

An Evaluation of Teachers Trained Through Different Routes to Certification

Final Report

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EXECUTIVE SUMMARY

Every year, thousands of new teachers pass through hundreds of different teacher preparation programs and are hired to teach in the nation's schools. Most new teachers come from traditional route to certification (TC) programs, in which they complete all their certification requirements before beginning to teach. In recent years, however, as many as a third of new hires have come from alternative route to certification (AC) programs, in which they begin teaching before completing all their certification requirements (Feistritzer and Chester 2002). AC programs have grown in number and size in recent years in response to a variety of factors, including teacher shortages and the No Child Left Behind (NCLB) Act, which requires that every core class be staffed with a teacher who has obtained full certification or, in the case of alternative routes to certification, is enrolled and making adequate progress toward certification through an approved program.

Despite the expansion of these new routes into teaching, there exists little research to provide guidance as to the effectiveness of different teacher training strategies. The increased variation in teacher preparation approaches created by the existence of various AC and TC programs offers an opportunity to examine the effect of different components of training on teacher performance. For example, some AC programs require less education coursework than TC programs. We can exploit this type of variation to examine whether the form of training is associated with differences in teacher performance.

The potential advantages and disadvantages of the various routes to certification have been debated, and the amount of coursework required by AC and TC programs is critical to issues of certification and teacher effectiveness. Some critics contend that the coursework required by TC (and some AC) programs is excessive and unnecessarily burdensome (Finn 2003; Hess 2001; U.S. Department of Education 2002), providing little benefit while discouraging talented people from entering the teaching profession (Ballou and Podgursky 1997). AC programs have been viewed as a way to eliminate these barriers. However, supporters of TC programs argue that easing requirements degrades quality because AC teachers are insufficiently prepared for the classroom and less effective than TC teachers (Darling-Hammond 1992). Even in cases where the coursework is similar, TC programs require that people complete their requirements prior to becoming a teacher of record, while AC programs allow them to begin teaching first. None of these claims, however, have been rigorously studied in the context of the programs that are most prevalent.

In light of these unresolved issues and the continuing need for highly qualified teachers, NCLB provides support "to ensure that teachers have the necessary subject matter knowledge and teaching skills in the academic subjects that the teachers teach." Specifically,

Title II of NCLB allows funds to be used for “carrying out programs that establish, expand, or improve alternative routes for state certification of teachers,” as well as for “reforming teacher certification (including recertification) or licensing requirements.” This study is intended to inform this effort by rigorously examining the effect of AC teachers on student achievement and classroom practices compared to the effect of TC teachers in their same school and grades. The study also provides suggestive evidence about what training and pretraining characteristics may be related to teacher performance.

Research on the effectiveness of AC teachers is not conclusive. A handful of studies have examined the effects on student achievement of specific AC programs, including Teach For America (TFA) and the New York City Teaching Fellows (NYCTF) program, and have reached mixed conclusions (Decker et al. 2004; Kane et al. 2006; Laczko-Kerr and Berliner 2002; Raymond et al. 2001). The more rigorous studies generally showed that students of AC teachers scored the same or higher than students of TC teachers, or that they scored slightly lower during their teacher’s first year of teaching, but scored the same by the teacher’s second year (Decker et al. 2004; Boyd et al. 2005; Kane et al. 2006). When effects have been found, they have typically been described by the authors as small. Some research—case studies or small-scale, nonexperimental observation and survey-based studies—has examined AC and TC teachers’ classroom practices, and also had mixed findings (Lutz and Hutton 1989; Jelmberg 1996; Miller et al. 1998). Finally, because of their limited scope, many of these studies appear to have limited relevance to the broad range of AC programs operating across the country. The TFA and NYCTF programs, for example, recruit graduates from top colleges and are quite selective in admission, whereas the entry requirements of the majority of AC programs are less stringent (Walsh and Jacobs 2007; Mayer et al. 2003). Lacking conclusive evidence, principals may be uncertain of the implications of hiring an AC teacher, and policymakers may wonder about the implications of various characteristics of teacher certification programs.

RESEARCH QUESTIONS AND STUDY DESIGN

This study addresses two questions related to teacher preparation and certification routes:

1. What are the relative effects on student achievement of teachers who chose to be trained through different routes to certification? How do observed teacher practices vary by chosen route to certification?
2. What aspects of certification programs (such as the amount of coursework, the timing of coursework relative to being the lead teacher in the classroom, the core coursework content) are associated with teacher effectiveness?²

The answer to the first question is most relevant to principals faced with a choice between hiring an AC or a TC teacher. The answer to the second is of interest to

² Throughout the report, we use the terms “teacher effects” and “teacher effectiveness” to denote the effect of teachers on student achievement or classroom practices.

policymakers and designers and administrators of teacher training programs in their efforts to identify the training characteristics and certification requirements that are related most positively to student achievement.

A brief description of the study design is presented below, followed by a summary of the main study findings. More details on the selection of teacher preparation programs models, study sample, random assignment and analytical strategy, and data collection follow.

Study Design

Participants: Schools that had recently hired alternatively certified (AC) teachers were recruited to participate in the study. If the AC teacher was teaching the same grade level as a relative novice traditionally certified (TC) teacher, the school was eligible to participate in the evaluation. The evaluation included 2,600 students in 63 schools in 20 districts.

Research Design: In the study schools, every grade that contained at least one eligible AC and one eligible TC teacher was included. Students in these study grades were randomly assigned to be in the class of an AC or a TC teacher. The random assignment ensured that, within each teacher pair, the students in each classroom were similar on average. The pairing of an AC teacher to a TC teacher in each school and grade level constituted a separate mini-experiment. Students were tested at the beginning of the school year as a baseline measure and at the end of the year as an outcome. Classroom instruction was observed at one point during the year as an outcome.

Analysis: In each school grade, the outcomes of students who were randomly assigned to an AC classroom were compared to the outcomes of students who were assigned to a TC classroom, generating an impact estimate for each teacher pair, referred to as a mini-experiment. The overall impact was calculated by taking the average of the impacts from all mini-experiments. The mini-experiments were also divided into two approximately equal-sized subgroups based on the amount of coursework that was required (low or high) by the AC teacher's program, and the impacts were averaged separately for each group. Low-coursework AC teachers were defined as teachers whose program required 274 or fewer hours of coursework, while high-coursework AC teachers were defined as teachers whose program required 308 hours or more of coursework.

The main findings of the study are:

- ***Both the AC and the TC programs with teachers in the study were diverse in the total instruction they required for their candidates.*** The total hours required by AC programs ranged from 75 to 795, and by TC programs, from 240 to 1,380. Thus not all AC programs require fewer hours of coursework than all TC programs. The degree of overlap in coursework requirements between AC and TC programs in the study was dictated by variations in state policies on teacher certification programs. For example, in New Jersey all AC teachers were required to complete fewer hours of coursework than all TC

- teachers, while in California, the range of coursework hours required was similar for AC and TC teachers.
- ***While teachers trained in TC programs receive all their instruction (and participate in student teaching) prior to becoming regular full-time teachers, AC teachers do not necessarily begin teaching without having received any formal instruction.*** Overall, low-coursework AC teachers in the study were required to take an average of 115 hours of instruction—64 percent of the total amount of instruction they would receive—before starting to teach, and high-coursework AC teachers in the study were required to take an average of 150 hours—about 35 percent of the total amount they would receive—before starting to teach. Nine AC teachers in the study, seven of them from New Jersey, were not required to complete any coursework before becoming regular full-time teachers.
 - ***There were no statistically significant differences between the AC and TC teachers in this study in their average scores on college entrance exams, the selectivity of the college that awarded their bachelor's degree, or their level of educational attainment.*** Both low- and high-coursework AC teachers were more likely than their TC counterparts to identify themselves as black (40.5 percent versus 17.5 percent and 32.4 percent versus 7.5 percent) and less likely to identify themselves as white (50 percent versus 75.5 percent and 40.5 percent versus 70 percent). In addition, the low-coursework AC teachers were more likely than their TC counterparts to report having children (70.2 percent versus 28.3 percent).
 - ***There was no statistically significant difference in performance between students of AC teachers and those of TC teachers.*** Average differences in reading and math achievement were not statistically significant. Furthermore, students of AC teachers scored higher than students of their TC counterparts in nearly as many cases as they scored lower (49 percent in reading and 44 percent in math). The effects of AC teachers varied across experiments, and nonexperimental correlational analysis of teachers' pretraining and training experiences explained 5 percent of the variation in math and 2 percent in reading. Therefore, the route to certification selected by a prospective teacher is unlikely to provide information, on average, about the expected quality of that teacher in terms of student achievement.
 - ***There is no evidence from this study that greater levels of teacher training coursework were associated with the effectiveness of AC teachers in the classroom.*** The experimental results provided no evidence that students of low-coursework AC teachers scored statistically differently from students of their TC counterparts, nor did students of high-coursework AC teachers compared to those of their TC counterparts. Correlational analysis similarly failed to show that the amount of coursework was associated with student

achievement. Therefore, there is no evidence that AC programs with greater coursework requirements produce more effective teachers.

- *There is no evidence that the content of coursework is correlated with teacher effectiveness.* After controlling for other observable characteristics that may be correlated with a teacher's effectiveness, there was no statistically significant relationship between student test scores and the content of the teacher's training, including the number of required hours of math pedagogy, reading/language arts pedagogy, or fieldwork. Similarly, there was no evidence of a statistically positive relationship between majoring in education and student achievement.

Selection of Teacher Preparation Program Models

To provide information about effective methods of preparing and certifying teachers, the study design called for selecting a sample of teacher preparation models that were different from one another in structure and amount of coursework. Because the sampled programs were characteristic of the types of programs that train most of the nation's teachers, the study provides comparative information on teacher effectiveness for those able to hire from both routes. To shed light on whether the timing of training is related to the effect of teachers on student achievement and classroom practices, we focused on programs that place teachers in classrooms in one of two ways: (1) after the teachers have completed all their training (TC programs), and (2) before they have completed it (AC programs). In terms of coursework, we did not limit our focus within the pool of AC or TC programs, but for the analyses we distinguished the AC programs with relatively low coursework requirements from those with relatively high ones, which helped us assess whether increasing the volume of coursework is related to teacher effectiveness. Finally, all the AC programs in the study had to have less selective entrance requirements.³ We focused on such AC programs for two reasons. First, most TC programs do not have highly selective entrance requirements (Hess 2001), nor do most AC programs (Walsh and Jacobs 2007; Mayer et al. 2003). Hence, less selective programs, whether AC or TC, are more policy relevant, since these are the programs that produce most teachers working today.

Second, AC programs with less selective entrance requirements are similar to the likely entrance requirements of the education programs attended by TC teachers in the study. To examine the relationship between preservice teacher training characteristics and teacher performance, it is important to disentangle the effects of the teacher training program on student achievement and classroom practices from the effects of pretraining teacher characteristics. Limiting the AC programs to the ones with entrance requirements similar to those of most TC programs helps to decrease at least some of the potential differences between teachers who attend AC or TC programs. For example, if the study included AC teachers entering through the TFA program or other highly selective teaching programs

³ We defined "less selective" programs as those that did not require applicants to have a grade point average (GPA) in excess of 3.0.

who, on average, attended more selective undergraduate institutions and have higher SAT or ACT scores than teachers who attended less selective AC programs or TC programs, then it would be more difficult to determine whether relative differences in the classroom are due to the programs attended or to teachers' pretraining.

The Study Sample

The study sample was constructed, and the study was conducted, over two years. We began in late 2003 by identifying as many potentially eligible AC programs as possible. Among those states not known to have selective admissions criteria for their AC programs (12 total)⁴ we compiled a list of 165 programs, from which we drew a random sample of 63, stratified to ensure diversity in terms of geography (state) and types of programs within states. For the 2004–2005 school year, we recruited schools that had hired teachers from a purposive subsample of the 63 sampled programs.⁵ For the 2005–2006 school year, we sought more teachers from the same programs and also directly approached new districts in some of the same states that hired large numbers of AC teachers (for example, because they operated their own program). Schools could be included in the study only if they had at least one eligible AC and one eligible TC teacher in the same grade, in kindergarten through grade 5. To be eligible, teachers (1) had to be relative novices (three or fewer years of teaching experience prior to 2004–2005, five or fewer years prior to 2005–2006); (2) had to teach in regular classrooms (for example, not in special education classrooms); and (3) had to deliver both reading and math instruction to all their own students. The final study sample included 87 AC teachers and 87 TC teachers (some of whom participated in the study both years) from 63 schools in 20 districts and 7 states, as shown in Exhibit 1. Fourteen of the 20 districts were in urban areas, and 4 were on the fringe of one. Although we identified and sampled from a large number of less selective AC programs operating in 2003–2004, the programs and teachers that were included in the study sample were not necessarily representative of all AC programs operating at the time.

Random Assignment and Analytical Strategy

Within each school, students in the same grade were randomly assigned to either an AC teacher or a TC teacher. Each instance in which we conducted random assignment constituted a “mini-experiment”—achievement of students in a classroom taught by an AC teacher was compared to achievement of students in a classroom taught by a TC teacher. Because students in the classrooms were randomly assigned within the same school, the characteristics and motivations of students for each teacher pair⁶ did not systematically

⁴ We identified the 12 states based on available documentation, including various websites and Feistritzer and Chester (2002), and discussions with state education officials.

⁵ We identified the subsample of programs through screening to ensure that the programs had at least one year of operational experience, would be in operation in the coming year, and had at least 12 graduates or enrollees teaching within a district.

⁶ Each mini-experiment is a teacher pair, with a few exceptions: four mini-experiments involved three teachers, and two involved four teachers.

Exhibit 1. States, Districts, Schools, and Teachers in Study

State	Districts	Schools	AC Teachers	TC Teachers
California	5	15	20	18
Illinois, Wisconsin, Georgia, Louisiana	7	12	15	16
New Jersey	3	9	9	9
Texas	5	27	43	44
Total	20	63	87	87

differ, and the contextual situation was the same. This was done to minimize preexisting differences in students and schools that might influence teacher practices and student test scores. Thus the difference in student test scores can be attributed to the type of teacher and not student, classroom, or school characteristics. T-tests confirmed that there were no statistically significant differences in demographic characteristics, including gender, race/ethnicity, and eligibility for free or reduced-price lunch, or baseline achievement levels between students assigned to AC or TC teachers. In addition, the integrity of random assignment was well maintained: fewer than 3 percent of students originally assigned to one type of classroom switched over to the other type.

An important distinction of this design is that because certification routes are not randomly assigned to teacher trainees, the estimates of the effects on student achievement and classroom practices of teachers who were trained through different routes to certification pertain to those who *chose* to participate in these programs. Because of likely differences in the types of people who attend various certification programs, the results cannot be used to rigorously address how a graduate of one type of program would fare if he or she had attended another type. The study design and the collection of extensive data on teacher characteristics and experiences facilitate answering the second research question, concerning how student achievement and teacher practices are associated with teachers' training experiences toward initial certification. These findings are suggestive, however, because teachers were not randomly assigned to training programs or to their personal characteristics.

To estimate the effects of teachers who chose to be trained through different routes on student achievement and the classroom practices experienced by students, we compared teachers from AC programs with teachers in the same schools and grades who completed a TC program. We also estimated two subgroups—AC programs with low and high amounts of required coursework—to investigate separately the comparison of (1) AC teachers from low-coursework programs relative to their TC counterparts, and (2) AC teachers from high-coursework programs relative to their TC counterparts.⁷ The comparison between AC and

⁷ We determined which programs had low or high coursework requirements after interviewing their program directors, and the precise definitions are explained in Chapter III.

TC teachers overall provided an experimental estimate of the average difference in student achievement of teachers from the two routes, a comparison useful to principals and school administrators because it provides an indication of how students might perform when instructed by an AC teacher compared to a TC teacher. The subgroup estimates are of interest independent of the overall estimate, since there is variation in the amount of coursework required by state or district certification policy. The subgroup analyses allow us to determine, within an experimental framework, the effects on student achievement and classroom practices experienced by students of teachers who attended programs with a relatively large difference in required coursework as demonstrated by the comparison between teachers from low-coursework AC programs and their TC counterparts. We can also examine the effects on students of teachers who attended programs with relatively little difference in required coursework as demonstrated by the comparison between teachers from high-coursework AC programs and their TC counterparts.⁸

Data Collection and Measurement

Data for the study were collected from a variety of sources.

Student Achievement. We obtained information on students' reading and math achievement by administering the California Achievement Test, 5th Edition (CAT-5), published by CTB Macmillan/McGraw-Hill. See Appendix A for additional details.

Teacher Practices. We collected information on teachers' classroom practices in two ways. First, we directly observed and rated the quality of their instruction in literacy and math using the Vermont Classroom Observation Tool (VCOT), a proprietary instrument for classroom observations developed by the Vermont Institutes which covers three domains—lesson implementation, lesson content, and classroom culture. Second, we had principals rate the quality of the study teachers' reading/language arts instruction, math instruction, and classroom management relative to those of other teachers in the school. See Appendix A for additional details.

Teacher Characteristics. The main data source was a survey, administered in the spring, that collected information on teachers' professional backgrounds, the support they received during their first year as a full-time teacher, and their personal background characteristics. We also obtained their college entrance examination (SAT and ACT) scores.

Teachers' Certification Program Experiences. We interviewed program directors to collect detailed information on several major aspects of the training programs that study teachers attended, including the admission requirements, the amount of instruction required (overall and in five areas of particular interest designated by the study: classroom management, reading/language arts pedagogy, math pedagogy, student assessment, and child

⁸ Low-coursework AC teachers were required to complete, on average, 179 hours of instruction, while their TC counterparts were required to complete an average of 671. High-coursework AC teachers were required to complete, on average, 432 hours of instruction, while their TC counterparts were required to complete 607.

development), the timing of instruction, the amount of required fieldwork, the length and features of student teaching assignments for TC teachers, and the provision of mentoring to AC teachers during their first year of teaching. The designation of AC teachers as either low-coursework or high-coursework, as well as measures of coursework in different subjects, reflects the requirements of the programs they attended and the amount of coursework required for certification, not the amount actually completed at the time of the study.

DESCRIPTIVE FINDINGS ON TEACHERS AND PROGRAMS

AC Teachers' Program Experiences

The AC teachers were required to take varying amounts of instruction in their programs, ranging from 75 to 795 hours. For analytical purposes, we divided AC teachers into two groups: the 47 who were required to complete 274 hours of instruction or less formed the low-coursework group, and the 40 who were required to complete 308 hours or more formed the high-coursework group. The low-coursework AC teachers' programs required an average of 179 hours of instruction (with a standard deviation [SD] of 54), while the high-coursework teachers' programs required, on average, 432 hours (SD of 112). Assuming that a typical college course involves about 45 hours of instruction (3 hours per week for 15 weeks), these means represent the equivalent of 4.0 and 9.6 courses, respectively.

Low- and high-coursework AC teachers also differed in the amount of coursework they were required to complete before, during, and after their first year of full-time classroom teaching, as shown in Exhibit 2.⁹ For example, high-coursework AC teachers had to complete, on average, 150 hours of instruction during their first year of teaching, which translates to about 17 hours a month, compared with 63 hours, on average, among low-coursework AC teachers, which translates to about 7 hours a month.

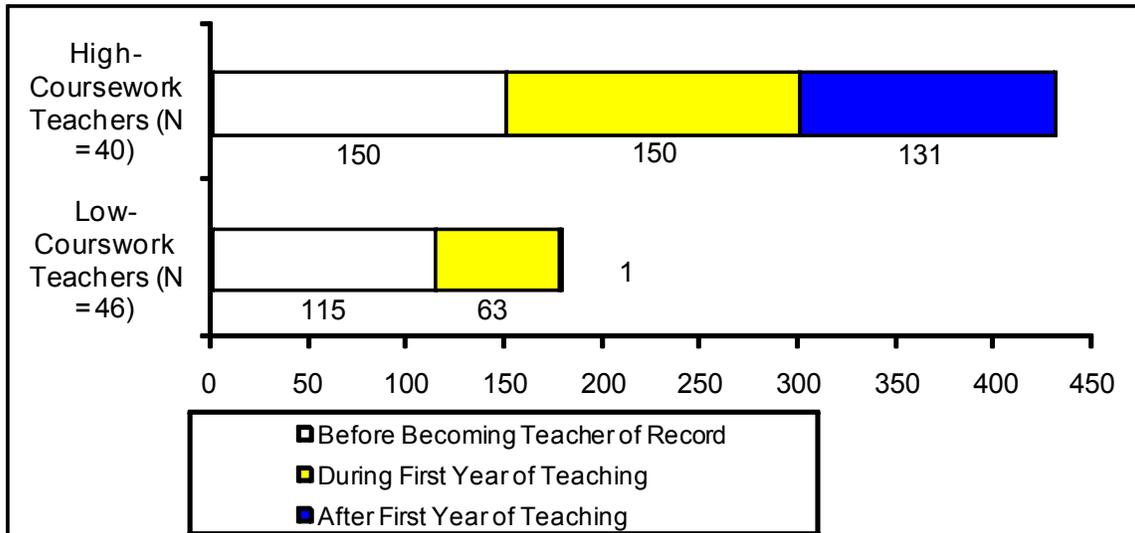
TC Teachers' Program Experiences

TC teachers, like their AC counterparts, received varying amounts of instruction, ranging from 240 to 1,380 hours. On average, they completed a total of 642 hours of instruction (SD of 225), equivalent to 14.3 typical college courses. This mean was more than double that of the AC teachers.

Comparisons of Instruction Required for AC and TC Teachers

We present data on four different groups of teachers: (1) teachers who chose low-coursework AC programs, (2) their TC counterparts, (3) teachers who chose high-coursework AC programs, and (4) their TC counterparts. In discussing the average amount

⁹ One low-coursework AC teacher did not enroll in her program during the study year; therefore, we do not include required coursework hours for this teacher in Exhibit 2.

Exhibit 2. Average Hours of Instruction Relative to First Year of Teaching, AC Teachers

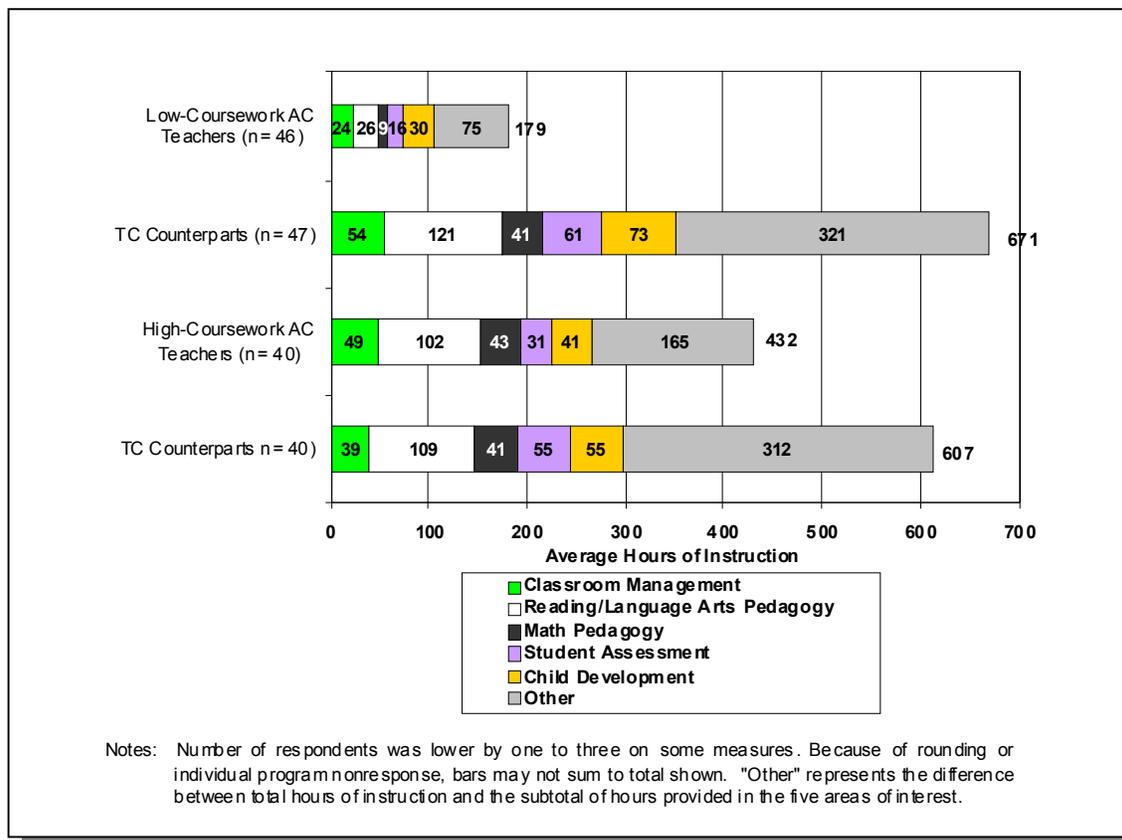
Source: Program director interviews.

Note: Because of rounding, bars do not sum to the averages reported earlier, 432 and 177.

of instruction that original study teachers were required to complete as part of their training programs, we examine differences between (1) the low- and high-coursework AC teachers, to explore the extent of differences in their programs' coursework requirements for certification; (2) the two groups of TC teacher counterparts to the low- and high-coursework AC teachers, to explore whether they provide a common benchmark for our experimental analyses¹⁰; and (3) each AC group and its counterpart TC group, to explore differences in coursework requirements that might be related to the results of the experimental and nonexperimental analyses presented below.

Coursework hours data collected for the study focused on five topics: reading/language arts pedagogy, math pedagogy, classroom management, student assessment, and child development. We hypothesized that coursework hours in these specific topic areas would be most related to student achievement. However, because hours of instruction in topics other than these five accounted for 38 to 51 percent of the average total hours of required instruction for each group of teachers, we also discuss required hours of such instruction.

¹⁰ If the two groups of TC teachers faced similar instructional requirements in their training programs, then both groups of AC teachers would face similar counterfactuals, and the key analyses (low-coursework AC teachers versus their TC counterparts, and high-coursework AC teachers versus their TC counterparts) would be comparable.

Exhibit 3. Average Hours of Instruction by Content Area, AC and TC Teachers

Low- and High-Coursework AC Teachers. AC teachers from high-coursework programs were required to take more hours of instruction overall than AC teachers from low-coursework programs, as shown in Exhibit 3. As discussed above, dividing AC teachers into two similar-sized groups based on a gap in required coursework of AC programs yielded two groups with large average differences in required coursework. High-coursework AC teachers were required to complete 432 hours of instruction, compared with 179 for low-coursework AC teachers. This difference in total hours of instruction is due to differences in all five subject areas of interest as well as other instruction (defined below). High-coursework AC teachers were required to complete more hours of instruction in all five subjects, on average, than AC teachers from low-coursework programs: 3.9 times as much instruction in reading/language arts pedagogy, 4.8 times as much in math pedagogy, 2.0 times as much in classroom management, 1.9 times as much in student assessment, and 37 percent more in child development. Although not shown in Exhibit 3, all these differences were statistically significant at the 0.01 level, except for child development, which was statistically significant at the 0.05 level.

TC Teachers Matched to Low- and High-Coursework AC Teachers. TC teachers matched with low-coursework AC teachers were required to complete a similar amount of total instruction as TC teachers matched to high-coursework AC teachers, 671 hours versus 607, and the difference was not statistically significant. TC teachers matched with low-

coursework AC teachers were required to complete, in each of the five subject areas, on average, the same amount as or more instruction than TC teachers matched with high-coursework AC teachers, with statistically significant differences for classroom management and child development (at the 0.05 level; analysis not shown in Exhibit 3). Thus, in terms of required coursework, TC teachers matched to low- and high-coursework AC teachers served as a common benchmark in conducting the subgroup analysis.

Matched AC and TC Teachers Subgroups. AC teachers from low-coursework programs were required to complete, on average, about one-quarter of the total hours of instruction overall as their TC counterparts (179 hours versus 671 hours). In addition, they were required to complete less coursework in all subject areas of interest. For example, their programs required about one-fifth the instruction in reading/language arts pedagogy (26 versus 121 hours), less than one-fourth in math pedagogy (9 versus 41 hours), and less than half in classroom management (24 versus 54 hours). All the differences were statistically significant.

AC teachers from high-coursework programs were required to complete, on average, less instruction than their TC counterparts, 432 hours versus 607 hours, a difference that was statistically significant. They were required to complete less coursework in two topics of interest (student assessment, and child development), with the differences statistically significant. However, their programs required *more* instruction in classroom management (49 versus 39 hours), a difference that was statistically significant. There was no statistically significant difference in the amount of math pedagogy instruction (43 versus 41). Considering all five topics of interest together (that is, excluding “other” instruction), high-coursework AC teachers’ programs required 91 percent as much instruction as their TC counterparts’ programs (267 versus 295 hours), a difference that was statistically significant at the 0.05 level.

“Other” Instruction. For all teachers, some of the required coursework fell outside the five subjects of most interest in this study. Instruction in other topics accounted for, on average, 42 percent of total coursework for the low-coursework AC teachers, 48 percent for their TC counterparts, 38 percent for the high-coursework AC teachers, and 51 percent for their TC counterparts. “Other” instruction accounted for half the statistically significant 493-hour difference in total instruction between low-coursework AC teachers and their TC counterparts, and for 84 percent of the statistically significant 176-hour difference between high-coursework AC teachers and their TC counterparts.

AC and TC Teachers’ Backgrounds

As context for interpreting the findings, Exhibit 4 presents information on the average background characteristics of the two AC teacher groups and their TC counterparts. Both low- and high-coursework AC teachers were more likely than their TC counterparts to identify themselves as black (40.5 percent versus 17.5 percent and 32.4 percent versus 7.5 percent) and less likely to identify themselves as white (50 percent versus 75.5 percent and 40.5 percent versus 70 percent). In addition, the low-coursework AC teachers were more likely than their TC counterparts to report having children (70.2 percent versus 28.3 percent). Low-coursework AC teachers had fewer years of teaching experience at the time

of their first year in the study, although the difference was less than one year. High-coursework AC teachers were more likely than their TC counterparts to be taking courses toward initial certification or an advanced degree during the study year (57 percent versus 30 percent). All these differences were statistically significant. Neither AC group had a statistically significant difference from its TC counterpart group in terms of college entrance exam scores or educational attainment.

Exhibit 4. Teacher Demographic and Educational Characteristics (Percentages, Except Where Noted)

	Low Coursework				High Coursework			
	AC	TC	Difference	p-Value	AC	TC	Difference	p-Value
White	48.8	73.8	-25.0	0.02	40.5	70.0	-29.5	0.01
Black	39.5	19.5	20.0	0.01	32.4	7.5	24.9	0.01
Female	95.7	97.9	-2.1	0.56	78.6	88.6	-10.1	0.21
Have children	70.2	27.7	42.6	0.00	38.1	29.5	8.5	0.41
Average age (years)	33.5	28.1	5.4	0.00	33.9	30.1	3.8	0.01
Average SAT or equivalent composite score ^a (points)	930	959	-29.0	0.43	1,010	1,013	-2.5	0.95
Highest degree: master's ^b	17.0	8.5	8.5	0.22	23.8	22.7	1.1	0.90
Currently taking courses ^c	31.9	21.3	10.6	0.25	57.1	29.5	27.6	0.01
Average study-eligible teaching experience (years) ^d	2.7	3.3	-0.6	0.04	3.3	3.0	0.2	0.45
Sample Size^e	46	46			42	44		

Sources: Teacher survey for all but SAT scores, which were obtained from the College Board, and ACT scores, which were obtained from ACT.

^aWe converted ACT scores to SAT equivalents using the concordance procedure available from the College Board.

^bAll teachers had completed a bachelor's degree.

^cIncludes courses toward teaching certification or an advanced degree.

^dIncludes years teaching full-time as a certified or emergency certified teacher.

^eSample sizes were lower on some items due to nonresponse on the teacher survey; also, some teachers had not taken a college entrance exam, and others did not consent to release of their score. However, teachers who were in the study both years are counted twice here, whereas they were counted only once in earlier exhibits.

FINDINGS FROM EXPERIMENTAL ANALYSES

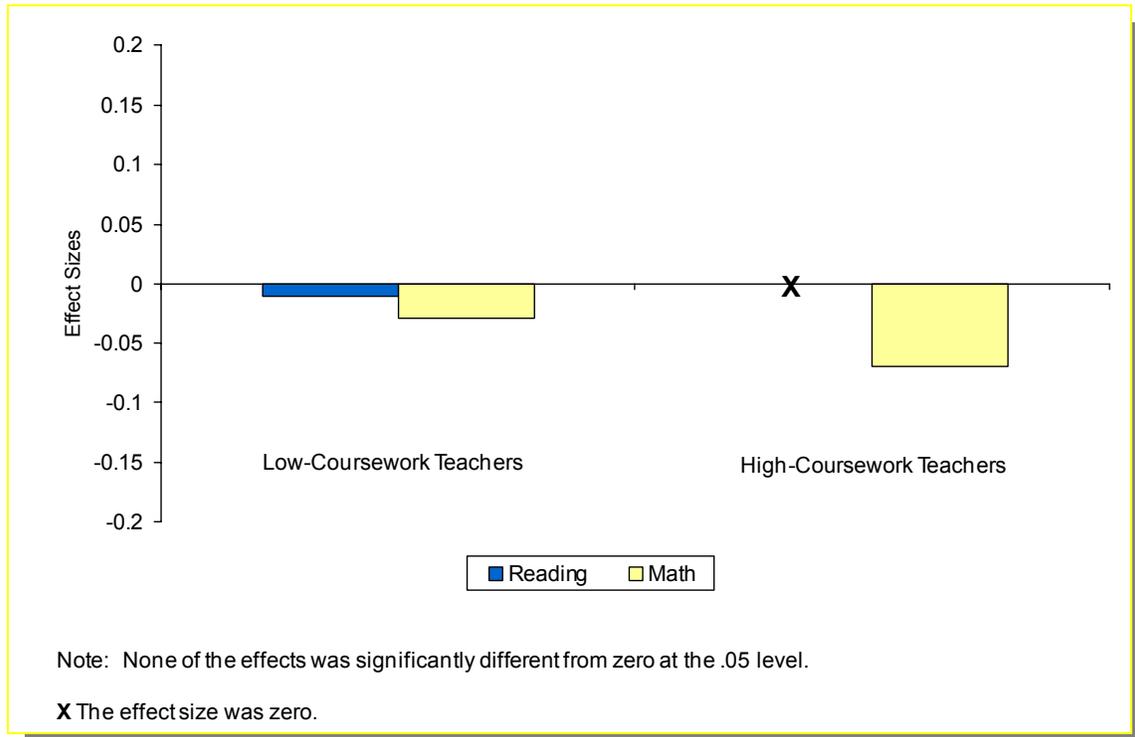
Students of AC teachers did not perform statistically differently from students of TC teachers. Although average differences in reading and math were generally negative, they were not statistically significant, as shown in Exhibit 5.

In addition to estimating the effects on student achievement of having a high- or low-coursework AC teacher, we examined effects within several subgroups to determine whether differences in teachers' effectiveness occurred within other dimensions even though differences did not exist overall. Specifically, we examined the relative effects of teachers in subgroups defined by state, current coursework status, grade level, and teaching experience.

All AC teachers in California were from high-coursework programs, and they accounted for half of all high-coursework AC teachers in the sample. Students of AC teachers in California scored lower on math than students of their TC counterparts, and the effect size (-0.13) was statistically significant. The effects of high-coursework AC teachers in other states was small (-0.01) and not statistically significant.

Students of AC teachers who were taking courses during the study year, toward either teacher certification or an advanced degree, had lower math scores than students of their TC counterparts (effect size = -0.09). The effect in reading was not statistically significant. Furthermore, neither the effect on reading nor the effect on math scores was significant for students of AC teachers who were not taking coursework during the study year.

Exhibit 5. Difference in Effect Sizes on Students' Reading and Math Scores of AC Teachers and Their TC Counterparts

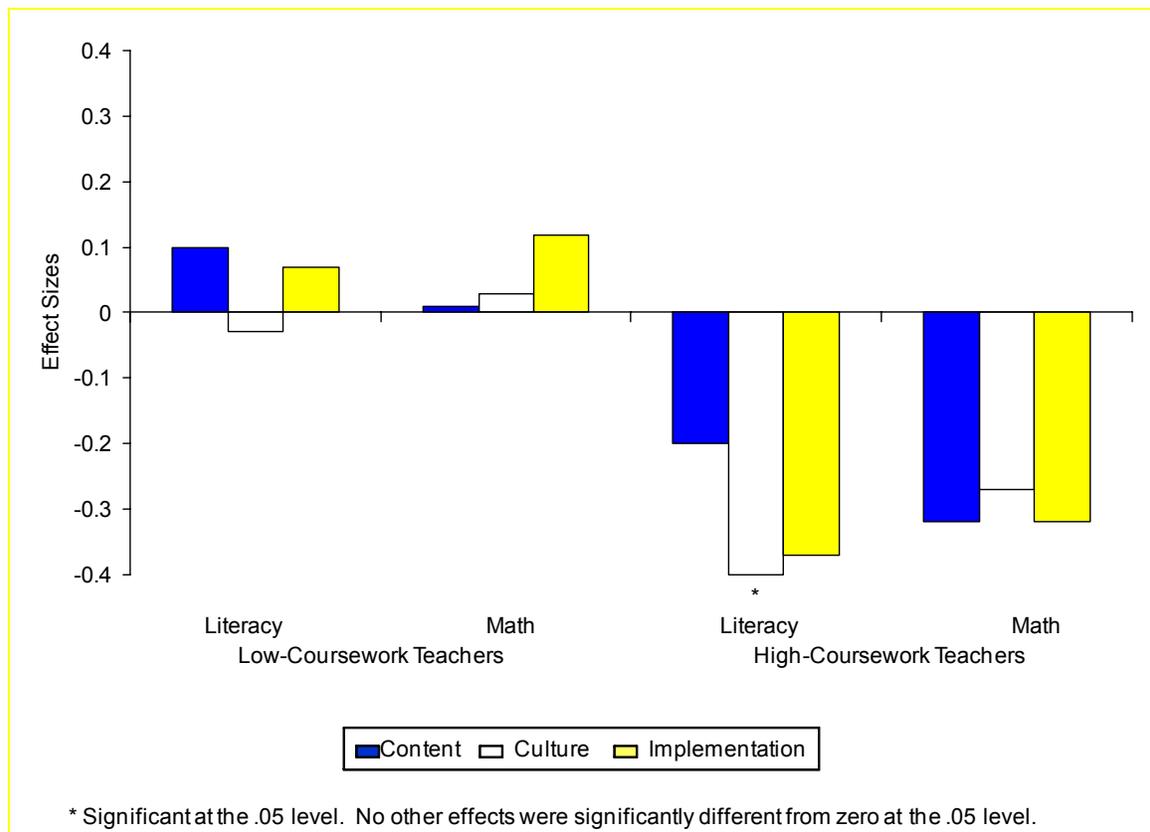


We found no evidence that AC teachers had a different effect on their students' math or reading achievement for different grade levels. There were no statistically significant differences between the lower elementary grades (K to 1) and the upper ones (2 to 5) for either the high- or the low-coursework AC teachers.

We found no evidence that students of AC teachers with less experience (1 to 2 years) had statistically significant different math or reading achievement, relative to their TC counterparts, than those with more experience (3 to 4 or 5 or more years). The one statistically significant difference pertained to students of low-coursework AC teachers in their third or fourth year of teaching, whose students scored lower in reading and math than students of their TC counterparts. Inferences based on these findings should be made with caution because the subgroup sizes were small and the experience levels of the TC comparison teachers varied.

With a single exception, ratings of classroom practices measuring the instruction received by students of AC and TC teachers did not differ. We found no statistically significant differences in VCOT scores between low-coursework AC teachers and their TC counterparts in the quality of their literacy and math instruction, as shown in Exhibit 6. High-coursework AC teachers also scored no differently from their TC counterparts on five of six VCOT measures, but they scored lower (by 0.40 SD) on the classroom culture dimension in teaching literacy, and the difference was statistically significant.

Exhibit 6. Difference in Effects Sizes on Classroom Practices of AC Teachers and Their TC Counterparts



FINDINGS FROM NONEXPERIMENTAL ANALYSES

Although the average effect sizes (comparing achievement of students of AC teachers to achievement of students of their TC counterparts) were not statistically different from zero, effect sizes varied across individual pairs of AC and TC teachers. In reading, the effect size was less than zero in half the pairs and greater than zero in the other half. For math, the effect was less than zero in 56 percent of the pairs and greater than zero in 44 percent. Separating the effects of characteristics of teachers from the influences of their training, however, requires nonexperimental analysis, as does examining the relationship between teacher characteristics and classroom practices and student achievement.

To estimate the relationship between teacher characteristics and training experiences and student achievement, we used ordinary least squares (OLS) regression equations to estimate the correlation between a student's posttest score and student-level characteristics (including pretest score), whether his or her teacher was from an AC program, differences between the characteristics of AC and TC teacher pair within a school and grade, and other unobservable effects. This model allows us to estimate the relationship between differences in student achievement and differences in AC teachers and their TC counterparts' characteristics, such as required coursework, whether a teacher is currently taking courses, undergraduate major, and SAT scores.

All together, the differences in AC teachers' characteristics and training experiences explained about 5 percent of the variation in effects on math test scores and less than 1 percent of the variation in effects on reading test scores.

Differences in teachers' demographic characteristics and coursework required for initial certification were not related to the effects of teachers on student achievement. Of the several aspects of teachers' education and training we examined, two were statistically significantly related to the effects of teachers on student achievement, and both relationships were negative. First, AC teachers with master's degrees were less effective in improving student achievement in reading than their TC counterparts without a master's degree (effect size was -0.12). Second, students of AC teachers who were taking coursework toward certification or a degree scored lower in reading (effect size -0.13) than did students of their TC counterparts who were not taking coursework.

CONCLUSION

This study found no benefit, on average, to student achievement from placing an AC teacher in the classroom when the alternative was a TC teacher, but there was no evidence of harm, either. In addition, the experimental and nonexperimental findings together indicate that although individual teachers appear to have an effect on students' achievement, we could not identify what it is about a teacher that affects student achievement. Variation in student achievement was not strongly linked to the teachers' chosen preparation route or to other measured teacher characteristics.