Do first grade teachers engage in effective mathematics teaching practices?

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ABSTRACT

Understanding the link between instructional practices and mathematics achievement is of vital importance as the nation strives to improve the mathematics skills of its students. Although several existing studies have identified teaching practices that are effective in raising mathematics achievement, little is known about the extent to which these practices are used in the classroom. This study sheds light on the implementation of effective practices by investigating factors associated with their differential use and the degree to which they match what teachers actually do in the classroom. Using the Early Childhood Longitudinal Study of the Kindergarten Class of 1998-1999 (ECLS-K), we find that first grade teachers' efforts are generally channeled into practices that promote student learning. Our results show the existence of teacher profiles that emphasize traditional practices while others emphasize reform-based strategies. We find that time spent on mathematics instruction, emphasis on traditional teaching, and emphasis on reform practice varies between teachers as a function of school location and type, and a range of teacher attributes that includes demographics, preparation, level of effort, and professional development activities.

Key Words: Teaching practices, reform-based practices, traditional practices, mathematics teaching, instructional practices, mathematics instruction

Introduction

Understanding the link between instructional practices and mathematics achievement is of vital importance as the nation strives to improve the mathematics skills of its students. In order to devise efficient policies to encourage effective teaching, we must not only identify desirable instructional practices but also understand the context in which these practices are to be promoted. Although several existing studies have identified teaching practices that are effective in raising mathematics achievement, little is known about the extent to which these practices are used in the classroom. This study sheds light on the implementation of effective practices by investigating factors associated with their differential use and the degree to which they match what teachers actually do in the classroom.

We focus on how teachers teach mathematical content to students in first grade. Because the impact of teachers is cumulative (Wright, Horn & Sanders, 1997; Sanders & Rivers, 1996) and early learning and intervention strategies have been shown to affect later outcomes (Currie & Thomas, 2000; Barnett, 1995, Kilpatrick, Swafford & Findell, 2001), the early grades serve as a basis for later success. First grade—the first compulsory grade across the entire US—is especially important as it lays the foundation for all subsequent mathematics learning in elementary school.

This study answers the following two research questions: (1) what factors are associated with the use of effective instructional practices by first grade teachers, and (2) how well do the practices commonly used by first grade teachers match those that have been identified as effective? To do this, we use data from the Early Childhood Longitudinal Study of the Kindergarten Class of 1998-1999 (ECLS-K). These data provide a comprehensive set of teacher characteristics and contextual factors that can be related to their self-reports of the practices they use in the classroom.

Background

One might expect mathematics instruction in the US to exhibit considerable heterogeneity, as the debate over optimal curricular and pedagogical approaches has historically been intense. Early controversies related to content coverage in the "new math" era of the 1950s—pitting those who emphasized teaching mathematical concepts and fundamentals (e.g., Meder, 1959) against those who

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maintained that mathematics should be taught less abstractly (e.g., Begle, 1962; Kline, 1973; Stanic & Kilpatrick, 1992; Wu, 1996)—were followed a few decades later by controversies related to pedagogy. The push toward reform generated by *A Nation at Risk* (National Commission on Excellence in Education, 1983) culminated in the 1989 report of the National Council for Mathematics Teachers (NCTM), which established standards emphasizing reform-based instructional practices focused on student-centered instruction. Examples of such pedagogical reforms were "project work, group work, discussion between teacher and students and among students, practice on mathematical methods, exposition by the teacher" (NCTM, 1989, p.10). The ensuing debate, termed "math wars," pitted proponents of these student-centered, inquiry-based approaches against advocates of traditional teaching methods such as routine practice and teacher directed instruction (Schoenfeld, 2004), and only in the past decade have participants in the debate tried to devise guidelines for practitioners that emphasize the need for elements of both approaches (e.g., Ball, et al., 2005; Kilpatrick, Swafford & Findell, 2001). Within the context of these debates, however, the extent to which the different points of view filter down into classroom practice and why this might vary is an open question and one that our study aims to answer.

Prior Research on Effective Practices

Since teaching practices are the primary vehicles through which information is transferred to students in the classroom, it is important to identify practices that have the most influence on students' achievement. Evidence suggests that teachers vary substantially in their impact on student learning (e.g., Sanders & Horn, 1994, 1998), and some studies suggest factors that differentiate teachers in their effectiveness. Certain teacher characteristics, such as scores on licensure tests or college entrance examinations (Goldhaber, 2007; Ehrenberg & Brewer, 1995), experience (Hanushek, Kain, O'Brien & Rivkin, 2005), subject-matter expertise (Monk, 1992, 1994), and coursework (Croninger et al, 2007) have been linked to effectiveness. However, the mechanisms by which these characteristics translate into pedagogical practice are unclear. Ball, Hill, and Bass (2005) and Hill, (2005, 2007) assess mathematical knowledge for teaching (MKT)[1] and link it to effectiveness but do not directly describe the classroom teaching that results from MKT.

A small body of studies investigates the links between specific types of instructional practices and student achievement in elementary school. Some studies point to evidence that reform-based practices are positively linked to student achievement, although the evidence is fairly weak and, in some cases, sensitive to the nature of the assessment tools being used. Reform-based practices, often also called inquiry-based or student-centered practices, include such pedagogies as the use of manipulatives, open-ended assessment, and group work (Hamilton et al., 2003). Le et al. (2006), in a longitudinal study of elementary and middle school students, asked teachers to report the frequency of use of particular reform-oriented practices (e.g., working in groups, using open-ended assessments, assigning problems that extend over several days, explaining mathematics problems, and assigning open-ended problems with several solutions). Using two forms of assessment—a standardized test and an open-ended question test—they found weak positive or no associations between a teacher's emphasis on most student-centered practices and student mathematics achievement. In addition, they found that an emphasis on group work was negatively associated with achievement measured on the standardized test and positively associated with achievement on the test consisting of open-ended questions. Overall, when achievement was measured using open-ended questions, the association between the use of reform-based practices and achievement tended to be stronger. In a study of about 500 elementary and middle school teachers that evaluated a large scale reform aimed at changing classroom practice, Hamilton et al. (2003), found small but positive associations between the use of reform-based practices and student's mathematics performance on an open response test as well as on a multiple choice test. Cohen and Hill (2000) found similar small and positive associations between the reported use of reform-based practice and student's mathematics achievement using data from approximately 500 California elementary school teachers. In their study, reform-based practices included working in small groups, doing problems that have several solutions, working on projects that take several days, and writing about and discussing how to solve a problem.

Three studies used ECLS-K to investigate links between practices and mathematics achievement; two examined kindergarten and one first grade. The ECLS-K surveys asked teachers to estimate the frequency with which they engaged in specific teaching practices. Guarino, Hamilton, Lockwood, and

Rathbun (2006) found that the amount of time a teacher spent teaching mathematics and the use of traditional resources, such as worksheets, textbooks, and chalkboards, were positively associated with mathematics learning in kindergarten. Bodovski and Farkas (2007a), using the same data but a somewhat different methodology, found that both traditional (defined as working with textbooks and worksheets and at the chalkboard) and interactive approaches (defined as explaining how a math problem was solved, group work, working on problems that reflect real-life situations, working in mixed achievement groups, and peer tutoring) were positively related to gains in kindergarten achievement. Palardy and Rumberger (2008) examined mathematics achievement in first grade and found that the use of math worksheets and calendars raised achievement, whereas the use of geometric manipulatives lowered it. No explanation was offered by the authors for this particular negative finding.

In summary, the literature identifies several practices that are linked to student achievement—the amount of time spent on teaching mathematics as well as the use calendar-related activities, and the use of both reform-oriented practices and traditional curricular tools such as worksheets and textbooks. The goals of this study are to investigate the degree to which teachers use these practices, to explore the factors that influence their use, and to determine how frequently these practices are used in the classroom relative to less effective practices.

Prior Research on the Use of Particular Teaching Practices

To guide our analysis, we look to the literature to develop hypotheses regarding factors at the teacher, classroom, and school levels that appear to drive heterogeneity in teaching practice at the elementary school level. Prior research on this topic is fairly limited, however.

One small-scale study suggests that teaching experience is positively related to the use of reform-based practices. In an observational study of three pairs of teachers (student pre-service teachers paired with expert district teachers) at the elementary and secondary level, Borko and Livingston (1989), found that experienced teachers were better able than novice teachers to deviate from planned material, respond to student inquiry, generate illustrative examples on the spot, and design long-term goals for the class.

A few studies have linked pre-service training and targeted post-degree professional development to the use of specific instructional practices in the classroom. Guarino et al. (2006), using ECLS-K, found that prior coursework in methods of teaching mathematics was positively associated with kindergarten teachers' emphasis on mixed-achievement grouping as well as student-centered instruction and traditional practices. Desimone, Porter, Garet, Yoon, and Birman (2002), in a study of about 200 teachers at the elementary, middle, and high school level, found that professional development focusing on technology increased the use of technology in the classroom. Cohen and Hill (2000) found that workshops specifically geared towards studying reform curriculum increased the use of reform-based practice on the part of second through fifth grade teachers.Two studies suggest that classroom composition affects instruction. In a study of approximately 300 kindergarten and first grade teachers across three states while controlling for socioeconomic status of the students, Stipek (2004) found that teachers in classrooms with primarily white children emphasized "constructivist" approaches, which allow for individualized instruction, active participation on the part of students, guided use of manipulatives, encouragement in problem-solving, and flexibility in routines. Teachers in classrooms with higher percentages of African-American students were more likely to engage in didactic approaches that emphasized the attainment of universal standards, and were more likely to control classroom conversation, teach number facts, and focus on procedural knowledge, rote counting, and correctness of response. Bodovski and Farkas (2007) using the ECLS-K and also controlling for student socioeconomic status, observed a positive association between the percentages of African-American and Hispanic students in kindergarten classes and time spent teaching practical mathematics and single-digit operations. These findings suggest that classrooms with higher minority percentages receive less in the way of reform-based teaching (e.g., teaching centered around student discovery using manipulatives, problem solving, and active participation) and more in the way of traditional forms of teaching (e.g., rote counting, emphasis on correctness of responses, number facts).

A small amount of evidence suggests that class size is inversely related to variety in teaching practices and the use of student-centered practices. A comparison of sixteen third-grade teachers in reduced and large class sizes following California's Class Size Reduction initiative found that teachers in smaller classes engaged in a wider range of pedagogical techniques compared to those in larger classes (Stasz & Stecher, 2000). Molnar et al. (1999), in a study of kindergarten through third grade teachers across the state of Wisconsin, found that smaller classrooms promoted small group activity and more individualized learning.

Prior research also indicates that school characteristics influence pedagogy. Bryk, Lee, & Blakeley (1993), in a review of approximately seven schools covering all grades, found that Catholic schools emphasized a structured teaching style that incorporated a greater use of lectures, traditional practices, computation, repetition, homework review, and tests. Bodovski & Farkas (2007) found that kindergarten teachers in religious schools spent less time on group and interactive teaching approaches than those in public schools. In addition, Bodovski and Farkas (2007) found that kindergarten teachers in the South used group activities and interactive approaches to teach mathematics more frequently than teachers in other regions. Regional differences in mathematics teaching might be expected to arise from the fact that responsibility for education is assigned to the states. In particular, kindergarten is not compulsory, and regions differ in the extent to which it is emphasized. For example, children in the South are more likely than those in other regions to enroll in full-day kindergartens programs (approximately 78% in the South, compared with the 60% in the Northeast, 53% in the Midwest, and 44% in the West, according to Wirt et al. (2004)).

Using ECLS-K, we are able to operationalize not only a wide range of teaching practices but also many of the factors at the school, classroom, and teacher level that appear to influence the use of these practices. Our study adds to the research in two ways. First, it examines the use of specific practices identified as effective in first grade—the first compulsory grade and the grade that lays the foundation for all elementary school learning—on a national scale. Second, our paper assesses the overall frequency of

use of effective practices in relation to other types of teaching practices. It is not enough to know what factors influence effective practice if such practices are infrequently used in comparison with others. To design efficient teacher training and professional development policies, one must know which practices need to be encouraged.

Data

The ECLS-K survey (National Center for Educational Statistics, 2009a), conducted by the National Center for Education Statistics (NCES) within the U.S. Department of Education's Institute of Education Sciences, provides data on a nationally representative sample of children who attended kindergarten during the 1998-99 school year. The children were followed through first, third, fifth, and eighth grades. For the initial wave, the children were selected using a multistage probability design that incorporated the public and private school populations using a dual sampling frame. Counties were sampled by region, schools with kindergartens were sampled within the selected counties, and approximately 24 kindergarteners were sampled in each school, for a total of 21,260. At each wave, the children were assessed in a variety of subjects and their parents, teachers, and school administrators were surveyed. We analyze public use data from the teacher and school surveys from the spring first grade wave. Our analyses make use of responses from 3,831 first grade teachers.

The teacher surveys are rich in detail and contain information about teaching practices, teacher attributes, and class characteristics. The administrator surveys provide information on school characteristics and geographic context. We next describe the construction of the variables we use.

Instructional Practices

ECLS-K data on instructional practices consist of information on time spent teaching mathematics and the frequency with which particular practices are used. With regard to the former, teachers were asked how many days per week they teach mathematics and how much time they spend on the subject on the days they teach it. We combine teacher answers to these two questions to create a measure of time spent on math, operationalized as minutes per week.

Specific teaching practices are listed as items in the ECLS-K teacher questionnaire under the question "How often do children in the class do each of the following math activities?" Using closed response categories, teachers indicated how often children in their classrooms engage in a specific math activity (reflecting a pedagogical approach). We code teacher responses on the practice items as times per month.[2]

There are 19 such practice items (summarized in Table 2 and discussed in more detail in the Findings section). Several of these items map directly into the set of reform-based practices as broadly defined in the literature. These are geometric manipulatives, counting manipulatives, explaining how mathematics problems are solved, solving problems in small groups or with a partner, working in mixed achievement groups, and working on problems with several solutions. Several others fall into the category of traditional practices: namely, mathematics worksheets, mathematics textbooks, and drill. Practices that do not explicitly fall into either of these categories are calendar-related activities, counting out loud, solving real-life problems, completing problems at the chalkboard, playing math-related games, peer tutoring, working with rulers and measuring equipment, using creative movement and drama, using music, and using calculators.

Covariates

The teacher attributes, classroom characteristics, school characteristics, and geographic location indicators used in our analyses are summarized in Table 1.

Insert Table 1 here

The teacher-level characteristics used in our analyses are race/ethnicity, age, teaching experience, educational attainment, whether the teacher has regular certification, and whether the teacher has taken more than two courses in methods of teaching mathematics, all treated as indicator variables.

We also use information on the amount of time teachers spent preparing for lessons, including an indicator variable for whether the teacher reported being given more than two hours per week of paid preparation time and a similar variable for whether the teacher spent more than five unpaid hours per week preparing for class[3]. In addition, we include information on professional development activities in

which the teacher participated. The ECLS-K professional development items ask whether, during the current academic year, teachers had taken part in each of nine activities—for example, "peer observation and feedback." Allowable responses were yes/no. We coded the items as dummy variables for analysis purposes. Classroom characteristics consist of class size and demographic composition variables. The percentage of African-American, Hispanic, Asian Pacific, and disabled students in the class are included as dummy variables indicating whether the percentage is less than five. This cut-off was chosen because the distributions of these variables are negatively skewed, with approximately 60 percent of classrooms having fewer than five percent of students in each of the categories.

School Characteristics are represented by school type, school size, and minority composition. We use dummy variable classifications for school type (public, private religious, private non-religious) and school size (<300, 300–499, 500–749, ≥750). Minority composition is coded ordinally in quintile categories.[4]

As location indicators we include region (South, West, Midwest, and Northeast) and the type of locale in which the school is located (central city, urban fringe, and small town) as dummy variable classifications.[5]

Methods

Using regression, we focus on the contributions of covariates to (i) amount of time spent on mathematics and (ii) specific pedagogical practices related to mathematics, while allowing for the clustering that stems from the hierarchical nesting of teachers within schools.[6] The regressions are of random intercept form

$$Y_{ij} = \alpha_j + x_{ij}^T \beta + z_j^T \gamma + \varepsilon_{ij} \quad (1)$$

where i=1,…,N indexes teachers and j=1,…,J indexes schools, Y_{ij} is an individual teacher outcome, α_j is a random school intercept, x_{ij}^T is a row vector of teacher- and classroom-level covariates for the i^{th} teacher, β is the associated column vector of coefficients, z_j^T is a row vector of school-level covariates, γ is the associated column vector of coefficients, and ε_{ij} is a teacher random error.[7]

The hierarchical linear model employed here assumes that the α_j are uncorrelated with the included covariates. To check this assumption, we compared the random-intercept regressions to fixed-effect regressions of the form

$$Y_{ij} = \alpha_j + x_{ij}^T \beta + \varepsilon_{ij} \quad (2)$$

where the α_j are treated as fixed parameters instead of realizations of a random variable. This estimation approach allows for the possibility of correlation between the α_j and the covariates but has the disadvantage of precluding the use of school-level covariates. Judged by visual comparison of the teacher-level coefficients and their precision estimates across models (1) and (2), and by the use of Hausman tests (1978), there is little difference in the results derived from the two estimation approaches; thus, we report the results of the random-intercept specification, which has the advantage of including school-level covariates.

The original first grade teacher sample contained 5,047 teachers. By survey design, 1,216 teachers were not administered any of the practice items. These teachers were dropped from our working sample. At that point, remaining item nonresponse varied between zero and eight percent (see Table 1), however, the combined missingness affect resulted in a working sample size reduced by about 42 percent. To counter this loss of information, we used Royston's (2004, 2005, 2007) Stata implementation of chained multiple imputation (Van Buuren, Boshuizen & Knook, 1999) to produce 40 imputed data sets, each with 3,831 first grade teachers. Post-estimation was carried out using a Stata routine supplied by Carlin, Galati & Royston (2008).

Findings

Frequency of Use of Teaching Practices

Table 2 displays non-imputed univariate statistics for each of the 19 practice items listed in ECLS-K. The means represent the average number of times per month teachers report engaging in the particular practices. The practices are listed from most frequently used to least frequently used. The average number of times per month a practice is used ranges from about 18 days a month (out of 20

possible times) to about one and a half times a month. We consider practices that have a mean frequency of less than 10 (half of the available times in a month) to be relatively infrequently used.

Insert Table 2 here

The use of calendars, identified as an effective teaching practice in Parlady and Rumberger (2008) and the most commonly reported practice among those listed in ECLS-K in first grade, has a (rounded) mean of 18 times per month and a relatively small (rounded) standard deviation of five days per month. As can be seen in the table, mathematics worksheets and counting out loud are the second and third most frequently used practices. Although calendar-related activities and mathematics worksheets have been found to positively affect achievement, the use of counting out loud has not. This means that teachers spend a significant amount of time utilizing a practice that does not affect student performance.

Table 2 shows that traditional practices, such as using textbooks, worksheets, and drill, are very widely used. Worksheets, in particular, are utilized on average 14 times per month. Given that worksheets and textbooks have been shown to promote student learning, this is an encouraging finding.

Only two of the six reform-based practices listed in ECLS-K are widely used. Counting manipulatives are emphasized on average 12 times per month. Teachers engage in explaining math problems on average 13 times per month. Of the less frequently used practices, teachers report working in mixed achievement groups an average of 10 times per month, working with small groups and partners an average of nine times a month, and working on problems with several solutions is used an average of eight times a month. Parlady and Rumberger (2008) find the reform-based use of geometric manipulatives to be negatively associated with achievement. This practice, however, is even less widely used, with an average reported use of six times per month. The results indicate that teachers generally are more likely to emphasize reform-based practices that are positively associated with achievement in the classroom. It is also important to note, however, that overall the use of reform-based practices in the classroom appears to be less frequent than the use of traditional pedagogy. All three of the traditional practices are used an average of 10 or more times per month, but only two of the six reform-based practices are at or above 10 days per month.

One other practice that is difficult to classify as traditional or reform-based but was frequently used is "working on mathematics problems that reflect real-life situations." The average reported frequency for this practice is approximately 10 times a month.

Apart from the four reform practices, the practices that are infrequently used appeared to have little consequence and were thus not investigated further. Overall we find a fairly good match between known effectiveness and frequency of use, with the exception of the widespread use of counting out loud and problems that reflect real-life situations.

We next examine correlations among those practices that are frequently used and/or found to affect achievement in order to see which practices are likely to be used in conjunction with others. Table 3 displays correlations that range from 0.006 to 0.563. The highest significant correlation is found between the traditional practices worksheets and drill (correlation 0.563). Correlations among the three traditional practices are relatively high compared with others. On the other hand, among the reform-based practices, the highest correlation is .387, between the use of counting manipulatives and geometric manipulatives. None of the other correlations among the reform-based practices exceeds .3, which suggests that teachers who use reform-based pedagogy do so selectively.

Insert Table 3 here

In general, correlations among reform-based practices and among traditional practices exceed those between individual reform-based practices and traditional practices by a fairly large margin. The largest correlation between a reform practice and a traditional practice is found between explaining how a mathematics problem is solved and drilling, and this correlation is only 0.123. These results suggest the existence of teacher profiles, with some leaning toward reform and some leaning toward traditional pedagogy. In addition, two significant negative correlations appear. The use of mathematics textbooks is negatively associated with the use of calendars and the use of working in mixed achievement groups, further evidence of a split between traditional and reform-oriented teachers. It is plausible that the use of textbooks is not conducive to working in groups consisting of students at different levels. Conceivably, a

textbook might offer prescribed lessons that are difficult to apply to apply in a group setting to students working at different levels.

Overall, the pattern of correlations among practices suggests that different groups of teachers are loosely identified with particular forms of pedagogy, but the abundance of positive correlations confirms that teachers engage in a wide range of techniques and do not always feel restricted to one style of teaching.

Regression Results

We next consider factors that may drive the differential use of the commonly used and effective practices among first grade teachers. We present the results of the regression analyses, beginning with "time on math" and then proceeding with the instructional practices. Because time spent on math may affect the use of particular practices, the regressions for instructional practices include time on math as a covariate. This allows us to identify the factors contributing to a teacher's emphasis on a particular practice after holding constant the amount of time a teacher spends on the subject.

Time on Math

Column 1 of Table 4 presents the regression for the amount of time first grade teachers report spending on mathematics in the classroom. Teachers in the South spend approximately 16 minutes more per week teaching math than those in the Northeast. Teachers in private religious schools spend approximately 13 minutes per week less on math than those in public schools. Additionally, the greater the percentage of minority students at the school the more time is dedicated to mathematics. At the classroom level, no associations are found. However, two teacher characteristics are linked to time spent teaching math: Black teachers spend approximately 16 minutes less per week on teaching mathematics than white teachers, and taking more than two math pedagogy courses is associated with an increase of about 10 minutes per week. Only one type of professional development is associated with the amount of time spent teaching math. Receiving follow-up support for trying out new skills is associated with an increase in the time spent on math of about eight minutes per week.

Insert Table 4 here

We turn next to a discussion of instructional practices, with results presented in the following order: commonly used teaching practices, reform-based practices, and traditional practices.

Commonly Used Practices

Table 4 (columns 2-4) reports the regression results for the commonly used practices: calendar-related activities, counting out loud, and working on mathematics problems that reflect real-life situations. In addition to being the most frequently used practice, the use of calendar-related activities was identified in the literature as positively affecting achievement. We find that public school teachers, white teachers, younger teachers, and more educated teachers tend to emphasis calendar-related activities more frequently than their respective counterparts (see Table 3, column 2). No associations are found between the use of calendars and the classroom-level variables. The only professional development activity associated with the teaching of calendars is receiving instruction from an outside consultant.

Counting out loud was more heavily emphasized by teachers in the following types of schools than by their counterparts: public schools, large schools, and schools serving higher percentages of minority students. Hispanic teachers use the practice more than white teachers while teachers with more than 10 years of experience use it less than those with less than four years of experience, and teachers above 50 years of age use it less than younger teachers. In addition, teachers who took more than two courses in methods of teaching math used counting out loud more those who did not. None of the classroom-level variables are associated with the use of counting out loud.

Interestingly, although counting out loud has not been identified as an effective practice, four professional development activities are positively associated with its use. Teachers who visited or observed other schools, participated in small group workshops, participated in peer observations, and who were given follow-up support for trying new skills in the classroom all reported using more frequent use of counting out loud than those who did not.

"Working on problems that reflect real-life situations" has not been identified as an effective practice, yet it is widely used. Teachers in the Northeast, teachers in small-to-medium sized schools, and teachers in classrooms in which more than five percent of the students are African American tend to

emphasize this practice more than their respective counterparts. In addition, teachers who took more than two courses in methods of teaching math, prepare more than two hours a week using paid time, and prepare for more than five hours a week using unpaid time all report a greater use of real-life problems than those who did not.

Again, although this practice is not linked to effectiveness, several professional development activities are associated with its use. Participating in small group workshops, receiving instruction from an outside consultant, receiving feedback, receiving support, and obtaining release time to attend early childhood conferences all are associated with an increased use of working on problems reflecting real-life solutions.

Reform-based practices

In our regressions (see Table 5) modeling the frequency of use of the six ECLS-K practices that can be categorized as reform based, we find significant differences across regions but consistency within them. With one exception (teachers in the South report a greater emphasis on explaining math problems), our results show that teachers in the Northeast focus more on reform-based practice than teachers elsewhere.

Insert Table 5 here

At the school level, first grade teachers in private religious schools are less apt to use nearly all the reform-based practices than those in public schools, with the largest differences being for working in mixed achievement groups and working on problems with several solutions. In addition, teachers in large schools are more likely to explain mathematics problems than those in small schools.

At the classroom level, we find that the larger the class, the less often counting manipulatives are used but the more often teachers engage in explaining problems. Teachers in classrooms with more than five percent disabled students have students working in mixed groups more often than those with low percentages of disabled students. With regard to the racial/ethnic composition variables, teachers in classrooms with more than five percent African-American students are more likely to use geometric manipulatives than those with fewer than five percent.

Several teacher characteristics and preparation indicators are associated with the use of reform-based practice. Non-white teachers report more frequent use of manipulatives than white teachers. In addition, Hispanic teachers report more frequent use of small-group work than their white counterparts. Additionally, teachers with higher levels of teaching experience are more likely to use counting manipulatives and engage in explaining math problems, whereas older teachers are less likely to use counting manipulatives than younger teachers.

Teachers with regular certification tend to focus less on several reform-based practices. It is striking, however, that teachers who have taken more than two courses in methods of teaching mathematics, as well as those who prepare more than five hours using nonpaid time, report more frequent use of *all* the reform-based practices. This suggests that implementing reform practices may require additional preparation time and that courses in math teaching actively promote the use of such practices.

Participation in four professional development activities is positively associated with the use of reform-based practices. In particular, receiving support for trying out new skills in the classroom and attending small-group workshops are positively associated with the use of all reform-based practices. The other professional development activities that are associated with reform-oriented teaching are receiving peer observations and feedback, obtaining release time to attend early childhood professional development conferences, and taking college or university courses. These results suggest specific vehicles through which professional development encourages the use of reform-based practices. They also illustrate that several frequently used professional development activities, such as in-service days, might not be effective in promoting reform-based practice.

Traditional practices

Table 6 reports the regression results for the frequency of use of traditional practices: working with mathematics worksheets, working with textbooks, and drilling.

Insert Table 6 here

At the school level, teachers in the Northeast are more likely to use textbooks than teachers in the West and Midwest. Teachers in small towns and the urban fringe are more likely than urban teachers to

use all three traditional forms of pedagogy. Teachers in private religious schools utilize traditional pedagogy more frequently than those in public schools by a relatively large margin. In addition, teachers in large schools (more than 750 students) rely more on worksheets and drilling than teachers in small schools (less than 300 students).

Only two classroom-level variables are significantly related to the use of mathematics worksheets at the five percent level, although a few are significant at the 10 percent level. The larger the size of the class the less frequently worksheets are used. In contrast, the presence of more than five percent Asian Pacific students in the classroom is associated with a decreased prevalence in the use of worksheets.

Interestingly, the racial/ethnic background of a teacher appears to play a role in influencing the frequency with which these pedagogies are used. African-American teachers use all three types of traditional practices more than white teachers, and "other-race" teachers focus more on worksheets and textbooks than white teachers.

In contrast to our findings pertaining to reform-based practices, we find that courses in methods of teaching mathematics show little or no association with the use of traditional practices other than drilling. A weak negative association with drilling is seen for the certification variable. Also in contrast to the findings regarding reform-based practices, preparation time—either paid or unpaid—is unrelated or weakly related to the use of traditional practices. In addition, teachers with a master's degree or above focus less on worksheets and textbooks than those with a bachelor's or less, but teachers who have more than 10 years of experience tend to use worksheets more than teachers with less than four years of experience.

In comparison with what we observed in the reform-based practice regressions, few professional development activities show significant associations with the use of traditional practices. First grade teachers who receive peer observation and feedback are significantly more likely to emphasize worksheets and textbooks than those who do not, whereas those who receive support in the classroom to try out new skills are less likely to use worksheets than those who do not. No professional development activities are associated with the use of drilling.

Discussion and Conclusions

In order for policy makers, districts, and teacher education programs to promote effective teaching practices, it is important to understand where and by whom these practices are currently used. Our study shows that first grade teachers' reports of time spent on mathematics instruction and their use of specific pedagogical practices varies considerably and in systematic ways. We find that, with the exception of a widespread emphasis on counting out loud, first grade teachers' efforts are generally channeled into practices that promote student learning. The most efficacious practices—use of worksheets and texts—are, on average, widely used. The use of reform-based practices is less widespread, but teachers apply at least some of these techniques fairly often. Because time spent teaching mathematics is positively associated with all of the teaching practices examined, it cannot be assumed that spending time using reform-based practices necessarily supplants the use of traditional methodologies. However, we do find that certain teachers tend to emphasize traditional practices while others tend to emphasize reform-based strategies and that some traditional practices, such as the use of textbooks, are used to the exclusion of certain reform-based practices, such as mixed achievement groupings.

When we examine how teacher profiles vary by geographic location, school characteristics, personal attributes, and professional development activities, we find that traditional pedagogy is clearly favored by teachers in suburban and rural schools as compared to those in cities and by teachers in private religious schools as compared to those in public schools. This variation by locale and type of institution is overlaid by regional variability: Teachers in the Northeast tend to utilize reform-based practices more frequently than those in the other parts of the country. Interestingly, teachers' race/ethnicity is sometimes associated with practice, with African-American teachers spending less time on mathematics than white teachers but more likely to employ traditional and certain reform-based pedagogical techniques.

We find that teacher certification is often negatively related to the use of effective practices. However, teacher preparation courses specifically aimed at mathematics pedagogy appear to be related to teachers spending more time teaching mathematics and emphasizing the use of reform-based practices. In addition, they are associated with the use of drilling, for which, however, no evidence of effectiveness has

been found. Although courses in methods of teaching mathematics are positive and significantly related to reform-based practices, no significant relationships emerge with respect to the two traditional practices related to effectiveness—worksheets and textbooks. One explanation for this may be that individual teachers do not always have decision-making authority concerning the use of textbooks and workbooks. Another may be that teachers are assumed to "know" how to use these more traditional teaching methodologies already so emphasis is not necessary. In any case, our findings related to certification and courses in mathematics pedagogy have implications for teacher preparation programs, suggesting that they revisit their emphasis on specific teaching methods shown to be effective.

Certain forms of professional development activities show significant associations with the effective instructional practices, although some of these are rare, whereas the most commonly sponsored forms of professional development show little association with practice. Interestingly, the professional development activities for which teachers report most frequent participation are not related to these practices. For example, participating in three or more in-service days is the professional development activity in which teachers most frequently engage (see Table 1), yet this participation is not associated with the use of *any* of the practices we examine. This suggests that in-service is not being used as a vehicle for significantly molding classroom practice toward effective teaching. In contrast, certain less widespread professional development activities show strong associations with pedagogical practices. The most prominent of these is the strong positive association between workshops involving small groups teachers and the use of reform-based practices. Second in prominence is support for trying out new skills in the classroom—which also strongly promotes the use of reform-based practices—a finding consistent with prior literature highlighting the importance of support for teachers adopting new practices in the classroom (Cohen & Hill, 2000; Garet et al., 2001). On the other hand, peer observation and feedback is strongly related to the use of effective traditional practices. Despite the seeming efficacy of support for trying out new skills in the classroom, and peer observation, fewer than half the first-grade teachers surveyed reported participating in professional development activities of this nature. In contrast,

professional development for this population of teachers appears to consist primarily of in-service training and instruction from outside consultants.

Our results suggest strategies that can influence classroom practice in desired ways. The findings presented here provide a snapshot of first-grade teaching practice based on the relative emphasis teachers place on particular techniques; they also show how teachers, classrooms, and schools with different characteristics deviate from the average. Thus they provide a roadmap to guide efforts on the part of school and district administrators and teacher preparation programs to encourage or discourage particular types of pedagogy.

Endnotes

1. "Mathematical knowledge for teaching" embodies both mathematical content knowledge and knowledge of ways to teach specific content and is a form of pedagogical content knowledge, such as that described by Schulman (1986, 1987).

2. We recode the response categories for the practice items using what is essentially interval midpoint scaling: "never" → 0 times per month; "once a month or less" → 1 times per month; "two or three times a month" → 2.5 times per month; "once or twice a week" → 6 days per month; "three or four times a week" → 14 days a month; "daily" → 20 times per month.

3. The cut-offs for the time spent preparing for lessons (paid and unpaid) were chosen because approximately 30% of the sample reported using less than two hours of paid time per week and less than five hours of unpaid time per week.

4. Initially, percent minority was grouped into approximate quintiles, which in turn defined the categories of a dummy variable classification used for data exploration. Subsequently, to obtain the results presented in the paper, the quintiles were coded ordinally to provide a check for the presence of monotonic associations with outcomes. The coding scheme is: 1:[0,10), 2:[10,25), 3[25,50), 4:[50,75), 5:[75, 100).

5. In the ECLS-K public use data files, the complete names of the categories are "central city (large city and mid-size city)," "urban fringe and large town" (includes urban fringes of large cities and mid-size cities), and "small town and rural."

6. About 15 percent of first grade teachers are sample singletons in their school, about 81 percent are in clusters ranging in size from 2 to 8, and about four percent are in clusters ranging in size from 9 to 13.

7. In our review of the regression results, we focus on $\hat{\beta}$, $\hat{\gamma}$, and their precision estimates; $\hat{\alpha}_j$ and $\hat{\sigma}_\alpha$ are not of primary interest. All regressions were computed using Stata 11 (StataCorp., 2009).

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Table 1. Descriptives, first grade teachers, ECLS-K[a]

Covariates	N	Mean	Standard Deviation
Time on math	3514	267.56	94.15
Geographic Location			
Region			
Northeast	3831	0.17	0.37
West	3831	0.24	0.43
South	3831	0.38	0.49
Midwest	3831	0.21	0.41
Type of place			
Central city	3816	0.39	0.49
Urban fringe	3816	0.43	0.49
Small town	3816	0.19	0.39
School Characteristics			
School type			
Public	3831	0.90	0.30
Private religious	3831	0.09	0.28
Private nonreligious	3831	0.02	0.13
% minority students	3785	2.94	1.55
School size			
<300	3811	0.13	0.34
300 to 499 students	3811	0.26	0.44
500 to 749 students	3811	0.30	0.46
≥ 750 students	3811	0.31	0.46
Classroom Composition (quintile coded)			
Class size	3816	20.51	4.03
Less than 5% disabled	3831	0.47	0.50
Less than 5% African American	3831	0.44	0.50
Less than 5% Asian/Pacific Islander	3831	0.71	0.46
Less than 5% Hispanic	3831	0.48	0.50

Table 1—Continued(1)

Covariates	N	Mean	Standard Deviation
Teacher Characteristics			
Race/ethnicity			
White	3831	0.78	0.41
African American	3831	0.07	0.25
Hispanic	3831	0.08	0.27
Other	3831	0.06	0.24
Age			
<35	3659	0.37	0.48
35-49	3659	0.24	0.43
50 or older	3659	0.33	0.47
Teaching experience			
<4 years	3748	0.19	0.39
4-9 years	3771	0.28	0.45
10 years or more	3771	0.30	0.46
Educational attainment			
BA degree or less	3729	0.01	0.08
BA degree plus additional coursework	3729	0.28	0.45
MA degree or above	3729	0.71	0.45
Certification/Coursework/Preparation			
Regular certification	3712	0.88	0.33
More than 2 courses on methods of teaching math	3531	0.45	0.50
More than 2 hours of paid time preparing	3626	0.72	0.45
More than 5 hours of unpaid time preparing	3748	0.45	0.50

Table 1—Continued(2)

Covariates	N	Mean	Standard Deviation
Professional Development Activities in Current Academic Year			
Received direct instruction from outside consultant	3744	0.76	0.43
Participated in 3 or more in-service training days	3754	0.89	0.32
Visited or observed other schools	3757	0.23	0.42
Received release time for early childhood conferences	3742	0.28	0.45
Participated in workshops involving small groups	3743	0.61	0.49
Participated in peer observation and feedback	3750	0.45	0.50
Participated in follow-up support for teachers trying new ideas	3738	0.44	0.50
Enrolled in college or university courses	3757	0.31	0.46
Attended workshops on technology	3758	0.59	0.49

Source: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998-99 (ECLS-K), Public-Use File, spring 2000.

Note: Sample size varies due to item nonresponse.

Table 2. Practices descriptives, first grade teachers, ECLS-K[a]

Practice	N[b]	Mean	S. D.	Classification
Engage in calendar-related activities	3807	17.89	5.10	Unclassifiable
Do mathematics worksheets	3819	14.36	6.37	Traditional
Count out loud	3804	14.02	6.76	Unclassifiable
Explain how a mathematics problem is solved	3812	13.19	6.64	Reform
Work with counting manipulatives	3792	11.69	6.44	Reform
Do worksheets or workbook page emphasizing routing practice or drill	3817	11.43	6.77	Traditional
Do mathematics problems from the textbook	3795	11.26	8.53	Traditional
Work on mathematics problems that reflect real-life situations	3809	10.35	6.56	Unclassifiable
Work in mixed achievement groups	3791	9.94	7.47	Reform
Complete mathematics problems on the chalkboard	3817	9.42	7.23	Unclassifiable
Play mathematics-related games	3792	8.75	6.15	Unclassifiable
Solve mathematics problems in small groups or with a partner	3817	8.52	6.41	Reform
Work on problems for which there are several solutions	3785	7.63	6.75	Reform
Peer tutoring	3777	7.39	6.91	Unclassifiable
Work with geometric manipulatives	3780	6.35	5.65	Reform
Work with rulers, measuring cups, spoons, or other measuring instruments	3798	4.33	5.00	Unclassifiable
Use creative movement or drama to understand mathematics concepts	3798	1.76	3.43	Unclassifiable
Use music to understand mathematics concepts	3806	1.65	3.50	Unclassifiable
Use calculator	3809	1.44	2.85	Unclassifiable

[a]Source: See Table 1.

[b]Sample size varies due to item nonresponse.

Table 3. Correlations among practice scales, first grade teachers, ECLS-K[a]

	Engage in calendar-related activities (1)	Count out loud (2)	Work on mathematics problems that reflect real-life situations (3)	*Work with geometric manipulatives (4)*	*Work with counting manipulatives (5)*	*Explain how a mathematics problem is solved (6)*	*Work in small groups or with partners (7)*	*Work in mixed achievement groups (8)*	*Work on problems with several solutions (9)*	**Do mathematics problems from the textbook (10)**	**Do mathematics problems from the textbook (11)**	**Do worksheets or workbook page emphasizing routing practice or drill (12)**
1	1											
2	0.22*	1										
3	0.14*	0.21*	1									
4	0.09*	0.25*	0.23*	1								
5	0.15*	0.30*	0.27*	0.39*	1							
6	0.13*	0.20*	0.42*	0.15*	0.21*	1						
7	0.07*	0.18*	0.46*	0.27*	0.30*	0.30*	1					
8	0.12*	0.16*	0.38*	0.21*	0.24*	0.25*	0.44*	1				
9	0.10*	0.18*	0.45*	0.25*	0.24*	0.39*	0.40*	0.38*	1			
10	0.05*	0.09*	0.08*	0.01	0.01	0.10*	0.05*	-0.02	-0.02	1		
11	-0.05*	-0.03	0.05*	-0.02	0.02	0.11*	0.05*	-0.04*	0.00	0.32*	1	
12	-0.02	0.09*	0.10*	0.06*	0.06*	0.12*	0.05*	0.01	0.08*	0.56*	0.31*	1

[a]Source: SeeTable 1.

Note: Traditional practices are in bold and reform practices are in italics.

Table 4. Time on math and frequently used practices regressions, first grade teachers, ECLS-K[a]

Covariates	Time on math	Calendar related activities	Counting out loud	Working on real-life problems
Time on math	NA	0.001**	0.01***	0.01***
Geographic Location				
Region				
Northeast	–[b]	–	–	–
West	0.6	0.28	0.01	-1.52***
South	15.76***	-0.39	-0.47	-0.71**
Midwest	-1.51	0.02	-0.02	-1.16***
Type of place				
Central city	–	–	–	–
Urban fringe	1.55	-0.04	0.26	0.29
Small town	-1.61	-0.37	0.38	0
School Characteristics				
School type				
Public	–	–	–	–
Private religious	-12.93*	-1.68***	-0.63	-0.23
Private nonreligious	-4.65	-4.43***	-3.31***	0.4
% minority students	7.08***	-0.13*	0.49***	-0.06
School size				
<300	–	–	–	–
300 to 499 students	4.11	0.57*	1.07**	0.3
500 to 749 students	12.42*	0.55	1.24***	0.49
≥ 750 students	5.85	0.07	1.20***	0.90**
Classroom Composition				
Class size	-0.28	-0.04	-0.08*	0.06
Less than 5% disabled	-3.05	-0.18	-0.1	-0.04
Less than 5% African American	-2.47	0.37	-0.17	-0.93***
Less than 5% Asian/Pacific Islander	-1.58	0.29	0.16	0.46
Less than 5% Hispanic	6.21	-0.34	0.32	-0.36

Table 4—Continued(1)

Covariates	Time on math	Calendar related activities	Counting out loud	Working on real-life problems
Teacher Characteristics				
Race/ethnicity				
White	–	–	–	–
African American	-15.84**	-2.13***	-0.86*	-0.38
Hispanic	-2.32	-0.73**	1.06**	0.33
Other	-5.78	-0.85**	-0.6	0.28
Age				
<35	–	–	–	–
35-49	0.22	-0.15	0.01	-0.15
50 or older	-0.99	-0.57**	-0.82***	-0.33
Teaching experience				
<4 years	–	–	–	–
4-9 years	1.2	0.05	-0.16	0.33
10 years or more	3.12	0.18	-1.12***	0.51*
Educational attainment				
BA degree or less	–	–	–	–
BA degree plus additional coursework	0.03	3.02***	1.46	0.05
MA degree or above	6.48	3.11***	1.07	0.64
Certification/Coursework/Preparation				
Regular certification	1.39	0.57**	-0.55	-0.46
More than 2 courses on methods of teaching math	10.17***	0.15	0.76***	0.70***
More than 2 hours of paid time preparing	-0.66	0.23	0.26	0.74***
More than 5 hours of unpaid time preparing	5.27*	0.19	0.1	0.67***

Table 4—Continued(2)

Covariates	Time on math	Calendar related activities	Counting out loud	Working on real-life problems
Professional Development Activities in Current Academic Year				
Received direct instruction from outside consultant	5.19	0.40**	0.4	0.51**
Participated in 3 or more in-service training days	-4.35	0.07	0.06	0.28
Visited or observed other schools	4.96	0.39*	0.59**	0.07
Received release time for early childhood conferences	-0.98	0.15	0.27	0.47**
Participated in workshops involving small groups	-1.31	-0.2	0.46**	0.97***
Participated in peer observation and feedback	4.96	0.39*	0.59**	0.07
Participated in follow-up support for teachers trying new ideas	7.62**	0.01	0.48**	0.97***
Enrolled in college or university courses	-0.12	0.17	0.35	0.26
Attended workshops on technology	0.23	0.16	0.19	0.40*
Constant	226.04***	14.54***	9.33***	3.72**

N=3,831

*$p < .1$, **$p < .05$, ***$p < .01$

Source: see Table 1.

[a] The data have been multiple-imputed. The coefficients and significance levels reported here are based on 40 imputed data sets. See text for further discussion.

[b] Throughout the table, "–" indicates a reference category for a set of dummy variables, for which no coefficient is estimated.

Table 5. Reform practices regressions, first grade teachers, ECLS-K[a]

Covariates	Geometric manipulatives	Counting manipulatives	Explaining math problems	Work in small groups or with partners	Work in mixed achievement groups	Working on problems with Several solutions
Time on math	0.004***	0.01***	0.01***	0.01***	0.01***	0.01***
Geographic Location						
Region						
Northeast	–[b]	–	–	–	–	–
West	-0.32	-1.86***	-0.87**	-1.15***	-1.06**	-1.46***
South	-0.31	-0.85**	0.69**	-0.88**	-1.51***	-1.20***
Midwest	-0.88***	-1.20***	-0.32	-1.36***	-1.71***	-1.42***
Type of place						
Central city	–	–	–	–	–	–
Urban fringe	-0.26	-0.49*	0.13	0.09	0.01	-0.25
Small town	-0.16	-0.16	-0.2	-0.25	-0.01	-0.72*
School Characteristics						
School type						
Public	–	–	–	–	–	–
Private religious	-0.85**	-1.13***	-0.05	-0.96**	-1.95***	-1.71***
Private nonreligious	0.6	-0.14	1.17	-0.11	-0.12	0.07
% minority students	0.07	0.12	0.03	0.20**	0.18	-0.1
School size						
<300	–	–	–	–	–	–
300 to 499 students	0.04	0.39	-0.23	-0.02	0.46	0.03
500 to 749 students	-0.49	0.19	0.11	0.48	0.66	0.54
≥ 750 students	-0.11	0.19	1.00**	0.25	0.37	0.41
Classroom Composition						
Class size	-0.02	-0.11***	0.09**	0	0.02	0.05
Less than 5% disabled	0.47*	0.15	0.07	0.24	-0.89**	0.15
Less than 5% African American	-0.84***	0.17	-0.67*	-0.28	-0.57	-0.5
Less than 5% Asian/Pacific Islander	0.5	0.3	0.11	-0.21	0.39	0.06
Less than 5% Hispanic	-0.36	-0.26	0.1	0.12	0.16	-0.04

Table 5—Continued(1)

Covariates	Geometric manipulatives	Counting manipulatives	Explaining math problems	Work in small groups or with partners	Work in mixed achievement groups	Working on problems with several solutions
Teacher Characteristics						
Race/ethnicity						
White	–	–	–	–	–	–
Black	1.27***	0.94**	0.27	0.69	0.08	0.75*
Hispanic	1.70***	1.54***	0.08	0.84**	0.68	0.66
Other	0.90**	1.49***	0.86*	0.81*	0.37	1.07**
Age						
<35	–	–	–	–	–	–
35-49	0.2	-0.06	0.1	-0.31	0.2	-0.11
50 or older	0.1	-0.61**	-0.47	-0.22	0.22	-0.05
Teaching experience						
<4 years	–	–	–	–	–	–
4-9 years	0.13	0.66***	0.33	0.18	0.32	0.51*
10 years or more	-0.37	0.68**	0.70**	-0.51*	0.04	0.26
Educational attainment						
BA degree or less	–	–	–	–	–	–
BA degree plus additional coursework	1.82	0.61	-2.46*	2.92**	1.97	-1.12
MA degree or above	2.02*	0.76	-2.09	3.01**	2.4	-0.93
Certification/Coursework/Preparation						
Regular certification	-0.36	-0.70**	-0.60*	-0.69**	-0.46	-0.76**
More than 2 courses on methods of teaching math	0.76***	1.03***	0.83***	0.83***	0.86***	0.57***
More than 2 hours of paid time preparing	0.21	0.18	0.71***	-0.1	0.37	0.60**
More than 5 hours of unpaid time preparing	0.48***	0.94***	0.75***	0.78***	1.06***	0.70***

Table 5—Continued(2)

Covariates	Geometric manipulatives	Counting manipulatives	Explaining math problems	Work in small groups or with partners	Work in mixed achievement groups	Working on problems with several solutions
Professional Development Activities in Current Academic Year						
Received direct instruction from outside consultant	-0.15	0.33	0.38	-0.07	0.36	0.11
Participated in 3 or more in-service training days	0.49*	0.22	-0.13	0.44	-0.15	0.11
Visited or observed other schools	0.21	-0.29	-0.01	0.23	-0.09	0.2
Received release time for early childhood conferences	0.43**	0.2	0.28	0.40*	0.90***	0.52**
Participated in workshops involving small groups	1.08***	0.89***	0.75***	0.95***	0.97***	0.81***
Participated in peer observation and feedback	0.97***	0.22	0.38*	0.99***	0.55**	0.80***
Participated in follow-up support for teachers trying new ideas	0.58***	0.88***	0.80***	0.88***	0.76***	0.84***
Enrolled in college or university courses	0.37*	0.18	0.15	0.92***	0.69**	0.47*
Attended workshops on technology	0.25	0.37*	0.25	0.05	0.32	0.57**
Constant	1.47	9.66***	8.99***	1.59	2.5	4.02**

N=3,831

*$p < .1$, **$p < .05$, ***$p < .01$

Source: see Table 1.

[a] The data have been multiple-imputed. The coefficients and significance levels reported here are based on 40 imputed data sets. See text for further discussion.

[b] Throughout the table, "–" indicates a reference category for a set of dummy variables, for which no coefficient is estimated.

Table 6. Traditional practices regressions, first grade teachers, ECLS-K[a]

Covariates	Working on math worksheets	Working with math textbooks	Drill
Time on math	0.004***	0.004***	0.003***
Geographic Location			
Region			
Northeast	–[b]	–	–
West	0.16	-2.11***	0.49
South	0.11	0.6	0.42
Midwest	-0.29	-1.69***	-0.04
Type of place			
Central city	–	–	–
Urban fringe	0.76**	1.06**	0.92***
Small town	1.47***	1.16**	1.86***
School Characteristics			
School type			
Public	–	–	–
Private religious	2.32***	4.07***	2.30***
Private nonreligious	-0.73	-0.38	-0.14
% minority students	-0.02	0.2	0.11
School size			
<300	–	–	–
300 to 499 students	0.29	-0.76	-0.26
500 to 749 students	0.74*	-0.81	0.23
≥ 750 students	1.60***	0.65	1.08**
Classroom Composition (quintile coded)			
Class size	-0.12***	0	-0.07*
Less than 5% disabled	0.32	0.74*	0.14
Less than 5% African American	-0.57*	-0.55	-0.55
Less than 5% Asian/Pacific Islander	0.97**	0.48	0.42
Less than 5% Hispanic	-0.02	-0.13	0.46

Table 6—Continued(1)

Covariates	Working on math worksheets	Working with math textbooks	Drill
Teacher Characteristics			
Race/ethnicity			
White	–	–	–
Black	0.96**	1.91***	2.00***
Hispanic	-0.18	0.77	0.43
Other	0.91**	1.25**	0.35
Age			
<35	–	–	–
35-49	-0.03	-0.08	-0.17
50 or older	-0.11	-0.21	-0.43
Teaching experience			
<4 years	–	–	–
4-9 years	0.05	0.42	0.09
10 years or more	0.28	1.31***	0.52*
Educational attainment			
BA degree or less	–	–	–
BA degree plus additional coursework	-1.87	-3.78**	-1.31
MA degree or above	-2.24*	-3.86**	-2.01
Certification/Coursework/Preparation			
Regular certification	-0.31	-0.05	-0.68*
More than 2 courses on methods of teaching math	0.14	0.47*	0.73***
More than 2 hours of paid time preparing	-0.12	-0.52*	-0.48*
More than 5 hours of unpaid time preparing	0.04	0.27	0.2

Table 6—Continued(2)

Covariates	Working on math worksheets	Working with math textbooks	Drill
Professional Development Activities in Current Academic Year			
Received direct instruction from outside consultant	-0.21	0.08	-0.1
Participated in 3 or more in-service training days	0	0.46	-0.04
Visited or observed other schools	-0.24	-0.27	-0.36
Received release time for early childhood conferences	-0.03	-0.55*	-0.36
Participated in workshops involving small groups	0.12	-0.43	0.02
Participated in peer observation and feedback	0.73***	0.59**	0.31
Participated in follow-up support for teachers trying new ideas	-0.51**	-0.42	0.08
Enrolled in college or university courses	-0.29	-0.14	-0.07
Attended workshops on technology	0.07	0.36	-0.1
Constant	16.13***	12.08***	12.28***

N=3,831

*$p < .1$, **$p < .05$, ***$p < .01$

Source: see Table 1.

[a] The data have been multiple-imputed. The coefficients and significance levels reported here are based on 40 imputed data sets. See text for further discussion.

[b] Throughout the table, "–" indicates a reference category for a set of dummy variables, for which no coefficient is estimated.