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APPENDIXES
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Regional Educational Laboratory Northeast
At Education Development Center, Inc.

Investigating the Relationship between Adherence to Connecticut's Teacher Education and Mentoring Program Requirements and Teacher Retention

See https://go.usa.gov/xGKbt for the full report.

Appendix A. Literature review

Teacher induction, coaching, and mentoring programs are common professional supports for beginning teachers (Goldrick, 2016). Such programs typically pair a beginning teacher with an experienced teacher or mentor (Smith & Ingersoll, 2004) and initiate beginning teachers into the profession and into a particular school. Induction programs are intended to support beginning teachers as the national teaching force grows older and retires and the proportion of new, inexperienced teachers increases (Ingersoll et al., 2014). The latest evidence suggests that beginning teachers are more common in U.S. schools today than at any other time in the last 20 years (Goldrick, 2016).

Teacher retention

Beginning teachers have the highest rates of turnover (Borman & Dowling, 2008; Guarino et al., 2006) and are often less effective than more experienced teachers (Hanushek et al., 2005; Ladd & Sorenson, 2015; Papay & Kraft, 2015). Recent national data suggest that 17 percent of beginning teachers leave the profession within their first four years (Gray & Taie, 2015).

School and district characteristics such as urbanicity and racial/ethnic composition are also related to teacher retention. Schools with higher proportions of racial/ethnic minority, low-income, and low-performing students tend to have lower teacher retention rates (Guarino et al., 2006). Further, there is a positive relationship between teacher retention and student achievement: schools with high teacher retention have higher student achievement (Boyd et al., 2005; Guin, 2004; Hanushek et al., 1999).

Teacher induction programs and outcomes

Teacher induction programs are one way to support beginning teachers, improve their teaching practices, and increase retention. Comprehensive teacher induction and mentoring programs may have a positive impact on three sets of outcomes: teacher commitment and retention, teacher classroom instructional practices, and student achievement (Ingersoll & Strong, 2011). Several studies have shown significantly higher retention rates among beginning teachers who are in induction programs than among beginning teachers who are not in such

programs (Bastian & Marks, 2017; Cohen & Fuller, 2006; Fuller, 2003; Henke et al., 2000; Ingersoll & Smith, 2004a, 2004b; Kapadia et al., 2007; Ronfeldt & McQueen, 2017).

However, there are exceptions to this pattern. One large-scale randomized controlled trial on teacher induction programs did not find a difference in teacher retention or in classroom practices but found an impact on student achievement after three years (Glazerman et al., 2010). The conflicting findings from studies of induction programs might be due partly to variations in program quality or to uneven implementation (Carver & Feiman-Nemser, 2009; Kardos & Johnson, 2010). One study of a statewide induction program reported uneven implementation across the state, with high engagement in the program related to higher scores on most measures of teaching practice and higher test scores for students (Thompson et al., 2004). The reality of uneven implementation makes monitoring fidelity an important part of education intervention (Hulleman & Cordray, 2009). Furthermore, such monitoring should be present for all the component processes within the intervention (Keller-Margulis, 2012).

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Appendix B. Methods

This appendix contains information about the data, nonresponse bias analysis, sample, analysis methods, and sensitivity analysis.

Data

The Connecticut State Department of Education's Talent Office maintains multiple databases of teacher information. The Employment/Assignment database contains information such as the hiring date and district employment. The Teacher Education and Mentoring (TEAM) Program implementation database, referred to as the TEAM system, contains logs for mentoring sessions and information about beginning teachers' progress through the program's five modules. The department merged data from these databases to prepare data files for the study team on the cohorts of teachers who started the TEAM Program between the 2012/13 and the 2015/16 school years. The data files contained the first three years of data for each teacher (table B1).

Table B1. Elements of the data files used for the study

Element	Description
Identification number	The state-issued identification number of each teacher.
District identification number and name	The state-issued identification number and name of the district in which a teacher taught each year.
School identification number and name	The state-issued identification number and name of the school in which a teacher taught each year.
Teacher Education and Mentoring (TEAM) system entry date	The date a teacher was entered into the TEAM system.
Module start date	The date a teacher created a performance profile for a module; there are four fields, one each for modules 1–4.
Module reflection paper submission date	Date a teacher submitted the reflection paper for a module for the first time; there are four fields, one each for modules 1–4.
Module completion date	Date the reviewer determined that the reflection paper for a module indicated that a teacher achieved the goals for the module; there are four fields, one each for modules 1–4.
Number of mentoring sessions in the module	Number of times mentoring took place in a module; there are four fields, one each for modules 1–4.
Total mentoring hours for the module	Total hours of mentoring for a module; there are four fields, one each for modules 1–4.
District performance category	Alliance district (which consists of Opportunity districts and Priority districts) or non–Alliance district.
School grade span	Preschool/elementary (preschool through grade 5), secondary (grades 6–12), or combined grade (a combination of preschool/elementary and secondary grades).
Title I status flag	Flag for Title I schools.

Source: Authors' compilation.

The legislation creating the TEAM Program contains eight requirements. The study team solicited input from its advisory committee on secondary, lenient thresholds for the requirements, but those thresholds were not used because reliable data were lacking or because they were met by nearly all teachers and therefore deemed not useful for the analyses. The variables considered for each requirement, and the secondary, lenient thresholds proposed for them, were:

- *Number of days elapsed from the date of entering the TEAM system before the beginning teacher is assigned a mentor.* Districts are required to assign beginning teachers a mentor within 30 days of their entering the TEAM system. The advisory committee suggested a lenient threshold of 40 days. The TEAM Program staff

advised the study team against using this variable because its reporting is extremely unreliable. The variable was thus not included in the data files used for the study.

- *Total contact hours.* Beginning teachers are required to have 50 contact hours with their mentor during the program. The advisory committee suggested a lenient threshold of 40 hours. The total contact hours variable was not included in the main analysis because it was confounded with the length of time a teacher was in the program.
- *Contact hours per module.* Beginning teachers are required to have 10 contact hours with their mentor per module. The advisory committee considered this overly restrictive, noting that contact hours should respond to the varying needs of individual teachers for each module. In addition, approximately 20 percent of teachers were missing data on contact hours for one or more modules. As a consequence, the study team used average contact hours per module to determine adherence to this requirement. Module 5 was excluded from the calculation of average contact hours because few teachers receive any mentoring for this special module that does not require a reflection paper. For determining adherence on contact hours during the first year of teaching, an alternative of a total of 20 contact hours in the first year of the program was used. This was based on the fact that sometimes teachers are in the middle of a module at the end of the first year.
- *Number of modules completed.* Beginning teachers are required to complete five modules. The advisory committee did not suggest a lenient threshold on the basis that the more stringent threshold mirrored the language of the state legislation.
- *Number of modules completed in the first year.* Beginning teachers are required to complete two modules in the first year. The advisory committee did not suggest a lenient threshold on the basis that the more stringent threshold mirrored the language of the state legislation.
- *Time to complete all five modules.* Beginning teachers are required to complete all five modules by the end of the second year. The advisory committee suggested a lenient threshold of three years; however, the study did not use the lenient threshold because nearly all teachers who did not leave the Connecticut public school system in the first three years met it. Also, a lenient threshold would make this "time to complete" requirement indistinguishable with the "number to complete" requirement, as the program has a limit of three years maximum.
- *Time to submit first two reflection papers.* Beginning teachers are required to submit two reflection papers in the first year. The advisory committee did not suggest a lenient threshold on the basis that the more stringent threshold mirrored the language of the state legislation.
- *Time to submit all reflection papers.* Beginning teachers are expected to submit all four reflection papers by the end of the second year of the program. The advisory committee suggested a lenient threshold of three years, but the study did not use the lenient threshold because nearly all teachers who did not leave the Connecticut public school system in the first three years met it.

The study team examined intercorrelations between program requirements in terms of teachers meeting the threshold for adherence and found that all but one of the pairwise correlations was positive and significant. Based on this finding, the study team proceeded with weighting each program requirement equally for the calculation of the adherence score.

Nonresponse bias analysis

A nonresponse bias analysis was conducted to examine differences between teachers with data on contact hours for all modules and teachers without these data for one or more modules. In addition, the study team consulted the TEAM Program staff. Missing data on contact hours meant that either teachers had no information on contact

hours or that the teachers had zero contact hours with their mentor. The nonresponse bias analysis revealed that teachers without data on contact hours for some modules had an adherence score that was statistically significantly lower than teachers with data on contact hours. The likelihood for retention among teachers without data on contact hours for some modules was also statistically significantly lower. This suggests that a lack of data on contact hours is an indicator of lower adherence, which in turn is related to lower teacher retention.

Sample

The sample for the study consisted of all 7,708 category 1 beginning teachers in Connecticut's 170 districts who entered the TEAM Program between the 2012/13 and 2015/16 school years. Category 1 teachers include teachers certified in elementary education (excluding birth through age 3 programs), middle school, English language arts, health, math, science, social studies, special education, bilingual education, music, physical education, art, world languages, remedial reading or remedial language arts, and English learner education. Category 1 teachers exclude teachers in business education or technology education as well as psychologists and driver education instructors, among others (Connecticut State Department of Education, n.d.). To participate in the TEAM Program, teachers must be:

- Teaching under an initial educator certificate or an interim initial educator certificate in a subject area applicable to the program, as long as the teacher will remain in the same position for the entire year.
- Employed in a Connecticut public school, charter school, or approved private special education facility.
- Employed full time or part time, provided they are teaching under a valid certificate in a content area that is in compliance with their certificate, or in a full 10-month Connecticut State Department of Education five-term substitute position in a content area that is in compliance with their certificate (Connecticut State Department of Education, n.d.).

Analysis methods

The study team calculated the adherence score for each individual teacher by counting the number of program requirements that met the threshold set by the legislature then dividing the total by six, which is the number of program requirements used in the study. The adherence score for a given teacher ranges from 0, meaning the teacher completed none of the requirements, to 1, meaning the teacher completed all six requirements. For the analysis of the association between program adherence and retention after one year of teaching, the study team used the adherence score based on the three program requirements that are relevant to the first year.

To determine whether adherence to individual requirements varied by school or district characteristics, the study team calculated the proportion of teachers completing each requirement, disaggregated by school grade span, school Title I status, and district performance category.

Retention was determined using data from the state's Employment/Assignment database. A teacher was considered retained in the district if he or she was teaching in the same district in both the base year and the follow-up year and retained in the state if the teacher was teaching in a Connecticut public school in both the base year and the follow-up year. Retention analyses do not account for when during the school year the teacher left. Although a variable in the database indicated the date when the teacher left the classroom, it did not differentiate the teachers who left the Connecticut public school system for good from the teachers who returned in the following school year, changed schools or districts, or changed from long-term substitute teaching to full-time teaching.

The study team investigated the viability of using the variable date out of classroom to perform a more nuanced analysis of retention but decided against doing so for five reasons. First, more than a third of teachers who left midyear did so during June, which is the end of the school year. Second, merely 1.5 percent of teachers left

midyear during their first year. Then, 1.1 percent of teachers left midyear during their first year but returned to teaching in the Connecticut public school system the following year. Likewise, merely 2.0 percent of teachers left midyear during their second year. Then, 1.5 percent of teachers left midyear during their second year but returned to teaching in the Connecticut public school system the following year. Taken together, these small percentages indicate that the use of the date out of classroom variable would not change the substantive results. Nevertheless, the study team found that teachers who left midyear, regardless of whether they returned, had lower adherence scores, and teachers who did not return after leaving had even lower scores.

To understand whether adherence to the requirements of the TEAM Program was correlated with teacher retention, the study team first calculated a series of summary descriptive statistics, including the percentage of beginning teachers retained in their district and in the Connecticut public school system. The study team then calculated retention rates for each district and used a chi-square test for contingency tables to determine whether retention rates differed by district performance category.

The study team also conducted a series of analyses in which a binary indicator of retention status was regressed on adherence score. Although the outcome, retention, and main independent variable (adherence score) were teacher-level variables, original district of employment is likely to exert idiosyncratic influence on retention. Consequently, the analysis relied on teacher-nested-within-district hierarchical generalized linear modeling. Retention was analyzed in terms of in-district and in-state (retention in the Connecticut public school system) for two periods: after the first year of teaching and after the third year of teaching.

The model was designed to address one of the Connecticut State Department of Education's main interests: whether the relationship between program adherence and retention is moderated by district's high-need status. Since the descriptive analysis revealed that Opportunity districts had distinctively different results from those of non–Opportunity districts, the study focused on the moderating effect of Opportunity district status.

The main analysis model was:

Teacher-level model:

$\text{Log}(P / (1 - P)) = b_{0j} + b_{1j}(\textit{Adherence Score})_{ij}$

District-level model:

Model for intercept

$b_{0j} = g_{00} + d_{01}(\textit{Opportunity district})_j + u_{0j}$

Model for slope b_{1j}

$b_{1j} = g_{10} + d_{11}(\textit{Opportunity district})_j$

where P is the probability of a teacher being retained after one year of teaching or after three years, subscripts i and j refer to individual teacher i in district j, u is the district random effect, and d is the indicator variable for Opportunity district. Non–Opportunity district therefore serves as the referent category.[1]

The decision to use hierarchical generalized linear modeling as opposed to single-level regression with clustered standard errors was based on the former's ability to model cross-level moderation—that is, the influence district characteristics may have on the relationship between program adherence and retention—as well as its flexibility to use various models for sensitivity analyses.

[1] Another set of analyses using Alliance district status instead of Opportunity district status was also performed but is not included in this report.

The model produces results in terms of odds ratios. In this study the odds ratios represent the change in the odds of a teacher being retained in the district or state in relation to the change in the teacher's adherence score. A statistically significant odds ratio above 1 indicates that a higher adherence score is related to increased odds of a teacher's being retained, and a statistically significant odds ratio below 1 indicates decreased odds.

Sensitivity analysis

The study team conducted five sensitivity analyses to ensure robustness in the results. Only the results of retention after three years are reported (see tables C13 and C14 in appendix C).

The first sensitivity analysis, referred to as model 1, was conducted to determine whether the results were similar when a more stringent criterion was used for the number of contact hours than the one used in the main analysis. In the analysis an average of 10 contact hours per module was replaced with a total of 10 contact hours per module because the more stringent criterion closely resembles the language used in the state legislation. The main analysis focuses on an average of 10 contact hours per module for two reasons. First, the study's advisory committee noted that hours of mentoring should be sensitive to the needs of the new teacher for each module, which is better reflected in the requirement of average of 10 contact hours per module. Second, a total of 10 contact hours per module would result in a smaller sample size because not all teachers had data on contact hours for all modules. The sensitivity analysis replicated the positive relationship between program adherence and both in-district and in-state retention observed in the main analysis.

The second sensitivity analysis, referred to as model 2, was performed to determine whether the results changed when school and teacher characteristics were included in the model. In particular, the model included two moderator variables: the percentage of students in the school who were eligible for the national school lunch program and teacher gender. Preliminary analyses found these variables to be correlated with program adherence. Opportunity district status, a district-level variable, was dropped from the model because both it and the percentage of students in a school who were eligible for the national school lunch program are possible proxies for the prevalence of poverty. In place of a district random effect, a school random effect was used to represent the nesting structure in the data. This sensitivity analysis also replicated the positive relationship between program adherence and both in-district and in-state retention observed in the main analysis.

The third sensitivity analysis, referred to as model 3, included a school characteristic—grade span—to test its role as a moderator. Preliminary analyses found grade span to be correlated with both program adherence and teacher retention. Prekindergarten/elementary was used as the referent category. Opportunity district status, a district-level variable, was also included. In place of a district random effect, a school random effect was used to represent the nesting structure in the data. This sensitivity analysis also replicated the positive relationship between adherence and both in-district and in-state retention observed in the main analysis. In addition, grade span moderated the relationship between adherence and retention, in that the relationship was significantly weaker for teachers in secondary schools than for teachers in prekindergarten/elementary schools, suggesting that program adherence matters less in predicting three-year retention for teachers in secondary schools.

The fourth sensitivity analysis, referred to as model 4, was similar to the third sensitivity analysis except that it included the percentage of students in a school who are eligible for the national school lunch program rather than Opportunity district. This sensitivity analysis also replicated the positive relationship between adherence and both in-district and in-state retention observed in the main analysis.

The first four sensitivity analyses verified that the observed relationship between program adherence and teacher retention did not depend on the specific model used for the analysis. In addition to the above sensitivity analyses using various model specifications, the study team performed a fifth sensitivity analysis based on an alternative definition of retention.

In assessing the relationship between program adherence and teacher retention, the study team used data from all teachers who started the TEAM Program. The analysis of teachers retained after the third year included teachers who were present in the beginning of their third year as well as teachers who left during their first two years. This leaves the possibility that the positive adherence–retention relationship may result from the fact that teachers who drop out early do not have the opportunity to complete the remaining program requirements. For instance, teachers who left the Connecticut public school system before the end of the second year did not have two full years to complete all the program requirements. Including those teachers in the analysis predicting retention after the third year would conflate the possible effect of program adherence on retention with the possible effect of retention on program adherence.

To rule out this interpretation, the fifth sensitivity analysis used the model that predicted retention after three years using only teachers who completed the first two years of the program. The study team operationalized completing the first two years as being retained as of the beginning of the third year using the state Employment/Assignment data. More specifically, if a teacher remained in the same district (for calculating district retention) or in the Connecticut public school system (for calculating state retention) at the start of the third year, that teacher is considered to have completed the first two years of the program. The results confirmed that the observed adherence–retention relationship is present even when the possible influence of retention on program adherence is removed (see table C15 in appendix C). This analysis produces very conservative estimates of the relationship between adherence and retention, as the data exclude teachers who had two full years to complete the program and left during the summer before the beginning of the third year.

Reference

Connecticut State Department of Education. (n.d.). *Teacher Education and Mentoring Program: Program manual 2017–2018.* https://www.ctteam.org/wp-content/uploads/2016/08/TEAM_Manual_2016-17.pdf.

Appendix C. Supplementary tables

Table C1. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program who stayed in the same school, moved to a different school in the same district, moved to a different district, or left teaching in the Connecticut public school system after one year and after three years, 2012/13–2017/18

	After one year		After three years[a]	
Teacher status	Percent	Number (n = 7,708)	Percent	Number (n = 6,121)
Stayed in the same school	79.4	6,121	57.2	3,503
Moved to a different school in the same district	5.5	424	9.3	566
Moved to a different district	6.3	484	17.1	1,046
Left teaching in the Connecticut public school system	8.8	679	16.4	1,006

a. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.
Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C2. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program who stayed in the same district, moved to a different district, or left teaching in the Connecticut public school system after one year, by district performance category, 2012/13–2017/18

	Alliance districts									
	Opportunity districts		Priority districts		Total		Non–Alliance districts		State total	
Teacher status	Percent	Number (n = 2,011)	Percent	Number (n = 1,595)	Percent	Number (n = 3,606)	Percent	Number (n = 4,074)	Percent	Number (n = 7,708)
Stayed in the same district	84.2	1,693	88.3	1,408	86.0	3,101	84.4	3,437	84.9	6,545
Moved to a different district	4.6	92	4.5	71	4.5	163	7.5	305	6.3	484
Left teaching in the Connecticut public school system	11.2	227	7.3	116	9.5	342	8.2	332	8.8	679

Note: Alliance districts are the 30 districts with the lowest academic performance among the 170 districts in Connecticut. The 10 lowest performing among them are called Opportunity districts, and the remaining 20 districts are called Priority districts. Data on district performance category were missing for 28 teachers.
Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C3. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program who stayed in the same district, moved to a different district, or left teaching in the Connecticut public school system after three years, by district performance category, 2012/13–2017/18

	Alliance districts									
	Opportunity districts		Priority districts		Total		Non–Alliance districts		State total	
Teacher status	Percent	Number (n = 1,609)	Percent	Number (n = 1,594)	Percent	Number (n = 2,857)	Percent	Number (n = 3,236)	Percent	Number (n = 6,121)
Stayed in the same district	62.8	1,011	73.0	911	67.3	1,922	66.2	2,142	66.5	4,069
Moved to a different district	16.7	269	14.8	185	15.9	454	17.7	572	17.1	1,046
Left teaching in the Connecticut public school system	20.5	329	12.2	152	16.8	481	16.1	522	16.4	1,006

Note: Alliance districts are the 30 districts with the lowest academic performance among the 170 districts in Connecticut. The 10 lowest performing among them are called Opportunity districts, and the remaining 20 districts are called Priority districts. Data on district performance category were missing for 28 teachers. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.
Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C4. Predicted probability of in-district retention after one year and after three years for teachers in Connecticut's Teacher Education and Mentoring Program, by adherence score, 2012/13–2017/18

	After one year (n = 7,708)		After three years (n = 6,121[a])	
Adherence score	Probability	Standard error	Probability	Standard error
.25	0.76*	.011	0.47*	.017
.5	0.82*	.008	0.56*	.013
.75	0.86*	.007	0.65*	.012

* Significant at $p < .05$.

a. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

Note: An adherence score of .25 indicates that a teacher completed 25 percent of the requirements, and a score of .75 indicates that a teacher completed 75 percent of the requirements. Because predicted probabilities were calculated from regression models, when data are missing for any of the variables, the sample size is smaller than the sample size used in the descriptive analyses in tables C1 and C2. Predicted retention at 25 percent and 75 percent was calculated through interpolation, as the quartile points are customarily used for illustration. The actual percentage of completion, however, was more frequently on the multiple of 16, such as 33 percent or 83 percent.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C5. Predicted probabilities of in-state retention after one year and after three years for teachers in Connecticut's Teacher Education and Mentoring Program, by adherence score, 2012/13–2017/18

	After one year (n = 7,708)		After three years (n = 6,121[a])	
Adherence score	Probability	Standard error	Probability	Standard error
.25	0.85*	.008	0.70*	.013
.5	0.90*	.005	0.79*	.008
.75	0.94*	.004	0.86*	.006

* Significant at $p < .05$.

a. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

Note: An adherence score of .25 indicates that a teacher completed 25 percent of the requirements, and a score of .75 indicates that a teacher completed 75 percent of the requirements. Because predicted probabilities were calculated from regression models, when data are missing for any of the variables, the sample size is smaller than the sample size used in the descriptive analyses in tables C1–C3. Predicted retention at 25 percent and 75 percent was calculated through interpolation, as the quartile points are customarily used for illustration. The actual percentage of completion, however, was more frequently on the multiple of 16, such as 33 percent or 83 percent.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C6. Odds ratios from model examining the relationship between adherence to the requirements of Connecticut's Teacher Education and Mentoring Program and in-district retention after one year and after three years for Opportunity districts and non–Opportunity districts, 2012/13–2017/18

	After one year (n = 7,680)		After three years (n = 6,093[a])	
Variable	Odds ratio	Standard error	Odds ratio	Standard error
Adherence score	3.97*	0.52	5.07*	0.64
Opportunity district	0.89	0.18	0.98	0.24
Opportunity district by adherence score	1.16	0.28	0.95	0.22
Wald chi-squared	166.58		233.65	
Log likelihood	–3,115.6		–3,674.6	
Likelihood ratio test[b] versus logistic model	21.3		83.2	

* Significant at $p < .05$.

a. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

b. Used to check the need for accounting for clustering in the analysis.

Note: Opportunity districts are the 10 districts with the lowest academic performance among the 170 districts in Connecticut.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C7. Odds ratios from model examining the relationship between adherence to the requirements of Connecticut's Teacher Education and Mentoring Program and in-state retention after one year and after three years for Opportunity districts and non–Opportunity districts, 2012/13–2017/18

	After one year (n = 7,680)		After three years (n = 6,093[a])	
Variable	Odds ratio	Standard error	Odds ratio	Standard error
Adherence score	5.95*	0.96	6.94*	0.98
Opportunity district	0.65*	0.13	0.66*	0.13
Opportunity district by adherence score	1.22	0.35	1.31	0.33
Wald chi-squared	201.4		304.0	
Log likelihood	–2,166.8		–2,547.4	
Likelihood ratio test[b] versus logistic model	6.5		5.0	

* Significant at $p < .05$.
a. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.
b. Used to check the need for accounting for clustering in the analysis.
Note: Opportunity districts are the 10 districts with the lowest academic performance among the 170 districts in Connecticut.
Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C8. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program completing each program requirement, 2012/13–2017/18

	Completed		Did not complete		Total number of teachers
Requirement	Percent	Number	Percent	Number	
Teacher–mentor contact hours					
Total of 20 contact hours in the first year[a]	25.6	1,975	74.4	5,733	7,708
Average of 10 contact hours per module for modules 1–4	36.4	2,762	63.6	4,833	7,595
Module completion					
Time to complete: Two modules in the first year	86.4	6,661	13.6	1,047	7,708
Time to complete: Five modules in two years	75.2	5,456	24.8	1,797	7,253
Total to complete: All five modules	90.3	6,552	9.7	701	7,253
Reflection paper submission					
Two reflection papers in the first year	77.6	5,984	22.4	1,724	7,708
All four reflection papers in two years	76.9	5,579	23.1	1,674	7,253

a. Used as an alternative to "Average of 10 contact hours per module for modules 1-4" for the first-year analysis.
Note: Sample sizes differ across requirements because of missing data.
Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C9. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program completing each requirement, by district performance category, 2012/13–2017/18

Requirement	Alliance districts		Non–Alliance districts		Chi-square statistic
	Percent	Number (n = 3,606)	Percent	Number (n = 4,074)	
Contact hours with mentor					
Total of 20 contact hours in the first year[a]	28.9	1,042	22.7	926	38.2*
Average of 10 contact hours per module for modules 1–4	42.8	1,519	30.7	1,235	119.6*
Modules completed					
Time to complete: Two modules in the first year	86.9	3,133	86.0	3,503	1.3
Time to complete: Five modules in two years	75.4	2,533	75.0	2,901	0.1
Total to complete: All five modules	91.9	3,088	89.0	3,440	17.3*
Reflection papers submitted					
Two reflection papers in the first year	78.1	2,815	77.2	3,145	0.8
All four reflection papers in two years	77.1	2,590	76.7	2,966	0.1

* Significant at $p < .05$.

a. Used as an alternative to "Average of 10 contact hours per module for modules 1–4" for the first-year analysis.

Note: Sample sizes differ across requirements because some teachers left. Alliance districts are the 30 districts with the lowest academic performance among the 170 districts in Connecticut. Chi-square tests of equality of distributions were used with Bonferroni adjustments to adjust for multiple comparisons. the Connecticut State Department of Education.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C10. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program completing each requirement, by school Title I status, 2012/13–2017/18

Requirement	Title I		Non-Title I		Chi-square statistic
	Percent	Number (n = 4,310)	Percent	Number (n = 3,148)	
Contact hours with mentor					
Total of 20 contact hours in the first year[a]	27.0	1,165	24.5	772	5.9*
Average of 10 contact hours per module for modules 1–4	37.9	1,611	35.3	1,099	5.1*
Modules completed					
Time to complete: Two modules in the first year	86.9	3,747	88.7	2,792	5.2*
Time to complete: Five modules in two years	76.7	3,112	75.4	2,246	1.6
Total to complete: All five modules	92.3	3,742	89.2	2,656	19.7*
Reflection papers submitted					
Two reflection papers in the first year	78.1	3,367	79.5	2,502	2.0
All four reflection papers in two years	78.4	3,181	77.0	2,293	2.0

* Significant at $p < .05$.

a. Used as an alternative to "Average of 10 contact hours per module for modules 1-4" for the first-year analysis.

Note: Sample sizes differ across requirements because some teachers left. Chi-square tests of equality of distributions were used with Bonferroni adjustments to adjust for multiple comparisons.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C11. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program completing each requirement, by Alliance district subcategory, 2012/13–2017/18

Requirement	Opportunity districts		Priority districts		Chi-square statistic
	Percent	Number (n = 2,011)	Percent	Number (n = 1,595)	
Contact hours with mentor					
Total of 20 contact hours in the first year[a]	29.2	587	28.5	455	0.2
Average of 10 contact hours per module for modules 1–4	44.6	878	40.6	641	5.8*
Modules completed					
Time to complete: Two modules in the first year	82.8	1,666	92.0	1,467	65.1*
Time to complete: Five modules in two years	69.3	1,272	82.7	1,261	80.7*
Total to complete: All five modules	90.0	1,652	94.2	1,436	19.6*
Reflection papers submitted					
Two reflection papers in the first year	73.2	1,471	84.3	1,344	64.2*
All four reflection papers in two years	71.2	1,307	84.1	1,283	79.0*

* Significant at $p < .05$.

a. Used as an alternative to "Average of 10 contact hours per module for modules 1-4" for the first-year analysis.

Note: Sample sizes differ across requirements because some teachers left. Alliance districts are the 30 districts with the lowest academic performance among the 170 districts in Connecticut. The 10 lowest performing among them are called Opportunity districts, and the remaining 20 districts are called Priority districts. Chi-square tests of equality of distributions were used with Bonferroni adjustments to adjust for multiple comparisons.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C12. Percentage of teachers in Connecticut's Teacher Education and Mentoring Program completing each requirement, by school grade span, 2012/13–2017/18

Requirement	Preschool/ elementary schools		Secondary schools		Combined-grade schools		Chi-square statistic
	Percent	Number (n = 2,474)	Percent	Number (n = 3,311)	Percent	Number (n = 1,672)	
Contact hours with mentor							
Total of 20 contact hours in the first year[a,b,d]	27.7	932	23.9	1,167	27.6	683	13.7*
Average of 10 contact hours per module for modules 1–4[c,d]	37.2	911	34.4	1,123	41.1	682	21.5*
Modules completed							
Time to complete: Two modules in the first year[b,c]	92.6	1,215	85.3	1,528	85.1	769	84.6*
Time to complete: Five modules in two years[b,c,d]	84.3	1,990	70.9	2,212	74.4	1,155	134.7*
Total to complete: All five modules[b,c,d]	95.3	2,251	86.8	2,706	92.7	1,440	126.0*
Reflection papers submitted							
Two reflection papers in the first year[b,c]	84.3	2,086	75.7	2,507	76.3	1,275	70.1*
All four reflection papers in two years[b,c,d]	85.5	2,019	72.6	2,263	76.7	1,191	131.0*

* Significant at $p < .05$.

a. Used as an alternative to "Average of 10 contact hours per module for modules 1-4" for the first-year analysis.

b. Difference between percentage for teachers in preschool/elementary schools and percentage for teachers in secondary schools is statistically significant.

c. Difference between percentage for teachers in preschool/elementary schools and percentage for teachers in combined-grade schools is statistically significant.

d. Difference between percentage for teachers in secondary schools and percentage for teachers in combined-grade schools is statistically significant.

Table C13. Odds ratios from models examining the relationship between adherence to the requirements of Connecticut's Teacher Education and Mentoring Program and in-district retention after three years, 2012/13–2017/18

Variable	Model 1 (*n* = 4,571)	Model 2 (*n* = 5,840)	Model 3 (*n* = 5,913)	Model 4 (*n* = 5,931)
Adherence score	3.34*	4.85*	9.13*	9.73*
District characteristics				
Opportunity district	1.36		0.96	
Fidelity by Opportunity district	0.72		0.94	
School characteristics				
Percent of students eligible for the national school lunch program		0.95		1.08
Fidelity by percent of students eligible for the national school lunch program		0.93		0.86
Grade span: secondary			1.51	1.47
Fidelity by grade span: secondary			0.43*	0.44*
Grade span: combined			0.76	0.73
Fidelity by grade span: combined			0.88	0.87
Teacher characteristics				
Gender		0.80		
Fidelity by gender		1.32		
Random effects	District	School	School	School

* Significant at $p < .05$.

Note: Model 1 includes Opportunity district status and its interaction with adherence score; where calculation of adherence score replaced the requirement for "10 or more mentoring hours on average" with "10 or more mentoring hours in all modules." Model 2 includes Opportunity district status, the percentage of students at the teacher's initial school who are eligible for the national school lunch program, teacher gender, and interaction terms for each variable with adherence score. Model 3 includes Opportunity district status, the grade span of the teacher's initial school, and interaction terms for each variable with adherence score. Model 4 includes the percentage of students at the teacher's initial school who are eligible for the national student lunch program, the grade span of the teacher's initial school, and interaction terms for each variable with adherence score. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C14. Odds ratios from models examining the relationship between adherence to the requirements of Connecticut's Teacher Education and Mentoring Program and in-state retention after three years, 2012/13–2017/18

Variable	Model 1 (*n* = 4,571)	Model 2 (*n* = 5,840)	Model 3 (*n* = 5,913)	Model 4 (*n* = 5,931)
Adherence score[a]	1.37	5.44*	9.76*	8.45*
District characteristics				
Opportunity district status	0.77		0.67*	
Fidelity by Opportunity district status	1.44		1.26	
School characteristics				
Percent of students eligible for the national school lunch program		0.61		0.69
Fidelity by percent of students eligible for the national school lunch program		1.66		
Grade span: secondary			1.19	1.17
Fidelity by grade span: secondary			0.57	0.59
Grade span: combined			0.73	0.68
Fidelity by grade span: combined			0.89	0.91
Teacher characteristics				
Gender		0.85		
Fidelity by gender		1.13		
Random effects	District	School	School	School

* Significant at $p < .05$.

Note: Model 1 includes Opportunity district status and its interaction with adherence score; where calculation of adherence score replaced the requirement for "10 or more mentoring hours on average" with "10 or more mentoring hours in all modules." Model 2 includes Opportunity district status, the percentage of students at the teacher's initial school who are eligible for the national school lunch program, teacher gender, and interaction terms for each variable with adherence score. Model 3 includes Opportunity district status, the grade span of the teacher's initial school, and interaction terms for each variable with adherence score. Model 4 includes the percentage of students at the teacher's initial school who are eligible for the national student lunch program, the grade span of the teacher's initial school, and interaction terms for each variable with adherence score. Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.

Table C15. Odds ratios from model examining the relationship between adherence to the requirements of Connecticut's Teacher Education and Mentoring Program and in-district and in-state retention after three years, for teachers who completed the first two years of teaching, 2012/13–2017/18

	In-district retention (*n* = 4,446)		In-state retention (*n* = 5,282)	
Variable	Odds ratio	Standard error	Odds ratio	Standard error
Adherence score	2.10*	0.42	2.11*	0.44

* Significant at $p < .05$

Note: Excludes the 2015/16 cohort, for which three-year retention data were not yet available.

Source: Authors' analysis of 2012/13–2017/18 data from the Connecticut State Department of Education.