	623.01	89.96	8.48	0.09	298	656.03	91.56	650.61	92.32	5.42	0.06
	Reading	830	629.59	88.95	628.74	91.13	0.85	0.01	298	635.47	93.07	627.05	87.29	8.42	0.09
Middle	*Mathematics*	4,771	715.47	90.54	716.53	88.82	−1.06	−0.01	1,278	731.55	88.73	735.75	90.95	−4.20	−0.05
	Reading	4,771	710.90	88.05	711.72	83.02	−0.83	−0.01	1,278	725.63	86.88	731.57	85.39	−5.94	−0.07

Note: TAKS = Texas Assessment of Knowledge and Skills; SD = standard deviation; TFA = Teach For America; the elementary sample taught by TFA alumni or experienced non-TFA teachers corresponds to an exploratory research question; all other samples correspond to confirmatory research questions.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

As shown in Table 6, one substantial difference was found for elementary students taught by TFA corps members compared to elementary students taught by novice non-TFA teachers—previous mathematics achievement (0.09). Two substantial differences were found for elementary students taught by TFA alumni compared to elementary students taught by an experienced non-TFA teacher in the reading analytic sample—previous mathematics achievement (0.06) and previous reading achievement (0.09).

For middle grade students in the reading analytic sample, no substantial differences were observed between middle grade students taught by TFA corps members compared to middle grades students taught by novice non-TFA teachers. However, one substantial difference was found for middle grade students taught by TFA alumni and middle grade students taught by an experienced non-TFA teacher in terms of previous reading achievement (0.07). These substantial differences suggested that the previous achievement be included in the model—for which substantial differences were identified—to assure that residual differences after matching did not affect the analysis results. For more information regarding the academic baseline equivalence by student grade level, see Appendix B, Tables B-1 and B-2.

Non-equivalence at baseline and inclusion of campus and student-level covariates in analysis model

Campus-level covariates

As shown in Table 2, there were four campus-level variables for which the difference between TFA and non-TFA campuses was between 0.05 and 0.25 standard deviations in the baseline sample used to conduct PSM. However, what really matters, when controlling for potential bias in estimating the effects of TFA corps members and alumni, are differences

between TFA and non-TFA campuses on mean demographic characteristics[65] of students in campuses, in the analytic sample. We calculated these differences, but did not present them, in a table, in this report. What is presented are: 1) the TFA versus non-TFA contrast in the analytic sample used to address each confirmatory research question; 2) substantial differences between TFA and non-TFA campuses on mean student demographic characteristics; and, 3) whether these characteristics were controlled for in the analytic models used to address each confirmatory research question.

TFA corps member versus non-TFA novice teacher in elementary mathematics sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- 2009-10 TAKS mathematics (0.23)

- Proportion of economically disadvantaged students (0.12)

No white or 'other' ethnicity students were included in this sample; therefore, it was not possible to estimate a standardized mean difference.

TFA corps member versus non-TFA novice teacher in elementary reading sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- 2009-10 TAKS reading (0.07)

- Proportion of limited English proficient students (0.07)

- Proportion of African American students (0.07)

- Proportion of Hispanic students (0.07)

- Proportion of economically disadvantaged students (0.15).

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[65] These are calculated by taking the mean of the average student demographic characteristics within each TFA and non-TFA campus.

No White or 'other' ethnicity students were included in this sample; therefore, it was not possible to estimate a standardized mean difference. Because students in this analytic sample were either African American or Hispanic, only the proportion of Hispanic students was included as a covariate (in addition to the other identified covariates) at the campus level in the multi-level regression model used to estimate the effect of TFA corps members on elementary students' reading achievement as measured by the 2010-11 TAKS reading.

TFA corps member versus non-TFA novice teacher in middle grades mathematics sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- Proportion of limited English proficient students (0.17)

- Proportion of 'other' ethnicity students (0.32)

- Proportion of African American students (0.19)

- Proportion of Hispanic students (0.20)

- Proportion of White students (0.07)

- Proportion of economically disadvantaged students (0.21).

After matching, TFA campuses contained a greater percentage of 'other' ethnicity students. Although the standardized difference for the proportion of 'other' ethnicity students was above 0.25, it is important to note that this was based on a very small portion of the sample (TFA $n = 4$; 0.14 percent and non-TFA $n = 2$; 0.03 percent). The proportions of each ethnic group were highly correlated and the model failed to converge when the proportions of African American, Hispanic and other ethnic group students were entered in the analysis model[66]. Therefore, only the proportion of Hispanic and 'other' ethnicity students as well as

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[66] The exact reason for non-convergence could not be discerned, but one possible reason is extreme multicollinearity.

proportion of LEP and economically disadvantaged students were included as a covariate at the campus level in the multi-level regression model used to estimate the effect of TFA corps members on middle grade students' mathematics achievement as measured by the 2010-11 TAKS mathematics.

TFA corps member versus non-TFA novice teacher in middle grades reading sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- Proportion of 'other' ethnicity students (0.07)

- Proportion of African American students (0.14)

- Proportion of Hispanic students (0.13)

- Proportion of White students (0.08)

- Proportion of economically disadvantaged students (0.21).

All possible ethnicity groups for students in this sample displayed standardized differences above 0.05; however, if all of the ethnicity covariates were included in the model they would predict each other fully. Therefore, the proportion of African American, Hispanic and 'other' ethnicity students were included as covariates (excluding the proportion of white students) at the campus-level in the multi-level regression model used to estimate the effect of TFA corps members on middle grade students' reading achievement as measured by the 2010-11 TAKS reading.

TFA alumni versus non-TFA experienced teacher in middle grades mathematics sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- Proportion of limited English proficient students (0.11)

- Proportion of economically disadvantaged students (0.18).

TFA alumni versus non-TFA experienced teacher in middle grades reading sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- 2009-10 TAKS reading (0.15)

- Proportion of limited English proficient students (0.28)

- Proportion of 'other' ethnicity students (0.08)

- Proportion of African American students (0.13)

- Proportion of Hispanic students (0.08)

- Proportion of economically disadvantaged students (0.11).

After matching, TFA campuses contained a greater percentage of students who were limited English proficient TFA ($n = 169$; 20 percent) and non-TFA ($n = 141$; 13 percent).

Two other important contrasts, discussed below, that were not included among confirmatory questions because of concerns about multiple comparisons, were: 1) elementary students of TFA alumni compared to elementary students of experienced non-TFA teachers in mathematics and 2) elementary students of TFA alumni compared to elementary students of experienced non-TFA teachers in reading.

(1). TFA alumni versus non-TFA experienced teacher in elementary mathematics sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics:

- 2009-10 TAKS mathematics (0.26)

- Proportion of African American students (0.29)

- Proportion of Hispanic students (0.29)

- Proportion of economically disadvantaged students (0.06).

White or 'other' ethnicity students were not included in this sample; therefore, a standardized mean difference was not calculated for these groups. The differences for three of the covariates were too large (above 0.25) for the covariate adjustment to reduce bias even though these covariates were included in the multi-level regression models with one exception. The proportions of African American and Hispanic students were highly correlated and the model failed to converge when both proportions of students were entered in the analysis model. Therefore, only the proportion of Hispanic students were included as a covariate at the campus level in the multi-level regression model used to estimate the effect of TFA corps members on elementary students' mathematics achievement as measured by the 2010-11 TAKS mathematics.

(2). TFA alumni versus non-TFA experienced teachers in elementary reading sample. There were substantial standardized mean differences between TFA and non-TFA campuses on the following characteristics

- 2009-10 TAKS reading (0.20)

- Proportion of 'other' ethnicity students (0.07)

- Proportion of African American students (0.14)

- Proportion of Hispanic students (0.15)

- Proportion of economically disadvantaged students (0.15).

No white students were included in this sample; therefore, it was not possible to estimate a standardized mean difference. Because there were only three ethnic groups (African American, White and 'other' ethnicity students) in this analytic sample, the proportion of 'other' ethnicity students was excluded as a covariate at the campus level in the multi-level

regression model used to estimate the effect of TFA corps members on elementary students'

reading achievement as measured by the 2010-11 TAKS reading.

Student-level covariates

Demographic variables and baseline achievement variables which maintained

standardized mean differences greater than 0.05 were included in the analysis model as a

student-level covariate.

Results

This section answers the descriptive, confirmatory, and exploratory research questions posed in the current evaluation. To address the descriptive research questions on the demographic and academic characteristics of campuses and students in the population and in the sample, differences between TFA and non-TFA campuses and students were measured by the standardized mean difference. To address the confirmatory research questions on the impact of TFA corps members and alumni on student achievement, estimates of the relative effects of TFA corps members or TFA alumni on students' 2010-11 TAKS mathematics and reading outcomes are presented and discussed. The result of a sensitivity analysis is also presented to evaluate how robust the relative effects were to the exclusion of students who took Algebra I in the middle grades. Finally, to address the exploratory research questions for consideration of future research topics on TFA, findings from exploratory analyses are presented.

Descriptive Results

First, we present campus-level demographic characteristics of TFA campuses and then compare these campuses to non-TFA campuses that employed non-TFA teachers. Second, we present student course taking patterns to identify whether these patterns could bias estimated effects of TFA corps members and alumni on student achievement. For example, if a large percentage of students taught by TFA corps members or alumni take only one semester of mathematics or reading rather than two semesters (a full year), this could bias the estimated effect of TFA corps members and alumni on student achievement, especially if these students are compared to students who completed two semesters of mathematics or reading with non-TFA teachers. Third, results presented concerning the extent to which student-level

demographic and academic characteristics of students taught by TFA corps members and alumni were different from characteristics of students taught by non-TFA teachers.

The campuses included in the analysis to address the descriptive research questions represent the actual campuses where TFA corps members, TFA alumni, and non-TFA teachers taught in the 2010-11 school year. The elementary grade sample resulted in 124 TFA campuses and 4,425 non-TFA campuses while the middle grade sample resulted in 111 TFA campuses and 1,548 non-TFA campuses.[67]

Academic and Demographic Characteristics of TFA Campuses

In the 2010-11 school year, TFA corps members were employed at 124 elementary grades and 111 middle schools across 32 districts open-enrollment charter schools in four regions in Texas. The academic and demographic characteristics of student populations at TFA campuses presented in Table 7. TFA campuses with at least one TFA corps member or alumni were comprised of a greater percentage of economically disadvantaged students and students who were limited English proficient compared to other Texas elementary and middle grade campuses. Consistent with TFA's program model, TFA corps members and alumni were assigned to high-needs elementary and middle grade campuses in Texas for the 2010-11 school year.

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[67] Although the samples of 124 elementary and 111 middle grade TFA campuses represent the total number of campuses examined in descriptive research Question 1, TAKS data were not available for some campuses, or other data elements, which is reflected in the different sample sizes. These TFA campuses were included in the descriptive research question analyses, but were excluded from the campus-level matching process due to the insufficient data.

Table 7. Academic and demographic characteristics of campuses that employed a TFA corps member or alumni

	Campus characteristic	*n*	Percent
Elementary	Economically disadvantaged	124	92.08
	African American	124	21.96
	Hispanic	124	73.54
	Limited English proficient	124	45.17
	Student mobility	124	20.30
	Special education	124	6.02
	TAKS mathematics (met state standard)	122	83.82
	TAKS reading (met state standard)	122	84.69
Middle	Economically disadvantaged	111	88.17
	African American	111	20.16
	Hispanic	111	74.78
	Limited English proficient	111	23.52
	Student mobility	104	19.05
	Special education	111	9.20
	TAKS mathematics (met state standard)	104	78.67
	TAKS reading (met state standard)	104	84.57

Note: TAKS = Texas Assessment of Knowledge and Skills.

Both elementary and middle grade campuses that employed TFA corps members in the 2010-11 school year included majority populations of economically disadvantaged students, with elementary grade averages above 92 percent and middle grade averages above 88 percent. The TFA campuses also included a majority of minority student populations with 74–75 percent Hispanic student populations. The academic characteristics of the elementary and middle grades that employed TFA corps member and alumni during the 2010-11 school year were similar. While the average rate of meeting state standards for TAKS in TFA elementary grades was nearly 84 percent, TFA middle grades were a slightly lower average rate at about 79 percent. The average rate for TAKS reading, however, was similar across TFA campuses for elementary and middle grades with both averaging approximately 85 percent.

Meaningful Differences between the Academic and Demographic Characteristics of TFA and non-TFA Campuses

To assess whether the TFA campuses were meaningfully different than all available non-TFA campuses prior to matching, standardized mean differences between the two groups were calculated. Presented in Table 8 are the academic and demographic characteristics of TFA and non-TFA campuses at the elementary and middle grades, and the standardized mean difference between the two groups.

Table 8. Academic and demographic characteristics of TFA and non-TFA campuses

| | | *Campus pre-matching* | | | | *Standardized* |
| | | *TFA* | | *non-TFA* | | |
Grade type	*Campus characteristic*	*n*	Percent	*n*	Percent	*difference*
Elementary	Economically disadvantaged	124	92.08	4,425	64.79	0.70
	African American	124	21.96	4,425	12.49	0.25
	Hispanic	124	73.54	4,425	50.30	0.49
	Limited English proficient	124	45.17	4,425	22.70	0.49
	Student mobility	124	20.30	4,164	17.05	0.08
	Special education	124	6.02	4,425	8.49	0.10
	TAKS mathematics (met state standard)	122	83.82	4,146	85.62	0.05
	TAKS reading (met state standard)	122	84.69	4,146	87.20	0.07
Middle	Economically disadvantaged	111	88.17	1,548	57.10	0.74
	African American	111	20.16	1,548	12.19	0.22
	Hispanic	111	74.78	1,548	44.26	0.65
	Limited English proficient	111	23.52	1,548	8.19	0.43
	Student mobility	104	19.05	1,509	15.04	0.11
	Special education	111	9.20	1,548	9.87	0.02
	TAKS mathematics (met state standard)	104	78.67	1,503	82.91	0.11
	TAKS reading (met state standard)	104	84.57	1,503	87.90	0.10

Note: TFA = Teach For America; TAKS = Texas Assessment of Knowledge and Skills.

As can be seen in Table 8, there were substantial differences between TFA and non-TFA campuses in Texas. The largest differences were between the demographic characteristics of the two types of campuses. Within TFA and non-TFA campuses, the greatest difference was

found for economically disadvantaged students. TFA corps members and alumni taught in TFA campuses with a greater percentage of economically disadvantaged elementary students (92.08 percent) than non-TFA teachers who taught at non-TFA campuses (64.79 percent). This difference was found for TFA and non-TFA middle grade campuses (88.17 percent versus 57.10 percent; see Table 8).

TFA corps members and alumni taught in TFA campuses with a greater percentage of Hispanic elementary students (73.54 percent) than non-TFA teachers who taught at non-TFA campuses (50.30 percent). This difference occurred for TFA and non-TFA middle grade campuses (74.78 percent versus 44.26 percent).

TFA corps members and alumni taught in TFA campuses with a greater percentage of elementary students with limited English proficiency (45.17 percent) than non-TFA teachers who taught at non-TFA campuses (22.70 percent; see Table 8). This difference occurred for TFA and non-TFA middle grade campuses (23.52 percent versus 8.19 percent).

Finally, an additional substantial difference was found for TFA corps members and alumni who taught in TFA campuses with a greater percentage of African American elementary students (21.96 percent) than non-TFA teachers who taught at non-TFA campuses (12.49 percent); however, this difference did not occur for middle grade campuses.

These results show that, consistent with TFA's mission, TFA corps members and alumni were teaching in high-need Texas schools in school year 2010-11. They were teaching in elementary and middle grades with higher percentages of economically disadvantaged and limited English proficient students, as well as higher percentages of Hispanic students. TFA corps members and alumni were also teaching in elementary grades with higher percentages of African American students.

Mathematics and Reading Course Taking Patterns of Students Taught by TFA Corps Members and TFA Alumni

We examined the semesters of mathematics taken by students taught by TFA corps members or alumni during the 2010-11 school year by grade level. One purpose for this analysis was to validate the assumption that at least 90 percent of the students in the sample at each grade completed two semesters of mathematics with a TFA corps member or alumni. Another purpose was to determine whether there was a substantial proportion of students taking either only one semester of mathematics or three or more semesters of mathematics because high percentages of students in each of these categories could potentially bias estimates of TFA corps member or alumni effects on student outcomes during the impact analyses.

As can be seen in Table 9, at each grade level, no less than 89 percent of students taught by TFA corps members or alumni completed two semesters of mathematics in 2010-11. For the grade 7 sample approximately 2 percent of students taught by TFA corps members or alumni completed one semester of mathematics and approximately 3 percent completed three or more semesters of mathematics[68]. These percentages were slightly higher for the grade 8 sample at approximately 4 percent and 7 percent respectively.

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[68] In these instances where students were reported as taking three or more semesters of mathematics, it is likely that students were enrolled in more than one mathematics course during the 2010-11 school year.

Table 9. Percentage of students by semesters of mathematics courses with a TFA corps member or alumni, 2010-11

Grade level	Semesters			
	One	*Two*	*Three or more*	*Total* n
4	0.00	100.00	0.00	833
5	0.10	99.90	0.00	988
6	0.83	98.94	0.23	2,648
7	2.12	94.46	3.41	1,932
8	4.05	89.25	6.70	1,507

We also examined the semesters of reading taken by students taught by TFA corps members or alumni during the 2010-11 school year by grade level for the same purposes described previously. The majority of students who received reading instruction for two or more semesters from a TFA corps member or alumni during the 2010-11 school year can be seen in Table 10. The reason for the large percentage of students receiving more than two semesters of reading is due to categorization of multiple courses in related content areas as 'reading courses' (for example, writing courses, English as a second language courses, and English language arts[69]).

A small percentage of students received only one semester of reading instruction from a TFA corps member or alumni (Table 10). The majority of elementary grade students received more than two semesters of reading while the majority of middle grade students received two semesters taught by TFA corps members or alumni.

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[69] In these instances where students were reported as taking three or more semesters of reading, it is likely that students were enrolled in more than one course categorized as a reading course during the 2010-11 school year.

Table 10. Percentage of students by semesters of reading courses with a TFA corps member or alumni, 2010-11

		Semesters		
Grade			*Three or*	
level	*One*	*Two*	*more*	*Total n*
4	0.00	30.92	69.05	756
5	0.00	39.17	60.83	1,606
6	0.47	62.73	36.81	1,701
7	0.50	89.93	9.56	3,822
8	2.46	90.64	6.90	2,362

Meaningful Differences between the Academic and Demographic Characteristics of TFA and Non-TFA Students

Comparisons between students taught by TFA corps members or alumni and non-TFA teachers, for both the mathematics and reading student samples in both elementary and middle grade campuses, can be seen in Table 11. The results show a higher percentage of economically disadvantaged students were taught by TFA corps members and alumni than were taught by non-TFA teachers in the 2010-11 school year. This difference was observed in both the mathematics and reading samples. The difference observed in the elementary mathematics sample was 12.05 and the middle grade mathematics was 15.16 percent. The difference observed in the elementary reading sample was 10.68 percent and the middle grade reading sample was 14.66[70].

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[70] In addition to the significant findings of economically disadvantaged students, significant findings were also identified for students who were not economically disadvantaged. These significant differences were also found across both the mathematics and reading samples for both elementary and middle grade students. Specifically, across samples, significantly more students who were not economically disadvantaged were found to be taught by non-TFA teachers compared to those taught by TFA corps members or alumni.

Table 11. Demographic characteristics of the elementary and middle grade students

		Mathematics sample					English language arts/reading sample				
		Students of TFA corps members or alumni		Students of non-TFA teachers		Standardized difference	Students of TFA corps members or		Students of non-TFA teachers		Standardized difference
Grade type	Characteristic	n	Percent	n	Percent		n	Percent	n	Percent	
Elementary	*Gender*										
	Female	937	51.46	26,606	49.07	0.05	1,178	49.87	27,080	48.92	0.02
	Male	884	48.54	27,614	50.93	0.05	1,184	50.13	28,279	51.08	0.02
	Race/ethnicity [a]										
	African American	252	13.84	11,727	21.63	0.19	439	18.59	11,585	20.93	0.06
	Hispanic	1,526	83.80	39,575	72.99	0.24	1,873	79.30	40,808	73.72	0.13
	Other	24	1.32	1,431	2.64	0.08	30	1.27	1,447	2.61	0.08
	White	19	1.04	1,487	2.74	0.10	20	0.85	1,519	2.74	0.12
	Economically disadvantaged	1,738	95.44	45,213	83.39	0.33	2,239	94.79	46,564	84.11	0.30
	Not economically disadvantaged	83	4.56	9,007	16.61	0.32	123	5.21	9,007	15.89	0.29
	Special education	93	5.11	4,851	8.95	0.14	118	5.00	4,991	9.02	0.14
	Not special education	1,728	94.89	49,369	91.05	0.14	2,244	95.00	50,368	90.98	0.14
	LEP	688	37.78	21,259	39.21	0.03	945	40.01	22,385	40.44	0.01
	non-LEP	1,133	62.22	32,961	60.79	0.03	1,417	59.99	32,974	59.56	0.01
Middle	*Gender*										
	Female	3,057	50.22	104,387	48.80	0.03	3,957	50.18	105,319	48.85	0.03
	Male	3,030	49.78	109,540	51.20	0.03	3,928	49.82	110,270	51.15	0.03
	Race/ethnicity [a]										
	African American	855	14.05	29,325	13.71	0.01	1,048	13.29	30,240	14.03	0.02
	Hispanic	5,161	84.79	167,208	78.16	0.16	6,649	84.32	168,005	77.93	0.15
	Other	36	0.59	7,439	3.48	0.16	100	1.27	7,337	3.40	0.12
	White	35	0.57	9,955	4.65	0.19	88	1.12	10,007	4.64	0.17
	Economically disadvantaged	5,691	93.49	167,575	78.33	0.37	7,341	93.10	169,111	78.44	0.36
	Not economically disadvantaged	396	6.51	46,352	21.67	0.37	544	6.90	46,478	21.56	0.36
	Special education	265	4.35	17,466	8.16	0.14	351	4.45	17,911	8.31	0.14
	Not special education	5,822	95.65	196,461	91.84	0.14	7,534	95.55	197,678	91.69	0.14
	LEP	1,521	24.99	39,998	18.70	0.16	1,856	23.54	40,264	18.68	0.12
	non-LEP	4,566	75.01	173,929	81.30	0.16	6,029	76.46	175,352	81.32	0.12

Note: TFA = Teach For America; LEP = limited English proficient.

a. Unless otherwise noted, 'other' includes American Indian, Alaskan Native, Asian, Native Hawaiian, other Pacific Islander, and two or more races; Hispanic includes Latino.

Although TFA corps members and alumni taught a higher percentage of economically disadvantaged students than non-TFA teachers, there were no meaningful differences between the two groups of teachers on the academic characteristics of the students they taught. This finding held for both the elementary and middle grade samples, as well as for both the mathematics and reading samples. Standardized differences for each comparison are presented in Table 12.

Table 12. Academic characteristics of the mathematics elementary and middle grade student sample

		Mathematics sample						Standardized difference	Reading/English language arts sample						Standardized difference
		Students of TFA corps members[a]			Students of novice non-TFA teachers[b]				Students of TFA alumni[c]			Students of experienced non-TFA teachers[d]			
Grade type	TAKS subtest	n	Mean	SD	n	Mean	SD		n	Mean	SD	n	Mean	SD	
Elementary	Mathematics	1,139	630.25	98.75	35,202	612.22	96.89	0.19	1,419	635.26	91.62	35,372	612.61	96.75	0.23
	Reading	1,025	629.19	98.10	29,063	616.43	96.79	0.10	1,286	628.52	90.96	29,402	616.05	96.89	0.13
Middle															
	Mathematics	5,105	709.84	93.79	171,723	711.72	91.48	0.02	6,711	721.05	92.91	172,709	711.90	91.62	0.10
	Reading	5,098	704.71	87.22	170,148	715.13	90.50	0.12	6,658	715.24	89.77	171,187	715.39	90.56	0.00

Note: TAKS = Texas Assessment of Knowledge and Skills; SD = standard deviation; TFA = Teach For America.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

Confirmatory Results

Presented in this section are findings on the effects of TFA corps members and TFA alumni on TAKS scores in mathematics and reading for elementary and middle grade students. The sensitivity of the middle grade findings to the inclusion of students taking Algebra I is presented to establish robustness[71]. The section concludes with a presentation of findings from exploratory analyses to inform future research on TFA.

Main Analysis to Estimate the Effect of TFA on Student Outcomes

TFA corps members versus novice non-TFA teachers

The effect of TFA corps members' instruction on elementary grade students' 2010-11 TAKS mathematics and reading scores was quantified as the covariate adjusted difference between the 2010-11 TAKS mean score[72] for TFA corps members' students and the mean score for students taught by novice non-TFA teachers. The effect of TFA corps members' instruction on middle grade students' 2010-11 TAKS mathematics and reading scores was similarly quantified.

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[71] In addition to the sensitivity analysis, an alternative specification of the ANCOVA model used in the confirmatory analyses was also conducted. The alternative model specified was a gain score model that consisted of: 1) replacing the 2010-11 TAKS score as the dependent variable in the multi-level regression model with the difference between the 2011 TAKS score and the 2009-10 TAKS score, and 2) removing the 2009-10 TAKS score as the pre-test covariate in the same multi-level regression model. Findings were consistent with the confirmatory results.

[72] Mean score refers to the adjusted mean score holding prior year's score constant.

Table 13. Estimated overall impact of TFA corps members and novice non-TFA teachers on student TAKS mathematics and reading achievement, elementary and middle grade

Grade type	TAKS content area	Students of TFA corps members [a]		Students of novice non-TFA teachers [b]		Estimated difference (SE)	95 percent confidence interval	Effect size [c]	p-value of estimates [d]
		Campus n	*Mean*	*Campus n*	*Mean*				
Elementary	Mathematics	25	688.65	90	678.66	9.99 (7.56)	[–4.99, 24.98]	0.11	0.283
	Reading	37	678.69	103	674.57	4.11 (6.02)	[–7.89, 16.03]	0.04	0.489
Middle	Mathematics	51	742.93	205	725.99	16.94 (3.74)	[9.58, 24.31]	0.19	<.001
	Reading	55	754.89	157	751.10	3.79 (3.43)	[–2.98, 10.56]	0.04	0.325

Notes: TFA=Teach For America; TAKS = Texas Assessment of Knowledge and Skills; SE = standard error. There were 545 elementary students in the mathematics sample and 830 elementary students in the reading sample taught by TFA corps members. There were 545 elementary students in the mathematics sample and 830 elementary students in the reading sample taught by novice non-TFA teachers. There were 4,028 middle grade students in the mathematics sample and 4,771 middle grade students in the reading sample taught by TFA alumni and 4,028 middle grade students in the mathematics sample and 4,771 middle grade students in the reading sample taught by novice non-TFA teachers. All the values in this table were estimate using a two-level HLM, which accounted for nesting of students within schools and controlled for students' pretest scores.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1). The mean difference is standardized by the unadjusted student-level pooled standard deviation of post-test scores. The unadjusted student-level standard deviations were 97.00 for mathematics and 87.61 for reading for elementary students of TFA corps members, and 91.82 for mathematics and 95.06 for reading for elementary students of novice non-TFA teachers. The unadjusted student-level standard deviations were 91.65 for mathematics and 93.49 for reading for middle grade students of TFA corps members, and 87.80 for mathematics and 90.13 for reading for middle grade students of novice non-TFA teachers.

d. Adjusted using Benjamini-Hochberg method.

Elementary Grade Mathematics. The TFA campus mean 2010-11 TAKS mathematics score for elementary grade students taught by TFA corps members was 688.65 points and the non-TFA campus mean for those taught by novice non-TFA teachers was 678.66 points, an estimated difference of 9.99 points favoring elementary students taught by TFA corps members (Table 13). This difference, although in the positive direction, was not statistically significant (*ES*=.11, *p*=.283). Accounting for sampling error, we are 95 percent confident that the true effect lies between –4.99 to 24.98 points. The magnitude of the adjusted mean

difference and the lack of statistical significance lead to the conclusion that TFA corps members had a positive but not statistically discernible relative effect on elementary grade students' 2010-11 TAKS mathematics scores.

Elementary Grade Reading. The results for 2010-11 TAKS reading scores for elementary grade students mirrored those for the 2010-11 TAKS mathematics scores. The TFA campus mean 2010-11 TAKS reading score for elementary grade students taught by TFA corps members was 678.69 points and the non-TFA campus mean for those taught by novice non-TFA teachers was 674.57 points, an estimated difference of 4.11 points favoring elementary students taught by TFA corps members (Table 13). This difference, although in the positive direction, was not statistically significant (*ES*=.04, *p*=.496). Accounting for sampling error, we are 95 percent confident that the true effect lies between –7.80 to 16.03 points. The magnitude of this adjusted mean difference and the lack of statistical significance leads to the conclusion that TFA corps members had a positive but not statistically discernible relative effect on elementary grade students' 2010-11 TAKS reading scores.

Middle Grade Mathematics. In contrast to the findings for elementary grade mathematics, there was a statistically discernible relative effect of TFA corps members on middle grade students. The TFA campus mean 2010-11 TAKS mathematics score for middle grade students taught by TFA corps members was 742.93 points and the non-TFA campus mean score for those taught by novice non-TFA teachers was 725.99 points, an estimated difference of 16.94 points[73] favoring middle grade students taught by TFA corps members (Table 13). This difference was statistically significant (*ES*=.19, *p*<.001). Accounting for sampling error, we are 95 percent confident that the true effect lies between 9.58 to 24.31

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[73] This estimated 17 point difference translates into approximately two additional items answered correctly on the 2010-11 TAKS mathematics.

points. The statistical significance of this effect leads to the conclusion that TFA corps members had a positive and statistically discernible relative effect on middle grade students' 2010-11 TAKS mathematics scores.

   Middle Grade Reading. The results for 2010-11 TAKS reading scores for middle grade students were similar to those for the 2010-11 TAKS reading scores for the elementary grade students. The estimated TFA campus mean 2010-11 TAKS reading score for middle grade students taught by TFA corps members was 754.89 points, and the estimated non-TFA campus mean reading score for those taught by novice non-TFA teachers was 751.10 points, an estimated difference of 3.79 favoring middle grade students taught by TFA corps members (Table 13). This difference, although in the positive direction, was not statistically significant (*ES*=.04, *p*=.325). Accounting for sampling error, we are 95 percent confident that the true effect lies between –2.98 to 10.56 points. Based on the magnitude of this adjusted mean difference and the lack of statistical significance, the conclusion is that TFA corps members had a positive but not statistically discernible relative effect on middle grade students' 2010-11 TAKS reading scores.

   The conclusion drawn from these analyses is that TFA corps members had a positive but not statistically significant relative effect on elementary students' TAKS mathematics and reading scores, as well as on middle grade students' TAKS reading scores, and a positive and statically significant relative effect on middle grade students' TAKS mathematics scores. See Appendix D for the complete set of parameter estimates from the multilevel models used to produce these findings for elementary and middle grades in the mathematics and reading domains.

TFA alumni vs. experienced non-TFA teachers

  Middle Grade Mathematics. The TFA campus mean 2010-11 TAKS mathematics score for middle grade students taught by TFA alumni was 764.09 points and the non-TFA campus mean mathematics score for those taught by experienced non-TFA teachers was 740.85 points, an estimated difference of 23.25 points[74] favoring middle grade students taught by TFA alumni (Table 14). This difference was statistically significant (*ES*=0.27, *p*<.001) and demonstrates that TFA alumni had a positive, meaningful, and statistically discernible relative effect on middle grade students' 2010-11 TAKS mathematics score. Accounting for sampling error, we are 95 percent confident that the true effect lies between 11.33 to 35.17 points.

  Middle Grade Reading. The TFA campus mean 2010-11 TAKS reading score for middle grade students taught by TFA alumni was 774.55 points and the non-TFA campus mean reading score for those taught by experienced non-TFA teachers was 764.19 points, an estimated difference of 10.36 points[75] favoring middle grade students taught by TFA alumni (Table 14). This difference was statistically significant (*ES*=0.11, *p*<.05) and demonstrates that TFA alumni had a positive, meaningful, and statistically discernible relative effect on middle grade students' 2010-11 TAKS reading score. Accounting for sampling error, we are 95 percent confident that the true effect lies between 1.61 to 19.11 points.

  The conclusion drawn from these analyses is that TFA alumni had a positive and statistically significant relative effect on middle grade students' TAKS mathematics and reading scores. See Appendix D for the complete set of parameter estimates from the multilevel model used to produce these findings for middle grades students in the mathematics and reading domains.

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[74] This estimated 23 point difference translates into approximately three additional items answered correctly on the 2010-11 TAKS mathematics.

[75] This estimated 10 point difference translates into approximately one additional item answered correctly on the 2010-11 TAKS reading.

Table 14. Estimated impact of TFA alumni and experienced non-TFA teachers on student TAKS mathematics and reading achievement, middle grade

Grade type	TAKS content area	Student participation status				Estimated difference (SE)	95 percent confidence interval	Effect size [c]	p-value of estimates [d]
		Students of TFA alumni [a]		Students of experienced non-TFA teachers [b]					
		Campus n	Mean	Campus n	Mean				
Middle	Mathematics	12	764.09	200	740.85	23.25 (6.05)	[11.33, 35.17]	0.27	<.001
	Reading [e]	18	774.55	185	764.19	10.36 (4.44)	[1.61, 19.11]	0.11	0.041

Note: TFA = Teach For America; TAKS = Texas Assessment of Knowledge and Skills; SE = standard error. There were 898 middle grade students in the mathematics sample and 1,278 middle grade students in the reading sample taught by TFA alumni and 898 middle grade students in the mathematics sample and 1,278 middle grade students in the reading sample taught by experienced non-TFA teachers. All the values in this table were estimated using a two-level HLM, which accounted for nesting of students within schools and controlled for student's pretest score.
a. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.
b. Experienced non-TFA teachers are teachers with three or more years of teaching experience.
c. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1). The mean difference is standardized by the unadjusted student-level pooled standard deviation of post-test scores. The unadjusted student-level standard deviations were 85.24 for mathematics and 95.04 for reading for middle grade students of TFA alumni, and 84.51 for mathematics and 91.71 for reading for middle grade students of experienced non-TFA teachers.
d. Adjusted using Benjamini-Hochberg method.

Sensitivity analysis for main results

Algebra I Analysis. The proportion of TFA students taking Algebra I was approximately 4 percentage points higher than the percentage of non-TFA students in the middle grade analysis sample. It is possible that these students were more academically advanced than those not taking Algebra I in middle grade. To evaluate how sensitive the impact analyses were to the inclusion of these students in the analysis sample, we replicated our main analysis but excluded these students from the sample. The results were consistent with the results from the confirmatory analyses that included these students. Students taught by TFA corps members and alumni still scored significantly higher than students taught by non-TFA teachers on 2010-11 TAKS mathematics scores.

To conclude, this sensitivity analysis showed that the findings from the main mathematics analyses were insensitive from the exclusion of middle grade students who took Algebra I. The complete results from the sensitivity analysis are presented in Appendix E.

Exploratory analysis to inform future research on TFA

Effects of TFA corps members by TFA region

In this analysis, TFA corps members, TFA alumni, novice non-TFA, and experienced non-TFA teachers were combined due to small campus-level sample size within each region. Analyses were conducted for elementary and middle grade groups separately for mathematics and reading TAKS outcome[76]. None of the interaction effects between TFA and regions was significant in the four analyses. However, a substantially large effect (as measured in the associated effect size) was found for the Dallas-Fort Worth region in reading mathematics for middle grade students and reading for middle grade students. In addition, the following individual interaction effects were substantially large:

- In the mathematics middle grade analysis, the interaction between TFA status and the Dallas-Fort Worth region was substantially large (*ES*=0.25; *p*=.248). In these interaction analyses, the reference region was San Antonio. Simple effect analyses showed that the TFA effect size within Dallas-Fort Worth region was 0.34 while the effect size within the San Antonio region was 0.06. This large effect size difference between two regions explains why the effect size for the interaction effect for the Dallas-Fort Worth region was substantial. While the difference is not statistically significant, it is large enough to warrant further investigation in a

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[76] Due to the exploratory nature of this question and the small sample size, baseline equivalence did not solely direct the inclusion of covariates in the model. Covariates that were included were the pre-test variable at the campus-level as well as imbalance at the student-level when multicollinearity was not an issue.

confirmatory analysis in future research. The TFA groups' adjusted mean

TAKS mathematics score is substantially larger than the comparison

groups' and is considered meaningful.

- In the reading middle grade analysis, the interaction between TFA and the

  Dallas-Fort Worth region was substantially large (*ES*=0.28; *p*=.229). In

  these interaction analyses, the reference region was again San Antonio.

  Simple effect analyses showed that the TFA effect size within Dallas-Fort

  Worth region was 0.18 while the effect size within the San Antonio region

  was –0.11. The group mean difference in Houston (*ES*=0.03) and the Rio

  Grande Valley (*ES*=0.08) were not considered substantial but were in the

  same direction as the Dallas-Fort Worth region.

Although there were no statistically significant interactions between TFA and region,

the simple effects reported as effect sizes were large enough to suggest investigating TFA by a

regional interaction as confirmatory analyses in future research. The complete set of regression

results can be seen in Appendix F, Table F-1.

Differential effects of TFA corps members and TFA alumni

Within the reading sample, a statistically significant interaction was observed for

middle grade students (*ES*=0.08; *p*<.05). This significant interaction suggests that the effect of

TFA alumni (in comparison to experienced non-TFA teachers) was statistically greater than the

effect of TFA corps members (in comparison to novice non-TFA teachers) on middle grade

student 2010-11 TAKS reading performance. The complete set of regression results can be

seen in Appendix F, Table F-2.

<u>*TFA alumni versus experienced non-TFA teachers*</u>

   Elementary Grade Mathematics. The TFA campus mean 2010-11 TAKS mathematics

score for elementary grade students taught by TFA alumni was 697.74 points and the non-TFA

campus mean score for those taught by experienced non-TFA teachers was 694.24 points, an

estimated difference of 3.50 points favoring elementary students taught by TFA alumni

(Appendix F, Table F-3). This difference, although in the positive direction, was not

statistically significant (*ES*=.04, *p*=.665). The magnitude of the adjusted mean difference and

the lack of statistical significance lead to the conclusion that TFA alumni had a positive but not

statistically discernible relative effect on elementary grade students' 2010-11 TAKS

mathematics score. Accounting for sampling error we are 95 percent confident that the true

difference is between –12.47 and 19.47.

   Elementary Grade Reading. The results for 2010-11 TAKS reading scores for

elementary grade students mirrored those for the 2010-11 TAKS mathematics scores. The TFA

campus mean 2010-11 TAKS reading score for elementary grade students taught by TFA

alumni was 683.11 points and the non-TFA campus mean score for those taught by

experienced non-TFA teachers was 687.20 points, an estimated difference of -4.09 points

(Appendix F, Table F-3). This difference, in the negative direction, was not statistically

significant (*ES*=.05, *p*=.644). The magnitude of this adjusted mean difference and the lack of

statistical significance leads to the conclusion that TFA alumni had a negative but not

statistically discernible relative effect on elementary grade students' 2010-11 TAKS reading

score. Accounting for sampling error we are 95 percent confident that the true difference is

between –21.63 and 13.44.

Discussion

The main purpose of this study was to estimate the *effect* of TFA corps members and TFA alumni on Texas students' mathematics and reading scores as measured by the TAKS in the state of Texas in 2010-11. Consistent with its mission, TFA corps members and alumni were teaching in high-need Texas campuses with high percentages of economically disadvantaged and limited English proficient students in the 2010-11 school year. Findings from the confirmatory impact analyses, which are the main policy relevant findings, show that students of TFA corps members and alumni performed better on 2010-11TAKS middle grade mathematics than students of non-TFA teachers.

Findings also show that students of TFA alumni performed better on 2010-11 TAKS middle grade reading than students of experienced non-TFA teachers. Differences between TFA and non-TFA students in 2010-11 TAKS elementary school mathematics and reading were mostly positive, but not statistically significant. In what follows, we elaborate on these main policy findings and discuss how they compare with previous research, note their limitations, and make recommendations for future research on TFA based on the data limitations imposed on this study and the exploratory findings.

Main Policy Findings on the Effects of TFA Corps Members or TFA Alumni on Student Academic Outcomes

Middle grade students of TFA corps members and alumni scored higher on the 2010-11 TAKS mathematics when compared to middle grade students of non-TFA teachers. The differences were substantial, statistically significant, and largest for students of TFA alumni. Middle grade students taught by TFA corps members scored an average of 17 points higher on the 2010-11 TAKS mathematics than students taught by a novice non-TFA teacher. The

difference between TFA corps members and non-TFA teachers on middle grade TAKS

mathematics scores can be translated to an effect size of 0.19. This difference translates to

more than half a year of additional learning for students of TFA corps members over students

of novice non-TFA teachers[77], and would reduce the achievement gap between these students

by 24 percent on the grade 8 National Assessment of Educational Progress (NAEP)[78].

The effect of TFA alumni on middle grade students' 2010-11 TAKS mathematics

scores was approximately 23 points higher than experienced non-TFA teachers. The difference

between the effect of TFA alumni and experienced non-TFA teachers on middle grade TAKS

mathematics scores translates to an effect size of 0.27. This difference translates to close to a

full-year of additional learning for students of TFA alumni over students of experienced non-

TFA teachers[79], and would reduce the achievement gap between these students by 34 percent

on the grade 8 NAEP[80].

The effect of TFA alumni on middle grade students' 2010-11 TAKS reading scores,

relative to experienced non-TFA middle grade teachers, was approximately 10 points higher

than experienced non-TFA teachers. The difference between the effect of TFA alumni and

experienced non-TFA teachers on middle grade TAKS reading scores translates to an effect

size of 0.11. This difference translates to approximately half of a year of learning for students

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[77] The additional months of learning were based on the average annual gain for middle school grades mathematics which was .31 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).

[78] This is based on an estimated achievement gap between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" of 0.80 standard deviations on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008). This finding was also not sensitive to the exclusion of middle grade students who took Algebra I during the 2010-11 school year. We considered translating the statistically significant effect sizes into economic gains measured by earnings; however, the translations that currently exist in the literature do not include middle grade samples.

[79] The additional months of learning was based on the average annual gain for middle school grades mathematics which was .31 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).

[80] This is based on an estimated achievement gap between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" of 0.80 standard deviations on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008).

of TFA alumni over students of experienced non-TFA teachers[81], and would reduce the achievement gap between these students by 17 percent on the grade 8 NAEP[82].

The three positive and statistically significant effects of TFA corps members and alumni on student outcomes must be tempered with reservations about attributing the *entire* effect to TFA. This is due to the limitations of forming matched comparisons based on measured characteristics.

One explanation for these positive and statistically significant effects could be that TFA corps members (including those who became alumni) were recruited from the top colleges and universities in the United States with strong academic training and achievement orientation. In addition, corps member's participation in an initial TFA training supplements their strong academic foundation. This combination may give TFA corps members an instructional advantage over novice non-TFA teachers. TFA corps members appear to be able to leverage their strong academic training and achievement orientation in addition to the initial TFA training while they gain teaching experience in the classroom. For TFA alumni the combination of a strong academic foundation and TFA training is coupled with teaching experience which may lead to quality instruction and explain higher middle grade student mathematics and reading achievement in TFA campuses. The relationship between teaching experience and student outcomes is well documented in prior research[83].

For 2010-11 TAKS mathematics scores, there was an estimated difference of approximately 10 points favoring elementary students taught by TFA corps members. Although in the positive direction, this difference was not statistically significant. For 2010-11

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[81] The additional months of learning were based on the average annual gain for middle school grades mathematics which was .245 standard deviations for a 9-month school year (Hill, Bloom, Black, and Lipsey, 2008).
[82] This is based on an estimated achievement gap of 0.66 standard deviations between students "eligible for free/reduced-price lunch" and students "ineligible for free/reduced-price lunch" on grade 8 National Assessment of Educational Progress (Hill, Bloom, Black, and Lipsey, 2008).
[83] For example, see Harris and Sass, 2011.

TAKS reading scores, there was an estimated difference of approximately 4 points favoring elementary students taught by TFA corps members. Although in the positive direction, this difference was also not statistically significant. Similar results were found when comparing middle grade students of TFA corps members with middle grade students of novice non-TFA teachers on 2010-11 TAKS reading scores. Because the positive results are not statistically significant and are imprecise, we do not translate the effect sizes into educationally meaningful metrics.

The findings for reading and mathematics at the elementary grade level can be viewed as positive in that TFA is fulfilling their mission of addressing a critical teacher shortage in high-need campuses and the students of these corps members and alumni are performing at least as well as similar students taught by non-TFA teachers. These findings can be also interpreted as the need for TFA to re-evaluate its program model as it applies to teaching elementary school mathematics and reading because the TFA program model theorizes that students taught by TFA corps members and alumni should show substantial gains over comparable students taught by non-TFA teachers. Future research could investigate the reason for positive but not statistically significant effects, found in the current study, of TFA corps members and alumni in mathematics and reading at the elementary grades.

How do the Findings from this Study Compare with Those from Previous Research on TFA?

The results from the Decker, Mayer, and Glazerman (2004) randomized control trial (RCT) are the most internally valid and serve as the most trustworthy benchmark of comparison for this study. Comparisons between the two studies are limited because the RCT results were not reported separately for Texas, and the RCT target population (grades 1–5) did not correspond with the target population in this study (grades 4–8). Despite these limits to the

comparison, the RCT found positive and statistically significant effects consistent with, albeit larger than, the findings from this study for students taught by TFA corps members compared with that of students taught by novice non-TFA teachers.

Among comparative studies conducted in Texas, Ware et al. (2011) aligned most closely with this study in that the former study included students in grades 3–8, and contrasted TFA corps members and novice non-TFA teachers. Ware et al. (2011) found statistically significant greater achievement in reading on the 2010-11 TAKS for students in grades 3–8 taught by TFA corps members compared to their peers taught by novice, non-TFA teachers. The present evaluation did not maintain these positive effects of TFA corps members versus novice non-TFA teachers on 2010-11 TAKS reading scores at the elementary or middle grade levels. However, the current study did find positive effects of TFA alumni compared to experienced non-TFA teachers on 2010-11 TAKS reading scores at the middle grades.

The present study rigorously controlled for pre-existing differences in students' 2009-10 TAKS reading scores through matching, estimated effects of TFA corps members versus novice non-TFA teachers separately for the elementary and middle grade samples, and encompassed all four TFA Texas regions (a broader group of TFA districts and campuses than the Ware et al. (2011) study).

Secondary Exploratory Findings

Exploratory analyses were conducted to investigate possible TFA regional differences, TFA status (corps member or alumni) differences, and whether there were significant differences between TFA alumni and experienced non-TFA teachers for elementary student mathematics and reading achievement on the 2010-11 TAKS. Two substantially large effects (as measured in the associated effect size) were found for the Dallas-Fort Worth region in

mathematics and reading for middle grade students. These substantially large, but not statistically significant, effect sizes suggest that TFA effects were greater in the Dallas-Fort Worth region for middle grade mathematics and reading achievement (compared to the San Antonio region[84]).

The exploratory analyses also found that the effect of TFA alumni (in comparison to experienced non-TFA teachers) was statistically greater than the effect of TFA corps members (in comparison to novice non-TFA teachers) on middle grade student 2010-11 reading TAKS performance.

Finally, no statistically significant results were found for elementary students taught by TFA alumni compared to elementary students taught by experienced non-TFA teachers in either mathematics or reading suggesting statistical equivalence between the two types of experienced teachers with regard to elementary student achievement.

These exploratory findings should be interpreted with caution because the present study was not designed, nor powered, to use the exploratory findings to inform TFA policy. However, the significant results presented warrant further investigation in studies where such questions are designed as confirmatory so that impacts may be estimated and findings used to inform TFA policy.

Limitations of Main Policy Findings

TFA Campuses

As in the current study, previous studies conducted in Texas on the effects of TFA corps members and alumni compared students of TFA corps members with students of non-TFA teachers on academic outcomes. However, a major difference between this current study

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[84] In this analysis, the San Antonio region was selected as the reference group.

and previous studies conducted in Texas is the use of propensity score matching at both the campus and student levels. TFA campuses were defined as campuses with at least one TFA corps member or alumni teaching during the 2010-11 school year. Given this definition, it is possible that the TFA campuses used to estimate the effect of TFA contained only one TFA corps member or alumnus. This possibility could not be confirmed or ruled out with the current data set because we could not determine how many TFA corps members or alumni were at each campus. Thus, the reader should consider this potential limitation when interpreting the results of this study.

Limitations of Propensity Score Matching

The propensity score matching removed pre-existing differences on measured characteristics between the contrasted student groups so that observed differences between the groups on the TAKS mathematics and reading subtests could be attributed, at least in part, to TFA corps members. And, if pre-existing differences on certain measured academic and demographic characteristics between contrasted groups remained even after propensity score matching, the characteristics for which these differences existed were controlled for when comparing the student groups on the outcomes. For these reasons, the estimated effects of TFA corps members and alumni, relative to novice and experienced non-TFA teachers, when observed, can be attributed to TFA corps members and alumni in most cases.

However, substantial pre-existing campus-level differences remained for proportions of 'other' ethnicity students in the TFA corps members' middle school mathematics analysis sample and for limited English proficient students in the TFA alumni middle school reading analysis sample. TFA campuses contained a greater percentage of 'other' ethnicity students, but this difference was based on a very small proportion of the sample (TFA, $n = 4$, 0.14

percent and non-TFA $n = 2$, 0.03 percent). It is possible that with a greater percentage of this group of minority students the findings in the present study could be biased. However, with such a small portion of the sample for TFA and non-TFA campuses, it is unlikely that this substantial difference biased the current findings.

TFA campuses contained a substantially greater percentage of limited English proficient students ($n = 169$; 20 percent) than non-TFA campuses ($n = 141$; 13 percent). The analysis excluded scores of non-English TAKS and test scores with linguistic accommodation. Therefore, it is possible that with a greater percentage of limited English proficient students in TFA campuses the impact estimate in the present study could be biased. The reader should take this into account when interpreting this confirmatory impact estimate.

For exploratory analyses, substantial differences remained for three campus-level demographic characteristics for one of the exploratory samples; investigating student 2010-11 TAKS mathematics achievement for elementary students taught by TFA alumni compared to the mathematics achievement of elementary students taught by experienced non-TFA teachers. Due to these maintained differences, caution is warranted when interpreting these exploratory findings. Future research should make efforts to investigate this comparison in a confirmatory manner while taking steps to limit pre-existing differences.

The attribution in this study of the estimated effects of TFA corps members and alumni, relative to novice and experienced non-TFA teachers does come with reservations. Propensity score matching cannot control for unmeasured campus and student characteristics in the way that a randomized experiment can. Random assignment of teachers and students would ensure that all observable and unobservable differences between teachers or students in different conditions would be no larger than would be expected by chance. Although random

assignment was not possible in the current study, future research should strive to conduct an RCT so that unobservable differences may also be taken into account. Although such randomization (either within the teacher-level or both the teacher- and student-level) presents difficulty and challenge, such efforts would allow for stronger attribution of study findings such as differences in student achievement to the effect of TFA.

Selection Bias and TFA Effects

We considered a *backcasting* analysis to assess whether the large and statistically significant *effects* found for TFA corps members or TFA alumni on student 2010-11 TAKS middle grade mathematics scores were an artifact of selection bias. This analysis would involve estimating the same analysis models used to estimate the effects of TFA corps members or TFA alumni on student 2010-11 TAKS middle grade mathematics scores, except the outcome would be the 2009-10 TAKS mathematics scores. The 2009-10 TAKS would measure middle grade students' mathematics scores the year before the TFA campus employed a TFA corps member(s). Because the TFA students were not taught by a TFA corps member before 2010-11 school year, there should be no *TFA effect* on students' 2009-10 TAKS middle grade mathematics scores. If there was an effect, a TFA corps member or alumni cannot improve student performance before they teach the student and the effect would suggest that unobserved, pre-existing student traits relevant to 2010-11 TAKS performance are correlated with the likelihood of being taught by a TFA corps member or alumni; therefore, confounding the TFA effect for 2010-11 TAKS middle grade mathematics scores. To conduct this analysis, we first would have needed to identify students who were not exposed to a TFA corps member or alumnus prior to the 2010-11 school year.

San Antonio ISD was the only district in the present study that did not employ TFA corps members or alumni prior to the 2010-11 school year; therefore, it is likely the majority of students in the district were not previously exposed to TFA corps members or alumni. Our preliminary analyses revealed that only eight or fewer schools in San Antonio ISD had students for whom 2009-10 TAKS scores were available. Therefore, we concluded there was an insufficient number of campuses (and locations representative of the study sample) to conduct a backcasting analysis. When interpreting the results of this study, especially for middle grade mathematics, the reader should consider that the observed effects of TFA corps members and alumni were not verified by a backcasting analysis.

Limited Data on Teacher Characteristics

Due to confidentiality concerns of releasing teacher-level data containing a linking variable to individual students, teacher-level analyses were not possible in the current study. Therefore, teachers were not included as part of the PSM process and additional teacher-level coefficients could not be obtained. Future research should consider similar potential barriers (and possible alternatives) when proposing to access teacher- and student-linked information in state-level data to ensure teacher-level data linked directly to students may be obtained.

The positive and statistically significant findings in this study should be replicated in future research with a richer array of administrative data from TEA to confirm the stability of these findings to extend the evaluation to include value added measures and to discern how to included high school grades with TAKS measures that are not vertically equated. Estimating the cost effectiveness of TFA corps members and alumni is another under-studied area of research in Texas. Previous research has interpreted a TFA effect as a cost savings associated with having a TFA corps member in the classroom, however, such investigations have not been

focused within the state of Texas nor on the middle grades but have focused primarily on the elementary and high school grades. Including measures of cost effectiveness in future research would extend such work and provide further understanding of the effect of TFA corps members and alumni on Texas students and the schools where they teach.

Lack of Data on Teacher Certification and Background

The present study did not investigate teacher certification or teacher degree type as the data were not available. Although previous literature is mixed concerning the effects of teacher certification on student achievement, some studies have found positive relationships[85]. In addition, previous research has also identified a relationship between content of attained college degrees and quality of teaching in matched content areas. For example, past research has found that students taught by teachers with a major in mathematics or mathematics education were more likely to have higher scores on the grade 8 National Assessment of Educational Progress mathematics subtest[86]. It may be the case that more TFA corps members or alumni previously attained degrees in content areas conducive to teaching mathematics compared to degrees obtained by non-TFA teachers. Future research should consider controlling for or investigating the differences between certification and degree status of TFA and non-TFA teachers as well as interactions between TFA status and certification, and degree type.

Variation Fidelity of TFA Implementation

One aspect of the TFA model, which differentiates it from other programs that offer alternative routes to teaching, is that TFA provides support to all TFA corps members during their two-year teaching commitment. In addition, TFA alumni continue to have access to TFA

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[85] Greenberg, Rhodes, Ye, and Stancavage, 2004; Goldhaber and Brewer, 2000.
[86] Greenberg, Rhodes, Ye, and Stancavage, 2004.

resources. However, it is possible that there is a wide variety in the type of support and guidance that non-TFA novice teachers may have received which was not captured in the current evaluation. Furthermore, the current study did not capture this variation by measuring fidelity of TFA corps members and alumni to the TFA instructional model. Thus, there remains an empirical "black box" as to the reasons for positive and statistically significant effects found in this study, and whether the results are reflective of full fidelity to the TFA program and instructional model. Future research should collect information on the fidelity of the on-going training and support that TFA and non-TFA teachers receive to provide context for, and more fully explain, how effects for TFA are produced.

2010–11 TAKS as an Outcome Measure

The 2010-11 TAKS has sound psychometric properties including high reliability. There are a few limitations on the use of 2010-11 TAKS scores for this evaluation that the reader should considered when interpreting the estimated TFA effects. First, TAKS is designed to assess whether a student has mastered knowledge and skills defined in Texas Essential Knowledge and Skills (TEKS) at each tested grade level. TAKS is not specifically designed to measure how students respond to specific instructional practices or instruction by teachers with specific qualifications. As a result, TAKS may not easily detect impact of instruction by TFA corps or alumni members. Second, TAKS is an end-of-year assessment. Unlike an end-of-course assessment, TAKS covers a broad area in each subject. If a course taught by TFA members focuses on a narrow area in a given subject, such as an Algebra I course in mathematics, the TAKS scale score may not exactly reflect what content was covered in such courses and potentially compromise the construct validity for this evaluation purpose.

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Appendices

Appendix A: Data Acquisition, Data Masking Process and Structure

Campus-level Data

To identify campuses with at least one TFA corps member or TFA alumni, researchers obtained a list of 1,840 individuals from TFA who were considered for teaching assignments in any Texas district or open enrollment charter school between the 2006-07 and 2010-11 school years. The TFA list consisted of the individual's name; TFA ID; birth date; cohort year (first year of TFA teaching assignment); TFA region, district, and campus the individual was assigned to (if applicable); main grade taught; additional grade taught; subject taught; subject group; and exit codes.

Exit codes corresponded to whether the individuals on the TFA list had completed their two year contract with TFA, or were assigned to a campus but did not complete their assignment. Reasons for non-completion include: (a) never started their assignment[87], (b) did not complete their assignment due to an emergency release, resignation, or termination, or (c) were still employed in a Texas school within their two year assignment. Based on the exit codes, we excluded all individuals from the TFA list who never started their assignment or did not complete their assignment due to an emergency release, resignation, or termination. As a result, the TFA list consisted of 1,749 individuals with exit codes corresponding to individuals having completed their TFA assignment by the 2010-11 school year, or who were still employed in a Texas school within their two year TFA assignment.

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[87] The exit codes also designated individuals who were interested in becoming corps members, but were not offered an assignment in Texas due to lack of eligibility or acceptable credentials.

We submitted the TFA list of 1,749 teachers to TEA to identify them in the 2010-11 school year Public Education Information Management System (PEIMS) data system submission. PEIMS data are student-, teacher-, administrative-, and campus-level data that are submitted to TEA every year by all districts in the state of Texas. TEA was able to identify 78 percent of the TFA alumni and TFA alumni through PEIMS (approximately 1,364 of the 1,749 individuals) by matching individuals' name, birth date, and district ID. The reason 22 percent of TFA alumni could not be found in the 2010-11 PEIMS data submission is unclear. One explanation may be that a number of individuals on the TFA list left their teaching position in Texas following the completion of their two-year assignment and, as a result, could not be identified in PEIMS.

Based on the TFA list of 1,364 individuals, TEA identified a list of 316 campuses in Texas that employed at least one of the 1,364 TFA corps members or alumni in the 2010-11 school year. We used this list of 316 TFA campuses to identify comparable campuses that did not employ a TFA corps member or alumni in the 2010-11 school year (hereafter' non-TFA campuses) using a propensity score matching (PSM) process (discussed subsequently in the section on PSM). To prepare for the PSM process, we identified the population of campuses in the state of Texas through the Academic Excellence Indicator System (AEIS). The campus population consisted of 8,197 total campuses (316 TFA corps member campuses and 7,882 non-TFA campuses). Next, we stratified the campuses based on campus grade type (elementary, middle, and high school). Within each stratum, non-TFA campuses that were comparable to TFA campuses in terms of 2010-11 campus-level demographics and 2009-10 student achievement were selected as comparison campuses. This matching process resulted in 924 non-TFA comparison campuses. In addition, all schools in the districts where TFA

campuses reside were included as a backup of the comparison campuses in case the 924 non-TFA comparison campuses could not provide a sufficient number of comparable students in the student-level matching. Finally, a list of 1,641 non-TFA campuses and 316 TFA campuses were identified and submitted to TEA for extraction of student-level demographic and achievement data.

Teacher-level Data (as Teacher Indicators at Student Level)

For the 316 TFA campuses, TFA cohorts were identified by their first year teaching assignment in the state of Texas using TFA organization records as shown in Table A-1. Individuals on the TFA list were placed in three categories based on years of experience:

1. **Cohort I**: 2010-11 cohort with first year TFA corps members in 2010-11 school year;

2. **Cohort II**: 2009-10 cohort with second year TFA corps members in 2009-10 school year;

3. **Cohort III:** 2006-07, 2007-08, and 2008-09 cohorts with TFA alumni ("TFA alumni") who have continued teaching in Texas as of the 2010-11 school year beyond their TFA two-year assignment.

Table A-1. TFA cohorts and years of teaching experience

| | Cohort | Years of teaching experience | | | | |
		1st Year	2nd Year	3rd Year	4th Year	5th Year
TFA alumni	2006-07	2006-07	2007-08	2008-09	2009-10	2010-11
	2007-08	2007-08	2008-09	2009-10	2010-11	
	2008-09	2008-09	2009-10	2010-11		
TFA corps members	2009-10	2009-10	2010-11			
	2010-11	2010-11				

Note: Shaded areas represent the school year for which there are student performance data and a teacher-level indicator.

TEA also provided the following two teacher characteristics coded as teacher variables within student-level data:

1. **Teacher Characteristic 1, TFA vs. non-TFA**—For each student course record, TEA included a dichotomous indicator designating whether the specific course the student took in the 2010-11 school year was taught by a TFA corps member or a non-TFA teacher.

2. **Teacher Characteristic 2, Teacher's Years of Teaching**—For each student course record, TEA included of an indicator of the years of teaching experience for TFA corps members, alumni, and non-TFA teachers.[88]

For the 924 non-TFA campuses, the two teacher-level indicators were also included in the student-level data records of students taught by non-TFA teachers.

Student-level Data

For the 1,957 campuses (316 TFA and 1,641 non-TFA campuses), we requested that TEA provide student-level data for students taught by TFA corps members and alumni in the TFA campuses and for all students taught by non-TFA teachers in non-TFA campuses. The request was for student demographic data for the 2010-11 school year, student course enrollment records for mathematics, reading, writing, science, and social studies for the 2010-11 school year, and assessment scores on the Texas Assessment of Knowledge and Skills (TAKS) for the 2007-08 to 2010-11 school years[89]. Each student record contains the following demographic variables:

- Student's district membership in 2010-11 school year

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[88] TEA defines years of experience as the number of verifiable completed years (not including current year) of creditable, professional experience as specified in 19 TAC, Chapter 153.
[89] The 2010-11 TAKS data was used as the outcome measure and the earlier years of TAKS data was averaged and used as the pre-test covariate.

- Student's campus membership in 2010-11 school year

- Number of days students was in the Texas public education system in 2010-11 school year

- Number of days student attended school in 2010-11 school year

- Gender

- Grade level

- Ethnicity

- Economic status

- Special education status

- Limited English proficiency (LEP) status

Student course data contained the following two course enrollment variables, along with two teacher characteristic variables:

- All courses taught by TFA members at TFA campuses and all courses taught by any teachers at non-TFA campuses in the 2010-11 school year.

- Whether the course in the 2010-11 school year was a one-semester course, first semester of two-semester course, second semester of two-semester course, or non-high school grade all-year course:
  o Teacher Characteristic 1 (as defined previously) associated with student course record.
  o Teacher Characteristic 2 (as defined previously) associated with student course record.

The student-level data was also merged with the students' TAKS assessment data. The requested student-level TAKS data included grade 3 through grade 11 students who took the

TAKS between the 2007-08 and 2010-11 school years. Subjects tested in TAKS include mathematics, reading, writing, social studies, and science.[90] For the purposes of this evaluation, however, we focused on TAKS scores for students of TFA corps members, TFA alumni, and non-TFA teachers in mathematics and reading only. The decision to focus solely on these two TAKS subject areas was based on the fact that, while students take TAKS mathematics and reading every year from grade 3 to grade 11, students are only tested in TAKS science in grades 5, 8, 10, and 11 and tested in social studies in grades 8, 10, and 11. Given that TAKS science and social studies are not tested in every grade in every year, the level of confidence in estimating the effect of a TFA corps member value-add on students' science and social studies achievement would have been diminished.

FERPA Requirements and Data Masking

Background

All requests for student-level, de-identified data from TEA must meet the requirements of the Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR Part 99). FERPA requires that TEA delete or mask individual cells associated with data requests that have fewer than five students to protect the identity of individual students and safeguard their personal information. For example, if the students that are categorized by specific demographic variables (e.g., ethnicity, gender, economically disadvantaged, limited English proficiency status, etc.) represent a group less than 5 students, their identities could be determined and therefore would be masked to ensure confidentiality.

Anticipating the data masking issues associated with the FERPA restrictions, we discussed with TEA various data manipulation techniques designed to increase individual

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[90] TAKS is a criterion-referenced assessment of student knowledge and skills as specified in the Texas Essential Knowledge and Skills (TEKS) by grade-level. The psychometric properties of the TAKS are considered a reliable and valid measure of student achievement at grades 3 through 11 in all content areas (Texas Education Agency and Pearson, 2011).

student cell sizes so that they would not be deleted. For instance, we requested that the student ethnicity variable be coded as four variables (i.e., African American, Hispanic, White, and other), with "other" encompassing traditionally smaller ethnic groups in Texas such as American Indian, Asian, and Pacific Islander. Additionally, we asked TEA to code students classified as *limited English proficient* (LEP) as *LEP* or *non-LEP*, rather than the five traditional codes representing different stages of LEP status, including "first year after exiting LEP status," or "second year after exiting LEP status." Our experience with this data has shown us that these simple coding procedures can help overcome many of the FERPA restrictions without jeopardizing the substantive meaning and appropriateness of the analyses.

Data masking process

The data masking process conducted by TEA involves three stages: 1) masking cell generation, 2) frequency calculation for each cell, and 3) masked data removal. In the masking cell generation stage, TEA uses the categorical student-level variables included in the request to create data masking cells. If the requested students' campus name, gender, dichotomous economic status, and dichotomous LEP status indicators are included in the data, the data will result in eight masking cells ($2 \times 2 \times 2 = 8$) within each campus. Since the number of masking cells will multiply by the number of levels for each variable added, especially those with more possible categories, the total number of masking cells will substantially increase. For example, adding the variable *ethnicity* with the six categories (African American, Hispanic, White, Asian, Pacific Islander, other) will result in 48 masked cells ($2 \times 2 \times 2 \times 2 \times 6$) instead of 32 if using the four categories of ethnicity mentioned above.

In the frequency calculation stage, the number of students is totaled for each cell. The size of the masking cell depends on the unit of analysis requested. For example, if the

requested data include student's classroom membership information, a class ID variable will be included and the students in each class will be further divided into masking cells within each class. As a result, some cells at the classroom level will have less than five students within them, assuming an average class size. If the unit of analysis is at the campus level, however, the cells will represent groups of students aggregated to the campus level and will likely not be subject to masking due to larger numbers of students. In the masked data removal stage, students belonging to cells smaller than five students are removed from the data.

A summary of the data masking process that occurred for this evaluation is provided in Table A-2. In particular, the table shows the student demographic distribution of the TFA campus population before masking and that of the masked data for students taught by TFA corps members and alumni at TFA campuses.

Table A-2. Summary of the data masking process

Demographic characteristic	Data before masking: Total TFA campus population from AEIS data		Data after masking: TFA campus student-level data provided by TEA		Percentage point difference
	n	*Percent*	*n*	*Percent*	
African American	50,946	18.62	9,788	18.77	-0.15
Hispanic	208,718	76.28	41,219	79.06	-2.78
White	6,770	2.47	537	1.03	1.44
Economically disadvantaged	237,635	86.84	47,000	90.15	-3.31
Special Education	24,617	9.00	2,748	5.27	3.73
Limited English proficient	73,349	26.81	11,886	22.80	4.01

Note: AEIS = Academic Excellence Indicator System; TFA = Teach For America; TEA = Texas Education Agency

As displayed in the table, Hispanic and economically disadvantaged student groups are somewhat over-represented in the TFA student data matched by TEA, while white, special education, and LEP student groups are somewhat under-represented. Based on the description of the data masking process detailed above, as expected we observed that the under-represented student groups were subject to more data masking than the over- represented

groups. Although the data masking represented a reduction of only 7 percent for the TFA

student group (93 percent match rate) and 1 percent for the non-TFA student group (99 percent

match rate), white, special education, and LEP students were masked most heavily than

Hispanic and economically disadvantaged students. The overall demographic distribution in

the data suggests, however, that the data received from TEA following the masking process are

fairly consistent with the distribution of student populations as evidenced by the statewide data

obtained through AEIS.

Appendix B: Academic Baseline Equivalence by Grade Level

Table B-1. Baseline academic mathematics sample by grade level

| | | | Student participation status | | | | | | | Student participation status | | | | | |
| | | | Students of TFA corps members [a] | | Students of novice non-TFA teachers [b] | | *Mean difference* | *Standardized difference* | | Students of TFA alumni [c] | | Students of experienced non-TFA teachers [d] | | *Mean difference* | *Standardized difference* |
Grade type	*TAKS subtest*	*n*	*Mean*	*SD*	*Mean*	*SD*			*n*	*Mean*	*SD*	*Mean*	*SD*		
Elementary	Grade 4														
	Mathematics	207	585.29	87.12	593.56	84.42	−8.27	0.10	143	577.87	85.58	583.65	86.44	−5.78	0.07
	Reading	207	621.91	104.40	634.04	99.62	−12.14	0.12	143	608.03	107.03	617.82	98.99	−9.78	0.09
	Grade 5														
	Mathematics	338	658.34	89.64	654.72	91.81	3.62	0.04	280	679.69	89.33	674.61	90.94	5.08	0.06
	Reading	338	632.85	89.48	634.04	87.29	−1.19	0.01	280	640.47	88.42	638.99	83.77	1.49	0.02
Middle	Grade 6														
	Mathematics	1,709	690.01	96.83	692.74	93.08	−2.73	0.03	386	715.91	95.64	722.16	96.15	−6.24	0.07
	Reading	1,709	680.61	83.13	679.97	82.33	0.63	0.01	386	696.26	81.10	700.82	85.71	−4.56	0.05
	Grade 7														
	Mathematics	1,384	714.28	96.25	724.52	95.38	−10.23	0.11	250	731.60	90.30	737.99	89.43	−6.39	0.07
	Reading	1,384	716.58	87.64	723.91	88.00	−7.32	0.08	250	691.52	84.54	693.06	83.18	−1.54	0.02
	Grade 8														
	Mathematics	935	734.69	79.41	734.04	79.75	0.65	0.01	262	717.68	77.97	728.36	80.20	−10.68	0.14
	Reading	935	738.98	82.02	739.76	82.62	−0.78	0.01	262	717.79	80.04	723.85	84.45	−6.06	0.07

Note: TFA = Teach For America; TAKS = Texas Assessment of Knowledge and Skills; SD = standard deviation.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

Table B-2. Baseline academic reading sample by grade level

| | | | *Student participation status* | | | | | | | *Student participation status* | | | | | |
| | | | *Students of TFA corps members* [a] | | *Students of novice non-TFA teachers* [b] | | *Mean difference* | *Standardized difference* | | *Students of TFA alumni* [c] | | *Students of experienced non-TFA teachers* [d] | | *Mean difference* | *Standardized difference* |
Grade type	*TAKS subtest*	*n*	*Mean*	*SD*	*Mean*	*SD*			*n*	*Mean*	*SD*	*Mean*	*SD*		
Elementary	Grade 4														
	Mathematics	280	587.08	83.47	584.45	84.81	2.63	0.03	52	603.17	92.35	601.50	95.49	1.67	0.02
	Reading	280	628.02	100.79	627.28	95.88	0.74	0.01	52	639.96	98.55	621.90	103.24	18.06	0.18
	Grade 5														
	Mathematics	550	654.10	85.81	642.64	86.14	11.46	0.13	246	667.21	87.57	660.99	88.40	6.22	0.07
	Reading	550	630.39	82.35	629.48	88.70	0.92	0.01	246	634.52	92.05	628.13	83.73	6.38	0.07
Middle	Grade 6														
	Mathematics	888	693.33	92.15	694.31	91.12	−0.98	0.01	332	693.74	90.20	697.82	95.53	−4.08	0.04
	Reading	888	683.45	86.25	680.21	80.16	3.25	0.04	332	686.96	76.15	698.52	82.15	−11.56	0.15
	Grade 7														
	Mathematics	2,478	712.29	93.44	715.21	91.16	−2.91	0.03	506	735.47	90.26	741.65	91.42	−6.18	0.07
	Reading	2,478	709.86	89.02	711.81	84.08	−1.95	0.02	506	722.57	88.38	728.06	86.17	−5.49	0.06
	Grade 8														
	Mathematics	1,405	735.06	79.81	732.91	79.47	2.15	0.03	440	755.58	75.61	757.59	77.21	−2.01	0.03
	Reading	1,405	730.07	82.55	731.49	76.57	−1.42	0.02	440	758.33	79.91	760.56	76.79	−2.22	0.03

Note: TFA = Teach For America; TAKS = Texas Assessment of Knowledge and Skills; SD = standard deviation.

a. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).

b. Novice non-TFA teachers are teachers with less than three years of teaching experience.

c. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

d. Experienced non-TFA teachers are teachers with three or more years of teaching experience.

Appendix C: Consort Figures

Figure C-1. Elementary grade mathematics sample
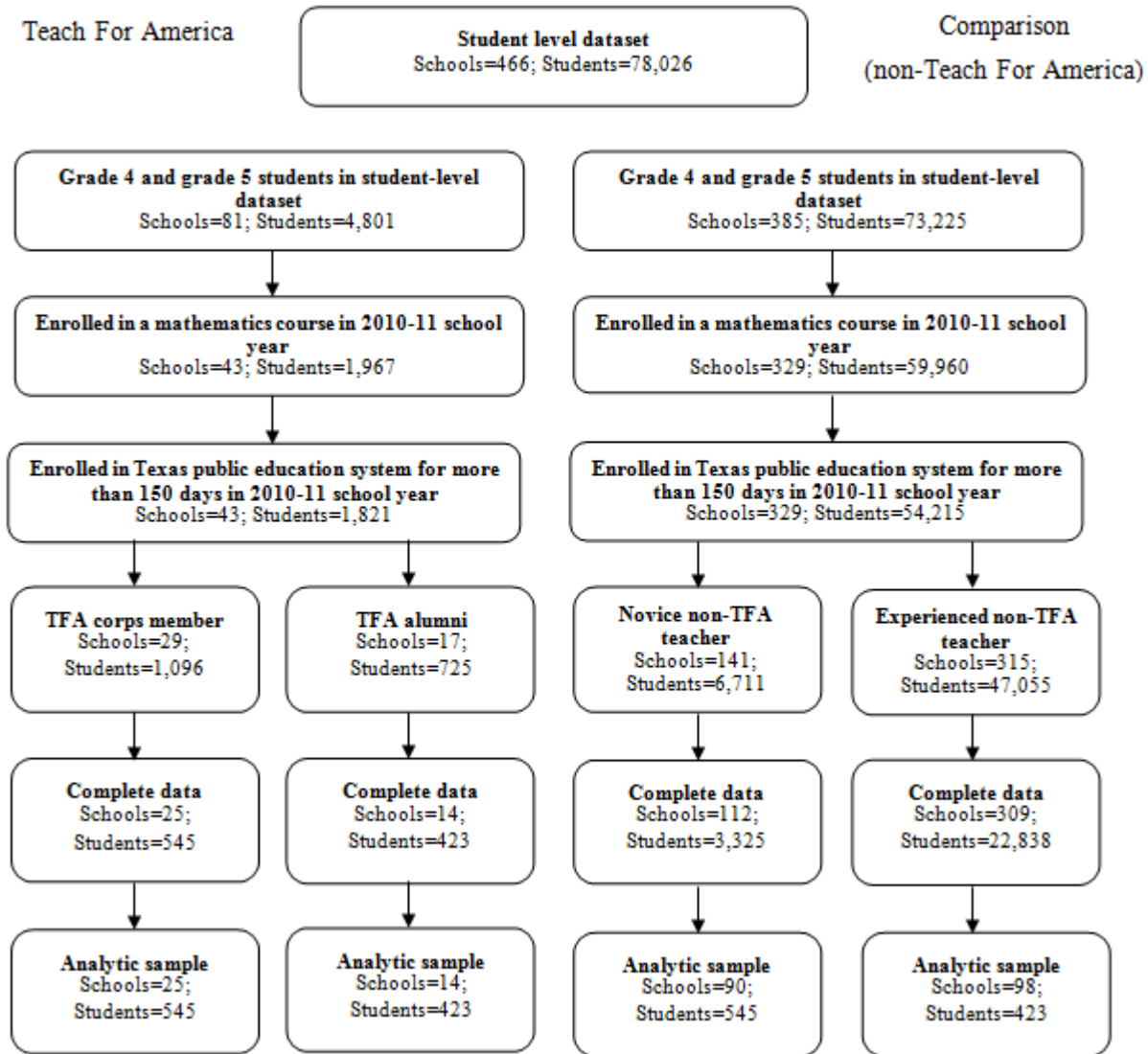
Note: Campus sample numbers may not total due to overlap in some campuses of TFA corps members and alumni with novice or experienced non-TFA teachers.

Figure C-2. Elementary grade reading sample

Teach For America

Student level dataset
Schools=466; Students=78,026

Comparison
(non-Teach For America)

Grade 4 and grade 5 students in student-level dataset
Schools=81; Students=4,801

Grade 4 and grade 5 students in student-level dataset
Schools=385; Students=73,225

Enrolled in an English language arts/reading course in 2010-11 school year
Schools=56; Students=2,585

Enrolled in an English language arts/reading course in 2010-11 school year
Schools=354; Students=60,908

Enrolled in Texas public education system for more than 150 days in 2010-11 school year
Schools=56; Students=2,362

Enrolled in Texas public education system for more than 150 days in 2010-11 school year
Schools=354; Students=55,355

TFA corps member
Schools=41;
Students=1,688

TFA alumni
Schools=18;
Students=574

Novice non-TFA teacher
Schools=155;
Students=6,964

Experienced non-TFA teacher
Schools=336;
Students=46,885

Complete data
Schools=37;
Students=830

Complete data
Schools=14;
Students=298

Complete data
Schools=121;
Students=3,398

Complete data
Schools=328;
Students=22,811

Analytic sample
Schools=37;
Students=830

Analytic sample
Schools=14;
Students=298

Analytic sample
Schools=103;
Students=830

Analytic sample
Schools=80;
Students=298

Note: Campus sample numbers may not total due to overlap in some campuses of TFA corps members and alumni with novice or experienced non-TFA teachers.

Figure C-3. Middle grade mathematics sample

Teach For America

Student level dataset
Schools=488; Students=269,275

Comparison
(non-Teach For America)

Grade 6, grade 7, and grade 8 students in student-level dataset	Grade 6, grade 7, and grade 8 students in student-level dataset
Schools=113; Students=22,275	Schools=375; Students=247,000

Enrolled in a mathematics course in 2010-11 school year	Enrolled in a mathematics course in 2010-11 school year
Schools=61; Students=6,774	Schools=370; Students=233,572

Enrolled in Texas public education system for more than 150 days in 2010-11 school year	Enrolled in Texas public education system for more than 150 days in 2010-11 school year
Schools=61; Students=6,087	Schools=369; Students=213,888

TFA corps member Schools=54; Students=4,935	**TFA alumni** Schools=12; Students=1,138	**Novice non-TFA teacher** Schools=228; Students=26,267	**Experienced non-TFA teacher** Schools=353; Students=182,786

Complete data Schools=51; Students=4,031	**Complete data** Schools=12; Students=898	**Complete data** Schools=209; Students=19,192	**Complete data** Schools=349; Students=135,689

Analytic sample Schools=51; Students=4,028	**Analytic sample** Schools=12; Students=898	**Analytic sample** Schools=205; Students=4,028	**Analytic sample** Schools=200; Students=898

Note: Campus sample numbers may not total due to overlap in some campuses of TFA corps members and alumni with novice or experienced non-TFA teachers.

Figure C-4. Middle grade reading sample

Teach For America

Student level dataset
Schools=488; Students=269,275

Comparison
(non-Teach For America)

Grade 6, grade 7, and grade 8 students in student-level dataset
Schools=113; Students=22,275

Grade 6, grade 7, and grade 8 students in student-level dataset
Schools=375; Students=247,000

Enrolled in a mathematics course in 2010-11 school year
Schools=66; Students=8,646

Enrolled in a mathematics course in 2010-11 school year
Schools=371; Students=235,390

Enrolled in Texas public education system for more than 150 days in 2010-11 school year
Schools=66; Students=7,885

Enrolled in Texas public education system for more than 150 days in 2010-11 school year
Schools=370; Students=215,549

TFA corps member
Schools=56;
Students=6,217

TFA alumni
Schools=19;
Students=1,592

Novice non-TFA teacher
Schools=191;
Students=13,402

Experienced non-TFA teacher
Schools=357;
Students=183,344

Complete data
Schools=55;
Students=5,159

Complete data
Schools=18;
Students=1,307

Complete data
Schools=159;
Students=9,885

Complete data
Schools=351;
Students=141,121

Analytic sample
Schools=55;
Students=4,771

Analytic sample
Schools=18;
Students=1,278

Analytic sample
Schools=157;
Students=4,771

Analytic sample
Schools=181;
Students=1,278

Note: Campus sample numbers may not total due to overlap in some campuses of TFA corps members and alumni with novice or experienced non-TFA teachers

Appendix D: Confirmatory Analyses

Table D-1. Confirmatory model results for TFA corps members

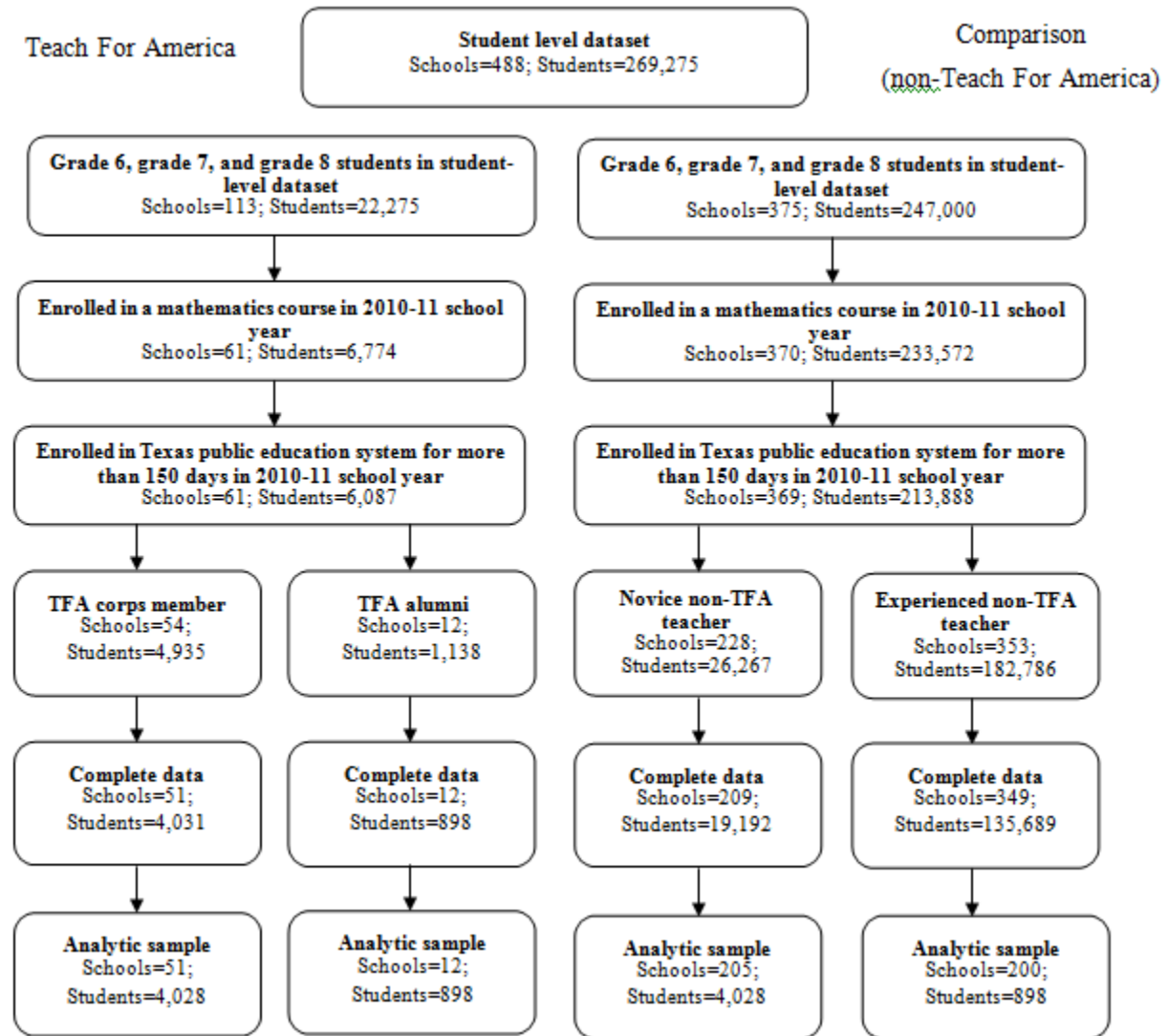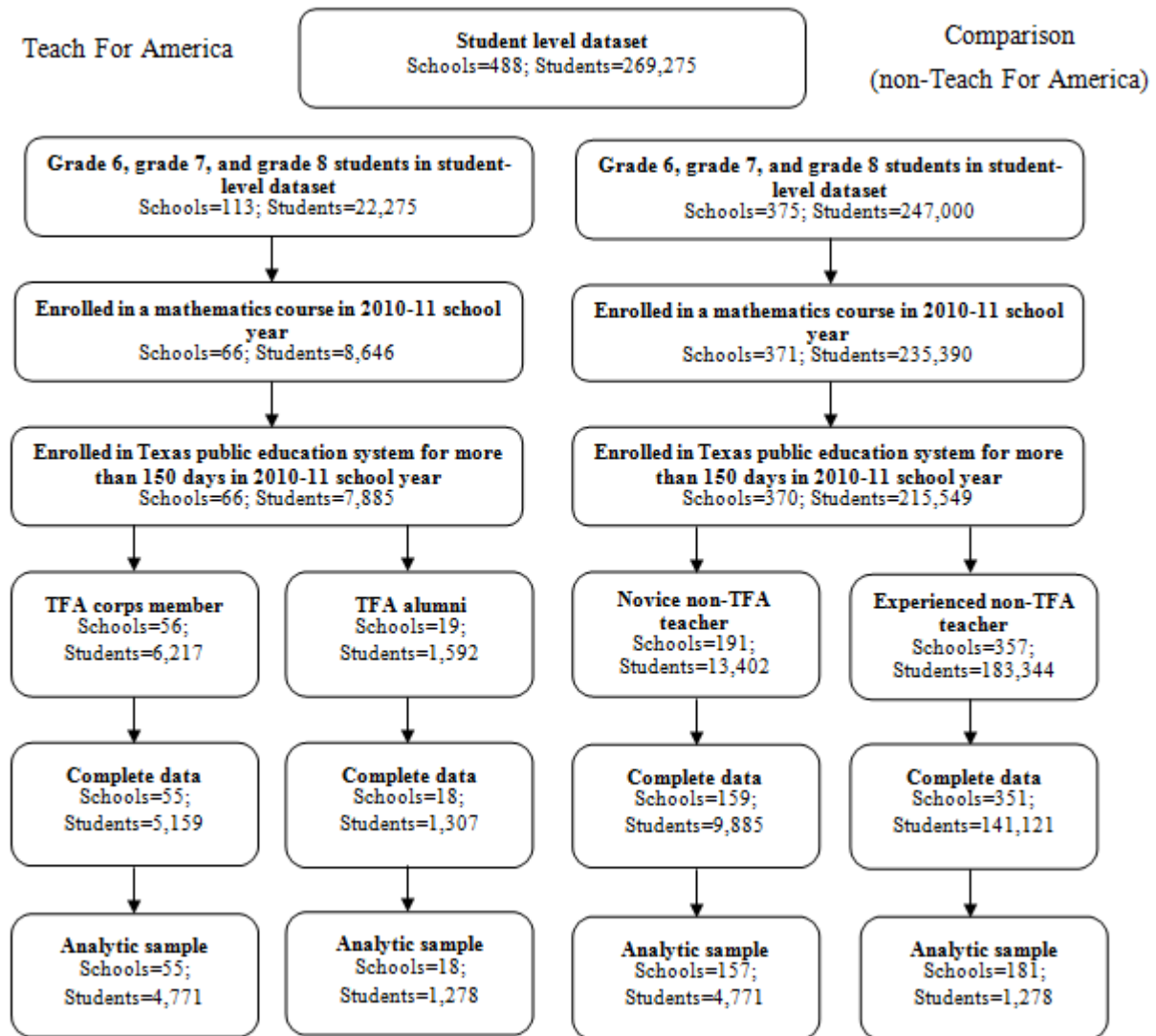| Grade type	TAKS content area / Fixed effects model	Coefficient	Standard error	t	Degrees of freedom	p-value of estimates	Effect size [a]
Elementary [b]	*Mathematics*						
	Intercept	653.97	33.73	19.39	111	<.001	
	TFA	9.99	7.56	1.32	111	0.189	0.11
	Mean centered 2009-10 TAKS [c]	0.72	0.02	29.69	974	<.001	
	Mean campus-level mathematics 2009-10 TAKS	−0.15	0.07	−2.24	111	0.027	
	Economically disadvantaged (campus-level)	0.25	0.35	0.74	111	0.463	
	Reading						
	Intercept	649.94	21.01	30.94	134	<.001	
	TFA	4.11	6.02	0.68	134	0.496	0.04
	Mean centered 2009-10 TAKS [c]	0.67	0.02	34.76	1,519	<.001	
	Mean campus-level reading 2009-10 TAKS	0.03	0.07	0.39	134	0.695	
	Limited English proficient (campus-level)	0.06	0.13	0.45	134	0.653	
	Hispanic (campus-level)	−0.14	0.08	−1.61	134	0.109	
	Economically disadvantaged (campus-level)	0.35	0.22	1.60	134	0.113	
Middle [d]	*Mathematics*						
	Intercept	716.90	9.32	76.94	250	<.001	
	TFA	16.94	3.74	4.53	250	<.001	0.19
	Mean centered 2009-10 TAKS [c]	0.69	0.01	95.10	7,799	<.001	
	Limited English proficient (campus-level)	−0.01	0.08	−0.18	250	0.855	
	Other ethnicity (campus-level)	1.46	4.20	0.35	250	0.729	
	Hispanic (campus-level)	0.15	0.07	2.21	250	0.028	
	Economically disadvantaged (campus-level)	−0.04	0.09	−0.47	250	0.642	
	Reading						
	Intercept	917.47	59.70	15.37	206	<.001	
	TFA	3.79	3.43	1.10	206	0.271	0.04
	Mean centered 2009-10 TAKS [c]	0.71	0.01	87.78	9,329	<.001	
	Other ethnicity (campus-level)	0.13	1.51	0.08	206	0.933	
	African American (campus-level)	−1.61	0.62	−2.62	206	0.010	
	Hispanic (campus-level)	−1.51	0.61	−2.46	206	0.015	
	Economically disadvantaged (campus-level)	0.16	0.10	−1.54	206	0.126	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills.

a. Effect sizes were calculated using Hedge's g, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).

b. Proportion of African American students (campus-level) was excluded from the elementary reading analysis due to multicollinearity.

c. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.

d. Proportions of African American and white students (campus-level) were excluded from the middle grade mathematics analysis due to multicollinearity; Proportion of white students (campus-level) was excluded from the middle grade reading sample because all other ethnic groups are included.

Table D-2. Confirmatory model results for TFA alumni

Grade type	*TAKS content area* Fixed effects model	*Coefficient*	*Standard error*	*t*	*Degrees of freedom*	*p-value of estimates* [a]	*Effect size* [b]
Middle	*Mathematics*						
	Intercept	733.58	20.88	35.14	208	<.001	
	TFA	23.25	6.05	3.84	208	<.001	0.27
	Mean centered 2009-10 TAKS [c]	0.64	0.02	39.53	1,582	<.001	
	Limited English proficient	−10.54	3.65	−2.88	1,582	0.004	
	Limited English proficient (campus-level)	0.02	0.11	0.15	208	0.884	
	Economically disadvantaged (campus-level)	0.10	0.21	0.45	208	0.655	
	Reading						
	Intercept	726.26	24.05	30.20	195	<.001	
	TFA	10.36	4.44	2.33	195	0.021	0.11
	Mean centered 2009-10 TAKS [c]	0.71	0.02	43.75	2,351	<.001	
	White	16.30	9.29	1.75	2,351	0.080	
	Mean campus-level reading 2009-10 TAKS	0.21	0.05	3.96	195	<.001	
	Limited English proficient (campus-level)	−0.16	0.11	−1.42	195	0.157	
	Other ethnicity (campus-level)	1.00	0.39	2.59	195	0.010	
	African American (campus-level)	0.39	0.27	1.44	195	0.152	
	Hispanic (campus-level)	0.54	0.26	2.06	195	0.041	
	Economically disadvantaged (campus-level)	−0.13	0.12	−1.15	195	0.251	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills.

a. Adjusted using Benjamini-Hochberg method.

b. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).

c. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.

d. Unless otherwise noted, 'other' includes American Indian, Alaskan Native, Asian, Native Hawaiian, other Pacific Islander, and two or more races; Hispanic includes Latino

Appendix E: Table for Confirmatory Sensitivity Analysis

Table E-1. Algebra I sensitivity analysis

TAKS content area Fixed effects model	*Coefficient*	*Standard error*	*t*	*Degrees of freedom*	*p-value of estimates*	*Effect size* [a]
TFA corps members [b]						
Intercept	713.66	9.40	75.89	245	<.001	
TFA	16.33	3.87	4.22	245	<.001	0.19
Mean centered 2009-10 TAKS [c]	0.68	0.01	90.98	7,296	<.001	
Limited English proficient (campus-level)	0.01	0.08	0.13	245	0.900	
Other ethnicity (campus-level)	0.67	3.20	0.21	245	0.835	
Hispanic (campus-level)	0.14	0.07	1.98	245	0.049	
Economically disadvantaged (campus-level)	−0.05	0.09	−0.55	245	0.582	
TFA alumni [d]						
Intercept	731.63	20.63	35.47	205	<.001	
TFA	21.28	6.24	3.41	205	0.001	0.26
Mean centered 2009-10 TAKS [c]	0.64	0.02	37.50	1,446	<.001	
Limited English proficient	−9.40	3.72	−2.53	1,446	0.012	
Limited English proficient (campus-level)	0.03	0.10	0.32	205	0.751	
Economically disadvantaged (campus-level)	0.06	0.21	0.30	205	0.763	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills. There were 3,667 students taught by TFA corps members and 3,881 students taught by novice non-TFA teachers. There were 815 students taught by TFA alumni and 842 students taught by experienced non-TFA teachers.

a. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).
b. TFA corps members are defined as members who were within their two-year contract assignment in the 2010-11 school year and include corps members in their first year of assignment (2010-11) and those in their second year of assignment (whose first year was 2009-10).
c. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.
d. TFA alumni are defined as corps members who completed their two-year assignment prior to the 2010-11 school year and continued to work in Texas schools in the 2010-11 school year.

Appendix F: Tables for Exploratory Analyses

Table F-1. Exploratory TFA effects by region

Grade type	TAKS content area Fixed effects model	Coefficient	Standard error	t	Degrees of freedom	p-value of estimates [a]	Effect size [b]
Elementary	*Mathematics*						
	Intercept	683.66	18.57	36.81	203	<.001	
	TFA	3.95	25.16	0.16	203	0.875	
	Dallas	30.22	19.55	1.55	203	0.124	
	Houston	10.75	14.30	0.75	203	0.453	
	Rio Grande Valley	7.60	15.13	0.50	203	0.616	
	TFA*Dallas-Fort Worth	−9.43	32.60	−0.29	203	0.773	−0.10
	TFA*Houston	6.46	26.04	0.25	203	0.804	0.07
	TFA*Rio Grande Valley	-3.55	28.17	−0.13	203	0.900	−0.04
	Mean centered 2009-10 TAKS [c]	0.71	0.02	39.01	1,697	<.001	
	Female	−2.08	2.99	−0.70	1,697	0.487	
	Limited English proficient	−6.55	5.24	−1.25	1,697	0.212	
	Economically disadvantaged	−21.14	11.01	−1.92	1,697	0.055	
	Hispanic	14.84	5.48	2.71	1,697	0.007	
	Mean campus-level mathematics 2009-10 TAKS	−0.07	0.05	−1.29	203	0.197	
	Reading						
	Intercept	678.52	19.91	34.07	151	<.001	
	TFA	−20.40	28.54	−0.71	151	0.476	
	Dallas	14.95	22.12	0.68	151	0.500	
	Houston	−0.37	18.38	−0.02	151	0.984	
	Rio Grande Valley	0.92	19.62	0.05	151	0.963	
	TFA*Dallas-Fort Worth	9.56	34.20	0.28	151	0.780	0.11
	TFA*Houston	29.43	29.36	1.00	151	0.318	0.03
	TFA*Rio Grande Valley	17.14	32.31	0.53	151	0.597	0.19
	Mean centered 2009-10 TAKS [c]	0.61	0.02	35.03	1,913	<.001	
	Female	8.26	2.87	2.87	1,913	0.004	
	Limited English proficient	−11.49	5.13	−2.24	1,913	0.025	
	Economically disadvantaged	−6.09	7.70	−0.79	1,913	0.430	
	Hispanic	3.43	4.55	0.75	1,913	0.451	
	Mean campus-level reading 2009-10 TAKS	0.04	0.07	0.67	151	0.504	
Middle	*Mathematics*						
	Intercept	713.35	13.00	54.85	125	<.001	
	TFA	4.98	15.91	0.31	125	0.755	
	Dallas	5.87	14.10	0.42	125	0.678	
	Houston	23.25	13.01	1.79	125	0.076	
	Rio Grande Valley	16.59	13.18	1.26	125	0.210	
	TFA*Dallas-Fort Worth	21.84	18.82	1.16	125	0.248	0.26
	TFA*Houston	4.96	16.84	0.29	125	0.769	0.06
	TFA*Rio Grande Valley	5.54	17.72	0.31	125	0.755	0.06
	Mean centered 2009-10 TAKS [c]	0.66	0.01	70.68	5,645	<.001	
	Female	−0.11	1.49	−0.08	5,645	0.939	
	Limited English proficient	−8.34	2.05	−4.06	5,645	<.001	
	Economically disadvantaged	−3.44	3.25	−1.06	5,645	0.290	
	Hispanic	9.82	2.53	3.88	5,645	<.001	
	Mean campus-level mathematics 2009-10 TAKS	0.23	0.05	4.45	125	<.001	
	Reading						
	Intercept	774.09	14.96	51.76	129	<.001	
	TFA	−9.44	18.50	−0.51	129	0.611	
	Dallas	−21.93	15.27	−1.44	129	0.153	
	Houston	−19.29	14.72	−1.31	129	0.193	
	Rio Grande Valley	−13.65	15.11	−0.90	129	0.368	
	TFA*Dallas-Fort Worth	25.09	20.76	1.21	129	0.229	0.28
	TFA*Houston	12.23	19.30	0.63	129	0.527	0.14
	TFA*Rio Grande Valley	16.95	20.24	0.84	129	0.404	0.19
	Mean centered 2009-10 TAKS [c]	0.66	0.01	50.68	4,187	<.001	
	Female	2.57	1.95	1.32	4,187	0.187	
	Limited English proficient	−16.56	3.14	−5.27	4,187	<.001	
	Economically disadvantaged	−7.82	4.22	−1.85	4,187	0.064	
	Hispanic	6.11	3.08	1.98	4,187	0.048	
	Mean campus-level reading 2009-10 TAKS	0.09	0.05	1.73	129	0.085	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills. In the elementary grade

mathematics sample, there were 39 students taught by TFA corps members at 4 campuses and 40 students taught by non-TFA teachers at 10 campuses in the Dallas-Fort Worth region; there were 736 students taught by TFA corps members at 24 campuses and 732 students taught by non-TFA teachers at 98 campuses in the Houston region; there were 159 students taught by TFA corps members at 6 campuses and 150 students taught by non-TFA teachers at 55 campuses in the Rio Grande Valley region; and there were 23 students taught by TFA corps members at 3 campuses and 35 students taught by non-TFA teachers at 12 campuses in the San Antonio region.

In the middle grade mathematics sample, there were 411 students taught by TFA corps members at 9 campuses and 418 students taught by non-TFA teachers at 12 campuses in the Dallas-Fort Worth region; there were 1,584 students taught by TFA corps members at 33 campuses and 1,551 students taught by non-TFA teachers at 32 campuses in the Houston region; there were 718 students taught by TFA corps members at 11 campuses and 763 students taught by non-TFA teachers at 29 campuses in the Rio Grande Valley region; and there were 179 students taught by TFA corps members at 5 campuses and 160 students taught by non-TFA teachers at 3 campuses in the San Antonio region.

In the elementary grade reading sample, there were 88 students taught by TFA corps members at 6 campuses and 84 students taught by non-TFA teachers at 7 campuses in the Dallas-Fort Worth region; there were 798 students taught by TFA corps members at 32 campuses and 815 students taught by non-TFA teachers at 70 campuses in the Houston region; there were 130 students taught by TFA corps members at 5 campuses and 123 students taught by non-TFA teachers at 27 campuses in the Rio Grande Valley region; and there were 23 students taught by TFA corps members at 3 campuses and 17 students taught by non-TFA teachers at 10 campuses in the San Antonio region.

In the middle grade reading sample, there were 338 students taught by TFA corps members at 9 campuses and 339 students taught by non-TFA teachers at 25 campuses in the Dallas-Fort Worth region; there were 1,206 students taught by TFA corps members at 37 campuses and 1,207 students taught by non-TFA teachers at 27 campuses in the Houston region; there were 554 students taught by TFA corps members at 10 campuses and 549 students taught by non-TFA teachers at 24 campuses in the Rio Grande Valley region; and there were 67 students taught by TFA corps members at 4 campuses and 70 students taught by non-TFA teachers at 2 campuses in the San Antonio region.

a. Adjusted using Benjamini-Hochberg method.

b. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).

c. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.

Table F-2. Exploratory TFA effects by status as corps member or alumni

Grade type	TAKS content area / Fixed effects model	Coefficient	Standard error	t	Degrees of freedom	p-value of estimates	Effect size [a]
Elementary	*Mathematics*						
	Intercept	671.51	26.24	25.59	180	<.001	
	TFA	9.94	6.73	1.48	180	0.141	
	TFA alumni or experienced non-TFA teacher	6.76	4.98	1.36	1,747	0.175	
	TFA*TFA alumni or experienced non-TFA teacher	−6.09	9.90	−0.62	1,747	0.538	−0.06
	Mean centered 2009-10 TAKS [b]	0.72	0.02	40.77	1,747	<.001	
	Limited English proficient	−14.08	4.88	−2.89	1,747	0.004	
	Mean campus-level mathematics 2009-10 TAKS	−0.08	0.05	−1.66	180	0.098	
	Economically disadvantaged (campus-level)	−0.03	0.26	−0.1	180	0.917	
	Hispanic (campus-level)	0.18	0.08	2.26	180	0.025	
	Reading						
	Intercept	659.33	16.82	39.20	191	<.001	
	TFA	3.04	5.65	0.54	191	0.591	
	TFA alumni or experienced non-TFA teacher	10.07	5.13	1.96	2,055	0.050	
	TFA*TFA alumni or experienced non-TFA teacher	0.20	9.17	0.02	2,055	0.983	0.00
	Mean centered 2009-10 TAKS [b]	0.65	0.02	40.08	2,055	<.001	
	Female	6.34	2.78	2.28	2,055	0.023	
	Mean campus-level reading 2009-10 TAKS	−0.02	0.06	−0.31	191	0.757	
	Limited English proficient (campus-level)	−0.11	0.11	−1.00	191	0.320	
	Hispanic (campus-level)	−0.07	0.08	−0.97	191	0.334	
	Economically disadvantaged (campus-level)	0.19	0.17	1.14	191	0.257	
Middle [c]	*Mathematics*						
	Intercept	718.03	8.88	80.85	335	<.001	
	TFA	18.67	3.45	5.41	335	<.001	
	TFA alumni or experienced non-TFA teacher	6.64	2.45	2.71	9,508	0.007	
	TFA*TFA alumni or experienced non-TFA teacher	−1.11	4.88	−0.23	9,508	0.820	−0.01
	Mean centered 2009-10 TAKS [b]	0.68	0.01	100.64	9,508	<.001	
	Limited English proficient	−9.66	1.56	−6.20	9,508	<.001	
	Limited English proficient (campus-level)	0.05	0.07	0.74	335	0.459	
	Hispanic (campus-level)	0.16	0.06	2.54	335	0.012	
	Economically disadvantaged (campus-level)	−0.04	0.08	−0.51	335	0.610	
	Reading						
	Intercept	751.17	7.94	94.58	312	<.001	
	TFA	3.66	2.61	1.40	312	0.163	
	TFA alumni or experienced non-TFA teacher	−1.60	2.34	−0.68	11,774	0.494	
	TFA*TFA alumni or experienced non-TFA teacher	7.71	3.69	2.09	11,774	0.037	0.08
	Mean centered 2009-10 TAKS [b]	0.68	0.01	89.20	11,774	<.001	
	Limited English proficient	−21.89	1.85	−11.86	11,774	<.001	
	White	6.80	7.87	0.86	11,774	0.388	
	Mean campus-level reading 2009-10 TAKS	0.33	0.04	9.02	312	<.001	
	Limited English proficient (campus-level)	0.34	0.07	4.92	312	<.001	
	Other ethnicity (campus-level)	0.51	0.30	1.70	312	0.090	
	Hispanic (campus-level)	0.06	0.05	1.20	312	0.233	
	Economically disadvantaged (campus-level)	−0.05	0.07	−0.70	312	0.487	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills. There were 545 elementary grade students in the mathematics sample taught by TFA corps members across 25 campuses and 545 elementary grade students in the mathematics sample taught by novice non-TFA teachers across 90 campuses; there were 423 elementary grade students in the mathematics sample taught by TFA alumni across 14 campuses and 423 elementary grade students in the mathematics sample taught by experienced non-TFA teachers across 98 campuses; there were 830 elementary grade students in the reading sample taught by TFA corps members across 37 campuses and 830 elementary grade students in the reading sample taught by novice non-TFA teachers across 103 campuses; there were 298 elementary grade students in the reading sample taught by TFA alumni across 14 campuses and 298 elementary grade students in the reading sample taught by experienced non-TFA teachers across 80 campuses. There were 4,028 middle grade students in the mathematics sample taught by TFA corps members across 51 campuses and 4,028 middle grade students in the mathematics sample taught by novice non-TFA teachers across 205 campuses; there were 898 middle grade students in the mathematics sample taught by TFA alumni across 12

campuses and 898 middle grade students in the mathematics sample taught by experienced non-TFA teachers across 200 campuses; there were 4,771 middle grade students in the reading sample taught by TFA corps members across 55 campuses and 4,771 middle grade students in the reading sample taught by novice non-TFA teachers across 157 campuses; there were 1,278 middle grade students in the reading sample taught by TFA alumni across 18 campuses and 1,278 middle grade students in the reading sample taught by experienced non-TFA teachers across 181 campuses.

a. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).

b. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.

c. The proportion of African American students (campus-level) was excluded from the middle grade reading analysis due to multicollinearity.

Table F-3. Exploratory effects of TFA alumni on elementary student TAKS mathematics and reading achievement

Grade type	TAKS content area	Coefficient	Standard error	t	Degrees of freedom	p-value of estimates	Effect size [a]
Elementary[c]	*Mathematics*						
	Intercept	713.60	38.55	18.51	107	<.001	
	TFA	3.50	8.05	0.43	107	0.665	0.04
	Mean centered 2009-10 TAKS [b]	0.74	0.03	27.57	732	<.001	
	Limited English proficient	−8.97	6.62	−1.36	732	0.176	
	Mean campus-level mathematics 2009-10 TAKS	−0.01	0.06	−0.10	107	0.920	
	Hispanic (campus-level)	0.04	0.11	0.31	107	0.757	
	Economically disadvantaged (campus-level)	−0.21	0.37	−0.58	107	0.566	
	Reading						
	Intercept	792.53	81.09	9.77	88	<.001	
	TFA	−4.09	8.82	-0.46	88	0.644	−0.05
	Mean centered 2009-10 TAKS [b]	0.60	0.03	18.74	501	<.001	
	Mean campus-level reading 2009-10 TAKS	0.07	0.08	0.93	88	0.356	
	African American (campus-level)	−1.04	0.82	−1.27	88	0.207	
	Hispanic (campus-level)	−1.04	0.80	−1.29	88	0.199	
	Economically disadvantaged (campus-level)	−0.02	0.27	−0.09	88	0.927	

Note: TFA = Teach For America; TAKS = Texas Assessment of Academic Skills. There were 423 students in the mathematics sample taught by TFA corps members or alumni across 14 campuses and 423 students taught by novice non-TFA teachers or experienced non-TFA teachers across 98 campuses; there were 298 students in the reading sample taught by TFA corps members or alumni across 14 campuses and 298 students taught by novice non-TFA teachers or experienced non-TFA teachers across 80 campuses.

a. Effect sizes were calculated using Hedge's *g*, consistent with the guidance in Appendix B of the WWC *Procedures and Standards Handbook* (version 2.1).

b. The content domain of mean centered 2009-10 TAKS corresponds with TAKS outcome content area.

c. The proportion of African American students (campus-level) was excluded from the elementary mathematics analysis due to multicollinearity. The proportion of 'other' ethnicity students (campus-level) was excluded from the elementary reading analysis due to multicollinearity.