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Design for the Evaluation of Early Elementary School Mathematics Curricula

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Roberto Agodini
John Deke
Sally Atkins-Burnett
Barbara Harris
Robert Murphy

Submitted to:

Institute of Education Sciences
Office of the Assistant Secretary
555 New Jersey Avenue, NW
Room 502E
Washington, DC 20208

Project Officer:
Audrey Pendleton

Submitted by:

Mathematica Policy Research, Inc.
P.O. Box 2393
Princeton, NJ 08543-2393
Telephone: (609) 799-3535
Facsimile: (609) 799-0005

Project Director:
Roberto Agodini

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EXECUTIVE SUMMARY

Many U.S. students enter elementary school with poor math skills. There also are differences in math performance between students from different socioeconomic backgrounds, with math achievement of those from poor families lagging behind achievement of those from more affluent ones. These differences also grow over time, resulting in substantial differences in math achievement by the time students reach the fourth grade (National Assessment of Educational Progress 2005).

This trend in student math performance presents significant challenges for schools. Under Title I of the No Child Left Behind Act, schools must make adequate yearly progress (AYP) in math performance, as well as in reading performance. AYP is a federally approved, state-specific standard that requires public schools to continuously and substantially improve student achievement in math and reading. The goal is to ensure that all students meet or exceed their state's standard by 2014.

Study Purpose. In fall 2005, the U.S. Department of Education contracted with Mathematica Policy Research, Inc. to conduct a large-scale, national study that will compare the effects of different elementary math curricula on improving student math achievement in disadvantaged schools. Although elementary schools use only a few instructional approaches (eight textbooks make up 83 percent of the texts used by K-2 educators), the approaches are based on different theories for developing student math skills, and there is little research evidence to support one theory over another. The goal of this study is to determine whether some of the approaches are more effective than others at improving student math achievement, thereby providing information to elementary educators that may help them make AYP.

Curricula Included in the Study. A competitive process was used to select four curricula for the evaluation that represent many of the diverse approaches to teaching math in elementary schools:

- Investigations in Number, Data, and Space
- Math Expressions

- Saxon Math
- Scott Foresman-Addison Wesley Mathematics

These curricula represent a range from strongly "reform" oriented to more "traditional" and direct instruction approaches. Traditional approaches are based on the belief that children will develop strong math skills by first being explicitly taught concepts, facts, and procedures, and then practicing and applying those skills to solve real-life problems. Reform approaches are based on the belief that mathematical principles are better learned in the context of solving real-life problems through student-directed activities. Other differences among the curricula include how practice is distributed within and across school years, and when content is introduced. Comparing the curricula selected for the study with those used by most schools indicates that the study's curricula are representative of the basic approaches used by most elementary educators.

Study Design. Experimental methods will be used to evaluate the relative effects of the four curricula, using a school-level random assignment design. This design randomly assigns schools in each participating district to the study's four curricula and compares math achievement gains made by students in the four curriculum groups.

Curriculum implementation will occur in both the first and second grade, which allows the study to examine first-year effects on achievement of two different grade levels. If a study option to examine the sustained effects of the curricula is exercised, implementation would be extended to the third grade among districts and schools willing to participate in the study for an additional year.

The study's goal is to detect an effect size as small as 0.20 between any pair of curricula, when examining first-year effects. To detect this effect, the goal is to recruit 12 districts with 108 schools, where each school contains an average of three first- and three second-grade classrooms. The effect size that can be detected for the optional question about sustained effects will depend on the number of districts and schools willing to participate in the study for an additional year.

Target Participant Group. The study is not statistically sampling sites to participate, because interested sites are likely to be unique in ways that make it difficult to select a representative sample of districts and schools. Interested districts must be comfortable with all four of the study's curricula; allow the curricula to be randomly assigned to its participating schools; and be willing to have the study test students, survey teachers, and observe classrooms (as described below).

Because it would be challenging to select a representative sample of districts that meet these criteria, the study is instead identifying and recruiting sites that (1) have Title I schools, (2) are geographically dispersed, and (3) contain at least four elementary schools to support implementation of the study's four curricula. Including districts that have Title I schools is consistent with that policy's interest in studying effective approaches to help low-income children meet state standards for academic achievement. Geographic diversity of the districts helps establish "face validity" for the findings, though districts and schools will be purposively selected and the findings will not be externally valid.

Outcome Measure and Other Data Collection. To measure the relative effects of the curricula, the study team will assess student math achievement at the beginning and end of the school year using the math assessment developed for the Early Childhood Longitudinal Study. The test meets the study's requirement regarding validity, reliability, and ability to measure achievement gains both within and across the study's grade levels.

To help interpret measured effects, the study will assess how teachers implemented the curricula by observing classrooms and surveying teachers about implementation. Because the within-district random assignment of schools to the four curricula creates a "mini" experiment in each site, the study also will examine whether effects vary across sites and, if so, whether site-level conditions explain any observed variation. The conditions in which the curricula are used, as well as the practices of the teachers who implement them, may vary considerably both in our study and more broadly in classrooms throughout the country. Therefore, a single math curriculum may not be appropriate in all settings.

Study Timeline and Progress to Date. The evaluation began in fall 2005 and is a four-year study, with an optional fifth year that would examine sustained effects among third graders. During the first year, several aspects of the study's design were finalized, the curricula were selected, data collection forms were developed, and district and school recruiting began.

To date, the study team has recruited 12 districts with a total of 111 schools to participate in the evaluation—three more schools than the 108 target mentioned above. Four districts with a total of 40 schools began participation during the past school year (2006-07). Another eight districts with a total of 71 schools plan to join the study this upcoming school year (2007-08). The table below summarizes the curriculum implementation plans of the participating schools.

Number of Schools Participating in the Study, Their Timing of Enrollment, and Curriculum Implementation Plans

	Curriculum Implementation			
	2006-07 School Year		2007-08 School Year	
Cohort	First Grade	Second Grade	First Grade	Second Grade
Initial 40 Schools	40 schools	--	28 schools[a]	28 schools[b]
Additional 71 Schools	--	--	71 schools	71 schools

[a]Most first-grade teachers in these schools will have participated for two years by the end of the 2007-08 school year.

[b]Most second-grade students in these schools will have participated for two years by the end of the 2007-08 school year.

-- Indicates that no schools participated during the specified school year and grade level.

Main Effects Supported by the Study Sample. Given the number of schools that plan to participate, their timing of enrollment, and curriculum implementation plans:

- At the first-grade level, the study can detect its target effect size of 0.20 for first-year effects.

- At the second-grade level, an effect size of 0.25 can be detected.

The first analysis would be based on all 111 schools recruited for the study—that is, 2006-07 school year data for first graders in the initial 40 schools, and 2007-08 school year data for first graders in the additional 71 schools. The second analysis would be based on 2007-08 school year data for second graders in the additional 71 schools.

Because 28 of the schools that joined the study during the past school year also plan to participate during the upcoming school year, the study could examine the optional question about sustained effects, even before the option is exercised. Two analyses could be conducted to answer the optional question. First, we could examine impacts on first graders when they are exposed to the curricula for the first time by teachers who already have one year of experience (minimum detectable effect size equals 0.42). Second, we could examine impacts on second graders who already had one year of curriculum experience as first graders but have teachers without any prior experience (minimum detectable effect size equals 0.43). Even though both analyses are based on 28 schools, we anticipate that the second one will have slightly lower statistical power than the first, because the second analysis is based on students who participated in the study for two years and we anticipate some attrition among these students.

Publication Plans. A report based on the first-year experiences of the initial cohort of schools is expected by September 2008. Because this analysis will be based on first graders only, and from just 40 of the 111 schools that plan to participate in the study, the report will provide only preliminary information about the curricula. A more comprehensive report based on both the first- and second-grade implementation in all the study's schools is expected by September 2009. The 2009 report also would present preliminary evidence for the optional questions about sustained effects described above. If the study option to extend implementation to the third grade is exercised, more comprehensive information about sustained effects would be presented in a September 2010 report.

CHAPTER I

INTRODUCTION

This report presents the design for a large-scale, national study that will compare the effects of different elementary school math curricula on improving math achievement of students in disadvantaged schools. The study includes four curricula that represent many of the diverse approaches to teaching math in the United States. Curriculum implementation will occur in the first and second grades, and it will be extended to the third grade if a study option to support implementation and data collection at that grade is exercised. Experimental methods will be used to evaluate the relative effects of the four curricula. To help interpret measured effects, the study also will assess how teachers implemented the curricula. The study is sponsored by the U.S. Department of Education (ED) and is being conducted by Mathematica Policy Research, Inc. (MPR).

The rest of this chapter presents the rationale for the study and a summary of its design. Chapter II provides details about the study's key features, including the target sample, steps involved in setting up the experiment, and the study team's and publishers' responsibilities surrounding curriculum implementation. The approach for assessing curriculum implementation and the relative effects of the curricula are presented in Chapters III and IV, respectively.

A. WHY EXAMINE THE EFFECTS OF VARIOUS MATH CURRICULA?

Under Title I of the No Child Left Behind Act, schools must make adequate yearly progress in student math performance, as well as in reading performance. "Adequate yearly progress" is a federally approved, state-specific standard that requires public schools to continuously and substantially improve student achievement in math and reading. The goal is to ensure that all students meet or exceed their state's standard by 2014.

Reaching this goal is challenging. Nationwide, many U.S. students show mastery of only rudimentary mathematics, and only a small proportion achieve at high levels. In the 2005 National Assessment of Educational Progress, only 36 percent of fourth graders were judged "proficient" in mathematics, and 20 percent scored below "basic." Differences in math performance also exist between fourth graders from different socioeconomic backgrounds (as measured by free/reduced-price lunch participation), with math achievement of those from poor backgrounds lagging behind achievement of those from more affluent backgrounds.

What is taught to students and how it is taught (that is, curriculum and its pedagogical approach) may be important factors in a school's ability to improve student math achievement, and elementary schools tend to use one of only a few approaches. A national survey conducted in March 2005 found that eight math textbooks make up 83 percent of the texts used by K-2 educators (Education Market Research 2005). These curricula often are categorized as either: "reform" curricula that were developed with support from the National Science Foundation (NSF), or "traditional" curricula that often were commercially generated. Traditional approaches are based on the belief that children will develop a strong understanding of mathematical principles by first being taught facts and procedures, and then applying those skills to solve real-life problems. Reform approaches are based on the belief that mathematical principles are better learned in the context of solving real-life problems through student-directed activities.

Research evidence exists on some of the approaches. Typically, however, the analytical methods used do not meet scientific standards, or the evidence is based on small-scale studies. Slavin and Lake (2007) reviewed studies on the achievement effects of different math curricula. They identified only 13 studies that met their inclusion criteria for review, and only 2 of those used an experimental evaluation design.[1] Other reports also point to the lack of rigorous evidence on the various curricular approaches (National Research Council 2004; What Works Clearinghouse 2006).

In addition to the lack of a research base, controversy exists about the type of approach that should be used to teach children. The debate about the two approaches often is so heated that it has been referred to as the "math war." For more details on the debate, see Whitehurst (2003) and Schoenfeld (2004).

The lack of research evidence and the controversy about the different approaches were recognized in recent discussions held by an Independent Review Panel, the Office of Elementary and Secondary Education, and a panel of curriculum experts, where the issue of whether to conduct impact studies in mathematics to assess the outcome of the Title I legislation was being considered. The group ultimately concluded that the Title I evaluation plan should include an evaluation of mathematics programs.

Early in 2005, ED contracted with MPR to convene a panel of experts in mathematics, mathematics instruction, and evaluation design to provide advice on an impact evaluation of mathematics curricula. The panel identified the early elementary grades as the most important level for the evaluation, because disadvantaged children fall behind their more

[1] A study was included in their review if (1) it used a randomized or matched control group design, (2) treatment duration lasted at least 12 weeks, and (3) the achievement measure was not biased toward the treatment.

advantaged peers in basic competencies (such as number line ordering and magnitude comparison) even before entering elementary school (Rathburn and West 2004).

The expert panel also recommended that the evaluation compare different approaches to teaching early elementary math. It mentioned that many math curricula have been developed in recent years with NSF support and are being widely implemented without evidence of effectiveness. The panel also noted that several basal math textbooks have been widely used over the years, also without evidence of effectiveness.

B. RESEARCH QUESTIONS AND METHODS FOR PROVIDING ANSWERS

In October 2005, ED awarded MPR a contract to conduct the "Evaluation of Mathematics Curricula" study. The study's goal is to select, implement, and evaluate the relative effects of several math curricula that use different instructional approaches.

The main questions to be addressed by the study are:

1. What is the relative effectiveness of different early elementary math curricula on student math achievement in disadvantaged schools?

2. Under what conditions is each math curriculum most effective?

3. What is the relationship between teacher knowledge of math content/pedagogy and the effectiveness of the curricula?

The study includes the following additional question that would be addressed if a study option that supports an additional year of curriculum implementation and data collection is exercised:

4. Which math curricula result in a sustained impact on student achievement?

The study will use scientifically based research methods to answer the questions. In particular, it will use a *school-level* random assignment design, which involves randomly assigning participating elementary schools in each district to the curricula included in the study. Consider, for example, a district that has eight elementary schools interested in participating in the study. The study will randomly select two schools to implement curriculum A, two schools to implement curriculum B, and so on. In each school, teachers at the target grade levels will receive training on the curriculum assigned to their school. Relative effects of the curricula will be estimated by comparing average math achievement of students in the schools. For example, the relative effectiveness of curriculum A versus curriculum B will be estimated as the difference in average achievement between students in the schools assigned to curriculum A and those in the schools assigned to curriculum B.

The study does not include a control group of schools that continue to use whatever math curriculum they were using before joining the study. The study decided not to include such a control group because it would be difficult to compare effects of the study's curricula to effects for this group, since the group would consist of a variety of curricula. In some districts, the control schools could be using a common prior curriculum, which may or may not be included in the evaluation. In other districts, where schools have discretion in choosing their math curriculum, the control schools could be using a wide variety of prior curricula. Therefore, the study instead chose to compare the effects of curricula that (as described below) represent many of the diverse approaches to teaching mathematics. In this way, the study can determine whether one curriculum is significantly more effective than the others in improving math achievement.[2] The study assembled a panel of outside experts in math instruction and evaluation design (see Appendix A) that suggests approaches for addressing difficult issues, such as the one above.

C. CURRICULA INCLUDED IN THE EVALUATION

A competitive process was used to select the curricula, in which the study invited developers and publishers of early elementary school math curricula to submit a proposal to include their curricula in the evaluation. A panel of experts in math and math instruction, convened by the study team, then reviewed the submissions and recommended to ED curricula suitable for the study. The goal was to identify widely used curricula that use different instructional approaches and that hold promise for improving student math achievement—such as those with prior evidence of effectiveness, or proof in concept based on other research.

The following four curricula were selected for the study:

- ***Investigations in Number, Data, and Space*** (published by Pearson Scott Foresman) uses a reform approach encouraging metacognitive reasoning and drawing on constructivist learning theory. The lessons focus on understanding, rather than on "correct answers" and build on students' knowledge and understanding. Students are engaged in thematic units of three to eight weeks in which they first investigate, then discuss and reason about problems and strategies. Students frequently create their own representations.

- ***Math Expressions*** (published by Houghton Mifflin) blends reform and traditional approaches to mathematics. Students question and discuss mathematics but are taught effective procedures explicitly. There is an emphasis on specific multiple representations of concepts using objects, drawings, language, and real-world situations. Students are expected to explain and justify their solutions.

- ***Saxon Math*** (published by Harcourt Achieve) is a scripted curriculum that blends direct teaching of new material with distributed practice of previously learned concepts and procedures every day. The teacher introduces concepts or

[2] Because students must take math in each of the elementary grades, the study also decided not to try and include a control group that does not use a math curriculum.

efficient strategies for solving problems. Students observe, then receive guided practice, followed by distributed practice. Students hear the correct answers and are explicitly taught procedures and strategies. Frequent monitoring of student achievement is built into the program. Daily routines are extensive and emphasize practice of number concepts and procedures, and use of representations. More challenging content is introduced in the primary grades

- ***Scott Foresman-Addison Wesley Mathematics*** (published by Pearson Scott Foresman) is a traditional basal program offering a variety of options and materials for teachers to use. Teachers select, often with the help of the publisher, the materials that seem most appropriate for their students. Daily lessons include the use of questioning, models and representations, and practice of new skills.

Investigations, Scott Foresman-Addison Wesley, and Saxon are among the eight most widely used curricula mentioned above, making up 26 percent of the texts used by K-2 educators (Education Market Research 2005). Estimating usage of Math Expressions is difficult because it is a newer curriculum, for which market share data are not yet available. However, comparing the four curricula selected for the study with those used by most schools indicates that the study's curricula are representative of the basic approaches that most elementary educators use.

D. THE STUDY'S STATISTICAL POWER AND TARGET PARTICIPANT GROUP

Curriculum implementation will occur in first and second grades, which allows the study to examine first-year effects on achievement of two different grade levels. If the study option to examine sustained effects is exercised, implementation would be extended to the third grade among districts and schools willing to participate in the study for an additional year.

The study's goal is to detect an effect size as small as 0.20 between any pair of curricula, when examining first-year effects. To detect this effect, the goal is to recruit 12 districts with 108 schools, where each school contains an average of three first-grade classrooms and three second-grade ones.[3] The effect size that can be detected for the optional question about sustained effects will depend on the number of districts and schools willing to participate in the study for an additional year.

Interested sites are likely to be unique in ways that make it difficult to select a representative sample of districts and schools. Therefore, the study is not statistically sampling sites, but instead is identifying and recruiting sites that meet several criteria. Sites suitable for the study include districts that contain Title I-eligible schools, are geographically diverse, and contain at least four elementary schools to support implementation of the

[3] Chapter II provides more details about the statistical power calculations.

study's four curricula. Interested districts must be comfortable with all four of the study's curricula; allow the curricula to be randomly assigned to its participating schools; and be willing to have the study test students, survey teachers, and observe classrooms.

E. Data Collection Plan and Study Timeline

Table I.1 lists the study's research questions and data collection that will support answers to each question, and Figure I.1 lists the timing of the collections. The data collection includes:

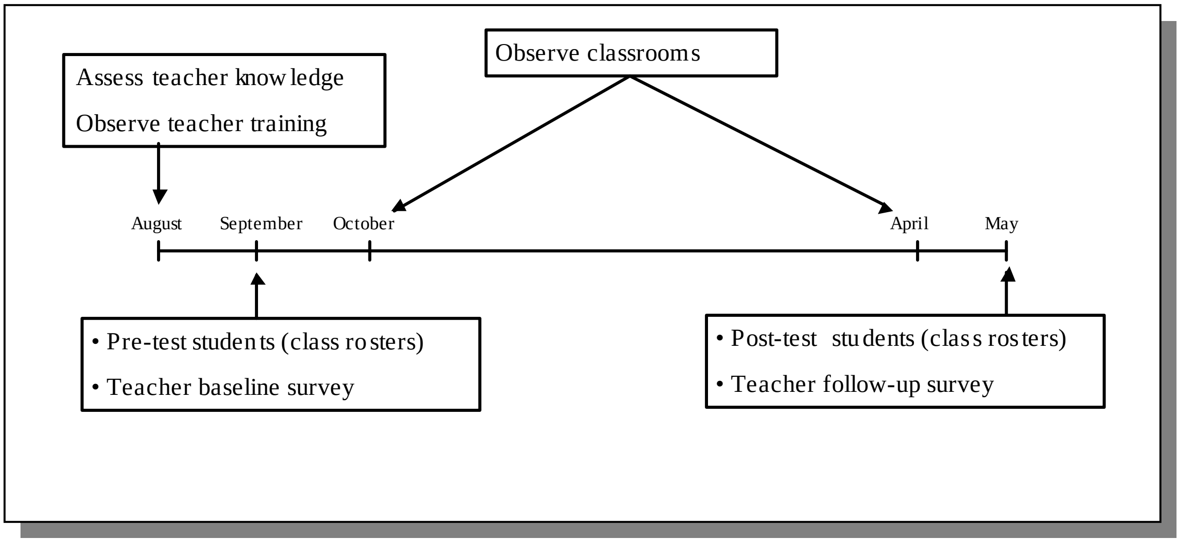
- ***Assessment of Teacher Knowledge of Math Content and Pedagogy.*** Teacher math content/pedagogical knowledge will be assessed at the initial teacher training sessions before the curricula are introduced, using an assessment developed by researchers at the University of Michigan. Scores on the test will be included in the analysis to examine the relationship between teacher math content/pedagogical knowledge and the effects of the curricula.

- ***Teacher Training Observations.*** The study will observe the initial teacher trainings that the publishers provide before the start of the school year. Information on follow-up training provided during the school year will be obtained from teacher surveys (described below). Collectively, these data will be used to characterize the trainings, and the fidelity of the trainings relative to publisher-specified standards.

Table I.1. Research Questions and Data Collection Methods

Research Question			Data Collection Method
1.	What is the relative effectiveness of different early elementary math curricula on student math achievement in disadvantaged schools?	►	Fall and spring tests of first- and second-grade student math achievement
2.	Under what conditions is each math curriculum most effective?	►	Teacher surveys; student demographics from class rosters; observations of teacher training; and classroom observations
3.	What is the relationship between teacher knowledge of math content/pedagogy and the effectiveness of the curricula?	►	Assessment of teacher knowledge of math content and pedagogy
4.	Which math curricula result in a sustained impact on student achievement?	►	Spring tests of students with more than one year of curriculum experience; student achievement in classrooms where teachers have more than one year of curriculum experience

Figure I.1. Data Collection Timeline During the First Year of Implementation



- ***Class Rosters.*** The study will collect rosters for each classroom in the study to build the frame for the student sample. Student demographic information will be requested as part of the roster collection, so the study can define subgroups for investigating whether curricula effects differ for subgroups. The request will include student gender, date of birth, race/ethnicity, free/reduced-price lunch eligibility, limited English proficient or an English-language learner, and individual education plan or receipt of special services for students with a disability.

- ***Assessment of Student Achievement.*** The study will assess student math achievement at the beginning and end of the school year using the assessment developed for the Early Childhood Longitudinal Study. The test meets the study's requirement regarding validity, reliability, and ability to measure achievement gains both within and across the study's grade levels. The assessment also is individually administered, adaptive, and nationally normed.

- ***Teacher Surveys.*** Two teacher surveys will be administered. The first (baseline) survey will be administered in the fall and focuses on teacher background information, classroom characteristics, curriculum training provided by the publishers up to that point, and math instruction approaches used before joining the study. The second (follow-up) survey will be administered in the spring and will gather information on follow-up training provided by the publishers, usage of the assigned curriculum and any other math curricula, and math instructional practice.

- ***Classroom Observations.*** The study's plan is to observe each study classroom once during each school year.[4] Classroom observation data, together with information collected on the follow-up teacher survey, will be used to assess implementation. The implementation assessment will be used to set a context for the achievement results, and for examining the relationship between impacts and implementation.

Appendix B contains the data collection forms. The teacher knowledge assessment and the student assessment are not included in the appendix because those instruments are copyrighted.

The evaluation began in fall 2005 and is a four-year study, with an optional fifth year that would examine the additional research question about sustained effects. During the first year, the curricula were selected, data collection forms were developed, and district and school recruiting began (immediately after the curricula were selected). Several aspects of the study's design also were finalized, such as the decision to target districts that could pilot all four of the study's curricula and to randomly assign participating schools in each district to the curricula, thereby creating a "mini" experiment in each district.

To date, the study team has recruited 12 districts with a total of 111 schools to participate in the evaluation—three more schools than the 108 target mentioned earlier. About a third of the schools began participation during the previous (2006-07) school year, and the rest will begin during the upcoming (2007-08) school year. Among the first cohort of schools, curricula implementation began in the first grade. Many of these schools plan to continue participating during the upcoming school year, where implementation will continue in the first grade (with a new cohort of students) and will be expanded to the second grade (which will include first graders from the previous year). Among the second cohort of schools that plan to begin participation this coming school year, curricula implementation will occur in both the first and second grades.

Given the number of schools that plan to participate and their implementation plans, at the first-grade level, the study can detect its target effect size of 0.20 for first-year effects. At the second-grade level, an effect size of 0.25 can be detected.[5] Because many of the schools that joined the study in 2006-07 plan to participate for a second year in 2007-08, the study would have data to examine the optional question about sustained effects, even before the option is exercised. Two analyses could be conducted to answer the optional question. First, we could examine impacts on first graders when they are exposed to the curricula for the first time by teachers who already have one year of experience (minimum detectable

[4] One observation per classroom allows the study to assess average implementation for the group of teachers using each curriculum, not implementation for each individual teacher. Assessing implementation for each teacher would require more than the one observation per classroom planned by the study.

[5] At the first-grade level, 111 schools from 12 districts would be used in the analysis; at the second-grade level, 71 schools from 8 districts would be used.

effect size equals 0.42). Second, we could examine impacts on second graders who already had one year of curriculum experience as first graders but have teachers without any prior experience (minimum detectable effect size equals 0.43).[6]

A report based on the first-year experiences of the first cohort of schools is expected by September 2008. Because this analysis will be based on first graders only, and from just a third of the 111 schools, the report will provide only preliminary information about the curricula. A more comprehensive report on the first- and second-grade implementation in all the study's schools is expected by September 2009. The 2009 report also would present preliminary evidence for the optional questions about sustained effects. If the option is exercised, implementation would be expanded to the third grade, and more comprehensive information about sustained effects would be presented in a 2010 report.

[6] Both of these analyses would be based on three districts with 28 schools from the first cohort that plan to continue participating for a second school year.

CHAPTER II

STUDY FEATURES

Conducting the evaluation involves four main activities. First, a decision must be made about the study's target sample. Included in this decision is the types of districts and schools that are suitable candidates for the study, the grade levels of interest, and the study's target effect size—which affects the number of districts and schools to include in the study. Second, the experiment must be set up. This task involves recruiting districts and schools, which requires an efficient plan because interested sites are likely to be unique and, therefore, challenging to identify and enroll in the study. The task also involves randomly assigning participating schools to the curricula and selecting a sample of students for data collection. Third, a test for assessing student math achievement must be selected. The assessment must meet several study requirements, including validity, reliability, and ability to measure achievement gains over the study's grade range. Fourth, clear roles and responsibilities for curriculum implementation must be established for the study team and publishers. Defining clear roles helps ensure that implementation reflects a level that publishers can support with most schools, and not an unrealistic level most schools could not achieve. This chapter provides more details about these main activities.

A. TARGET SAMPLE

Balancing the generalizability of the study's results with the need to enroll suitable and willing participants is challenging, because interested sites are likely to be unique in ways that make it difficult to select a representative sample of schools. Early conversations with several districts made it clear to the research team that sites interested in the study will probably have a unique set of circumstances and attitudes. For example, interested districts must be willing to implement four very different curricula and to use the curricula randomly assigned to their participating schools. Sites that fall into this category may be those that value research evidence and would like to use direct evidence for their district to inform a future curriculum adoption decision. Principals and teachers in schools that districts nominate also may need to be consulted about participation, because curriculum implementation ultimately depends on the willingness of principals and teachers to use whatever curriculum is assigned to their schools. These factors suggest that the study is likely to require support at many levels within a school district. Selecting a representative sample of districts that meet these criteria would be challenging, because national district data sets do not contain information on the criteria, and it would be extremely costly to collect the information directly.

1. Suitable Districts and Schools

Because of the challenges of including in the study a representative sample of sites, the study will not select a statistical sample of districts and schools. Instead, it will identify and recruit sites that meet several criteria. Sites must:

- ***Have Title I schools***. Including districts that have Title I schools is consistent with the policy interest that underlies Title I for studying effective approaches to help low-income children meet state standards for academic achievement.
- ***Contain at least four schools interested in study participation.*** To support implementation of the study's four curricula, each district must have at least four elementary schools willing to participate in the evaluation.
- ***Be geographically dispersed.*** Geographic diversity helps establish "face validity" for the findings, though districts and schools will be purposively selected and the findings will not be externally valid.

Ideally, districts interested in the study would be able to provide schools that meet two additional criteria. First, the schools should contain students with low math proficiency, to support the study's goal of identifying approaches to improving achievement of students with weak math skills. Measures of a school's economic situation, such as Title I status, help identify sites where math achievement improvements are needed, because economically disadvantaged schools tend to contain a large fraction of students with weak math skills. However, a school's economic status is not always a perfect indicator of academic improvement needs. The study will use publicly available data on school math proficiency to identify schools with below-average math proficiency.[7] The goal will be to include schools with math proficiency far below the average and those that are closer to the average, so the study can examine whether the relative effects of the curricula are related to the degree to which students are struggling in math.

Second, although only four schools are needed in a district to support implementation of the study's four curricula, the goal will be to recruit districts with at least eight elementary

[7] The data will be obtained from www.SchoolMatters.com and www.GreatSchools.net. Both websites collect performance data from each state's Department of Education, thereby providing similar data in a central location. The plan will be to use data from www.SchoolMatters.com because they are more easily accessible, and to use data from www.GreatSchools.net when data from www.SchoolMatters.com are not available. The data will be used to identify districts with below-average math proficiency at the elementary level, where average proficiency is defined on a state-by-state basis. Each district's proficiency will be compared to its state average. (Because states administer different assessments and set different performance standards, it is difficult to compare each district's proficiency to a national average.)

schools. A participating school could find itself unable to continue using its assigned curriculum at some point during the school year. Having at least two schools assigned to each curriculum in a district helps maintain each curriculum's presence in the district if some schools must stop using their assigned curriculum.

Assigning more than one school to each curriculum (within each district) also helps reduce the potential confounding of school and curriculum effects when examining district-level results. In addition to examining results based on all districts, the study will examine results for each district to explore whether treatment effects vary across sites and, if so, factors related to the variation. If a district provides only four schools to the study (one school per curriculum), and those four schools differ from each other in ways that are related to student math achievement, the effects of the curricula cannot be separated from the influence of school characteristics on student achievement. With more than one school per curriculum in a district, the study can create blocks of schools that are similar to each other and randomly assign the curricula to the schools in each block, thereby helping to balance school characteristics across the curriculum groups. We describe this process in Section B of this chapter.

2. Grade Levels of Interest

The study will examine the relative effects of the curricula for first and second graders. If the study option to support an additional year of curriculum implementation and data collection is exercised, the study will also examine the relative effects for third graders.

The study is focusing on the early grades because research shows that math performance in the early grades is poor overall. Research also shows the achievement differences by socioeconomic status already exist when students first enter school, and these differences grow over time. In a report on students' early elementary school experiences, kindergarteners in 1998-99 who were from households with at least two risk factors scored lower in math than those from households with no risk factors (Rathburn and West 2004). These differences in achievement grew over time, resulting in substantial differences in math achievement by the time students reached the third grade in 2001-02. This trend is evident in the most recent National Assessment of Educational Progress (NAEP), conducted in 2005, where only 36 percent of fourth graders were judged "proficient" in mathematics, and 20 percent scored below "basic." The NAEP also showed substantial differences in math performance between fourth graders eligible for free/reduced-price lunch and those not eligible for it.

Identifying strategies that help students develop a strong math foundation in the early grades may not only help improve math performance in those grades, but may also have lasting benefits by promoting math learning in later grades. For example, Milgram (2005) states that many students misunderstand place value (ones, tens, hundreds, and so on), which is necessary to develop basic skills with numbers, including addition, subtraction, multiplication, and division. A thorough understanding of place value is also necessary to assess the magnitude of one number and make comparisons between different numbers.

Learning these skills in the early grades could have lasting benefits that promote learning later, such as understanding fractions in later elementary grades.

3. Sample Size and Statistical Power

When examining effects during the first year of curriculum implementation, the study's goal is to detect an effect size as small as 0.20 between any pair of curricula. This effect represents about 14 percent of the one-year math achievement gains made by the average first grader from a low socioeconomic family—the type of student that largely will be part of this evaluation.[8] Put differently, when comparing two curriculum groups, student achievement gains must differ by at least 14 percent of the gains made by the average first grader for the study to detect those differences.[9]

To detect the target effect size at both the first- and second-grade levels, the study's goal is to recruit 12 districts with a total of 108 schools, where each school contains an average of three first-grade classrooms and three second-grade ones—a total of 324 first-grade classrooms and 324 second-grade ones. Both fall and spring tests must be obtained from an average of nearly 11 students selected at random from each classroom—a total of about 7,000 students (3,500 from each of the two grade levels).

The statistical power of the analysis that examines effects after two years of curriculum implementation depends on the number of schools that are willing to participate in the study for a second year, and student attrition. We expect that 85 percent of each classroom sample (about nine students) would still be in a study classroom at the end of the second year and would complete the spring test at that time. Assuming that all 108 of the schools targeted for the study are willing to participate for a second year, the second-year analysis could detect an effect size as small as 0.20 between any pair of curricula, just as for the first-year effects.

The sample size calculations were estimated for an 80 percent power level and a 5 percent significance level. Because districts are purposefully selected, their effects are treated as fixed in the calculation. We assume school- and classroom-level intra-cluster correlations (ICC) of 0.125 each, meaning that 75 percent of the variance in test scores is explained by students within classrooms. We assume regression R^2 values of 0.60, 0.75, and 0.80 at the

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[8] Statistic is based on data from the Early Childhood Longitudinal Study (Pollack et al. 2004). On average, children in the ECLS who were in the bottom quintile of socioeconomic status (a composite measure based on an equal weighting of children's parents' education, occupation, and household income) gained about 16 scale points in math during the first grade. The standard deviation for these children's fall scores was 10.9. Therefore, an effect size of 0.20 equals 2.18 scale points ($0.20 \times 10.9 = 2.18$) during first grade. Another perspective on these magnitudes is that an effect size of 0.20 equals 14 percent of the average math gains made by the average first grader [$(2.18/16)\times100 = 14\%$].

[9] Smaller differences (that is, a smaller target effect size) also may be meaningful, but the goal is to determine if math curricula can help improve achievement as soon as students enter school and can help reduce, or even eliminate, the achievement gap that exists among students from different socioeconomic backgrounds.

student, classroom, and school levels, respectively.[10] The amount of student attrition likely to occur (as described later in this chapter) also was considered in the calculations.

The sample size calculations also accounted for the fact that multiple comparisons of curriculum effects will be made. In particular, with the study's four curricula, six possible comparisons can be made between the curricula (1 versus 2, 1 versus 3, 1 versus 4, 2 versus 3, 2 versus 4, and 3 versus 4). If each comparison is made using a *t*-test with a 5 percent level of significance, the probability that one of those six tests will be statistically significant, *even when there are no real differences between groups*, could be as high as 26 percent, if the six tests are independent of each other.[11] This probability is known as the family-wise error rate (FWE). We use the Tukey adjustment to control for the FWE and for the fact that some of the curriculum comparisons that can be made involve the same curriculum groups (for example, 1 versus 2 and 1 versus 3 both involve curriculum 1). The Tukey adjustment obtains critical values from a multivariate *t*-distribution that incorporates the correlations among test statistics.[12] The source for this discussion is Hochberg and Tamhane (1987).

B. ENROLLING PARTICIPANTS

As described in Section A of this chapter, districts suitable for the study include those that have Title I schools, have at least four elementary schools, and are geographically dispersed. Ideally, districts willing to participate in the study also have a high fraction of students with weak math skills and can provide at least eight elementary schools (instead of the required minimum of four), so two schools can be assigned to each of the four curricula within each district.

The recruitment effort will begin by identifying districts that meet these criteria, followed by an assessment of district interest in the study. The study team will schedule site visits to districts that want to discuss participation, to further discuss the study's details with the district contact and with any other staff the district would like at the meeting. Recruiters will work with promising districts to identify suitable schools for the study and to obtain teacher consents from the schools. After all consents are received, the study team will randomly assign the participating schools in each district to the four curricula. Conducting random assignment after schools and teachers have signed on to the study will helps identify participants willing to participate in the study, regardless of the curriculum to which they are

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[10] The ICC and R^2 assumptions are based on calculations using data from the Evaluation of Educational Technology Interventions and from recent papers by Hedges and Hedberg (2007), Bloom et al. (2007), and Schochet (forthcoming).

[11] The probability that one of six independent tests can be statistically significant, even when there are no differences, is calculated as $[1 - (1\text{-}0.05)^6] = 26$ percent.

[12] Many approaches exist to control the FWE. One of the most conservative ones—called the Bonferroni correction—achieves an FWE of 5 percent by reducing the significance level of each individual *t*-test to 0.85 percent: $[1 - (1\text{-}0.0085)^6] = 0.05$. Because some of the comparisons that can be made involve the same curriculum groups (for example, 1 versus 2 and 1 versus 3 both involve curriculum 1), the test statistics are not independent, and the Bonferroni adjustment is overly conservative.

assigned. Such willingness may be important for strong commitment throughout the study period and, therefore, may be important for successful curriculum implementation.

The following section describes in more detail the process that will be used to enroll participants in the study. This is helpful for understanding the study's context, because the study is not selecting a statistical sample of districts and schools. The description includes the plan for identifying and recruiting districts and schools, random assignment of curricula to schools, and selecting the sample of students for data collection.

1. Recruiting Districts, Schools, and Teachers

As described in the previous section, a variety of sources will be used to identify districts and schools suitable for the study. These sources include district and school characteristics in publicly available data (including the Common Core of Data, www.SchoolMatters.com, and www.GreatSchools.net), the hundreds of districts MPR has worked with on previous studies, publisher nominations of districts that have expressed interest to publishers in using their curricula, and announcements about the study in publications with national circulation.

Initial Outreach. Two identical letters will be sent to each potential district—one to the superintendent and the other to the director of curriculum. The letters will briefly describe the study and benefits of participating. Recruiters will follow up with telephone calls to discuss district interest in participating. The initial telephone calls will be placed to senior administrators in math curriculum departments. In these discussions, recruiters will make clear that random assignment of curricula to schools is a key aspect of the study and that discussions can proceed only with districts that can accommodate this study aspect. Recruiters also will make clear that the plan is to have each district pilot all four curricula included in the study. Additional discussions will be pursued in districts that do not object to random assignment and to piloting all four curricula.

As mentioned earlier, districts willing to participate in this study are likely to have a unique set of circumstances and attitudes. Districts must be considering a curriculum change, open-minded to piloting various instructional approaches that may help inform a curriculum adoption decision in the future, and willing to have the curricula randomly assigned to participating schools. Other issues that may be important to districts considering study participation are whether the study's curricula are on a state's adoption list, the alignment of each curriculum to state standards, and the study's data collection plan.

These circumstances and attitudes suggest that a study of this kind is likely to require widespread support and approval within each district, ranging from the support of superintendents, to principals, to teachers. After the initial telephone calls, recruiters will give administrators time to hold meetings with other senior staff, school principals, and teachers to talk about their interest in participating. If a district contact indicates that there are no plans to hold such a meeting, recruiters will suggest that these meetings may be worthwhile, emphasizing that participation in the study involves many people at all levels within the district and schools, so buy-in could be important for successful participation. If districts would like more information for their discussions, additional documents about the study and curricula will be sent.

Preliminary Recruitment. Site visits will be scheduled with promising districts. Recruiters will meet with district administrators and, if appropriate from the district's perspective, with principals and teachers. After the initial meetings, recruitment could take a variety of paths. Some districts may hold a few additional internal meetings and quickly decide whether they want to participate; others may hold several meetings over a long period of time. Districts could also request additional meetings with recruiters.

Principals and teachers—particularly teachers—will be directly involved in the study, and their willingness to participate can be critical to a district's participation decision. Administrators may have strong support for the study, but the study is voluntary at all levels. Because teachers will be on the front lines of the study, implementing the curriculum assigned to their school, teacher approval for the study will likely be important for successful curricula implementation.

Recruiters will offer to meet with principals and teachers as districts discuss the study with them. Schools may have many questions about the curricula the study is implementing, as well as about the study's design and data collection plan. Because recruiters are not experts on the curricula, they will answer only basic questions about the curricula. When detailed questions arise about the curricula, they will be deferred to the appropriate publisher.

Finalizing Participation. As districts near a decision to participate, recruiters will work with administrators to confirm which schools will participate. Recruiters will encourage districts to select schools that are open to using any of the study's four curricula, because a school could be assigned any one of them. After the schools have been identified, recruiters will provide districts with consent forms to distribute to teachers within those schools.

All teachers at the target (first and second) grade levels will be encouraged to participate. The study is not focusing on a particular type of teacher or classroom within a school. Instead, it will include all classrooms the district, study, and publisher have agreed upon, possibly including self-contained special education classes. Teachers who participate will agree to implement their school's assigned curriculum to the best of their ability and cooperate with the study's data collection plan.[13]

The study also will encourage participation among other school staff whom schools and publishers indicate are important for implementation, by suggesting they attend training on the curricula. Schools or publishers may consider it important for math curriculum

[13] A school can be included in the study if some teachers do not want to have data collected about themselves—such as through teacher surveys. The main data collection requirement is that the study can test students.

coordinators and math coaches who provide support to teachers to learn the school's assigned curriculum. Many schools also have teachers who provide math instruction to a subset of students through a remedial math or special education pull-out program. To maintain consistency in the math instruction delivered to students in their main classroom and the pull-out program, teachers who work with students in pull-out programs will be invited to participate in the study and attend curriculum training.

Receipt of the teacher consent forms indicates a school's agreement to participate in the study and willingness to use any one of the study's four curricula. As soon as teacher consent forms are received from all schools in a district, the study will randomly assign the curricula to schools and put the publishers in touch with the district, so initial teacher training can be scheduled and the process for district receipt of curriculum materials can be established.

2. Randomly Assigning Curricula to Schools

Random assignment of curricula to schools will be conducted separately for each district. For example, if a district contains eight schools, the study will randomly select the two schools that will be assigned to implement curriculum A, the two schools that will be assigned to implement curriculum B, and so on. Stratifying random assignment by districts supports an analysis of curriculum effects for each district, which is useful for examining whether curriculum effects vary across sites.

If many schools were being assigned to each curriculum, the simple (within-district) random assignment process described above would generate curriculum groups with desirable properties. Such a design would ensure no systematic differences in the baseline characteristics of the schools assigned to each curriculum group or in the number of schools, teachers, and students assigned to each group.

However, the study is assigning a relatively small number of schools to each curriculum—about 27 schools to each of the four curricula. Using the simple random assignment procedure described above could result in chance differences in school characteristics and sample sizes of each curriculum group. Eliminating chance differences in school characteristics across the curriculum groups increases the face validity of the design (Raudenbush et al. 2007). Equalizing the sample size of each curriculum group also increases the statistical power of the design, because a "balanced" design—one in which an equal number of schools are assigned to each curriculum—can detect smaller impacts than an unbalanced one.

The study will use a "blocked" random assignment procedure to address these potential issues. To illustrate the idea behind this procedure, consider a district with eight schools. Suppose the only difference between the schools is the number of students in the target (first and second) grades, where four schools have a small number of students and the other four have a large number. The blocked random assignment procedure creates two blocks with four schools each, where the first block contains the four small schools and the second block contains the four large schools. The four curricula are then randomly assigned (without replacement) to the four schools in each block, which results in the same sample size and characteristics for each curriculum—two schools per curriculum, where one school contains a small number of students and the other a large number.

A more complex procedure is needed when several school characteristics are used to create the blocks. Below, we describe the procedure that will be used to address this issue. A more complex procedure also is needed when the number of schools in a district is not a multiple of four. For example, suppose the study includes two districts with 6 schools each—a total of 12 schools. To provide each curriculum with the same number of schools, three schools would be assigned to each curriculum across the two districts. With random assignment conducted separately for each of the two districts, how can we reach this goal? The random assignment procedure described below provides each curriculum group with a similar number of schools, even when the number of schools in some districts is not a multiple of four.

a. Creating Blocks of Schools

For districts with less than eight schools (because each district will include a minimum of four schools, the possibilities in this situation are four to seven schools), the school blocking process is straightforward—one block is created consisting of all participating schools in the district. For such districts, placing all the schools in one block supports all pairwise comparisons of curriculum effects.[14]

For districts with eight or more schools and where the number of schools is a multiple of four, the blocking procedure divides the schools into blocks with four schools each, where each block contains schools similar to each other along key baseline characteristics. If the number of schools is not a multiple of four, the schools are divided into blocks with four or more similar schools in each.

Specifically, the following steps are taken to create blocks in districts with eight or more schools, whether or not the number is a multiple of four:

1. Generate a list of all participating schools in the district. Because the blocking procedure is sensitive to the ordering of schools, the procedure is repeated for all possible orderings to identify the optimal ordering, as described below.

2. Select the first school from the list and assign it to block #1.

3. From the remaining unassigned schools, use the Mahalanobis distance to select the school most similar to the first school assigned to the block.[15] The

[14] An alternative approach would be to form one block with four schools and a second block that contains the remaining (one to three) schools. However, as described below, it is important that all pairwise comparisons of curriculum effects can be made in each block, and such an analysis could not be supported in the second block because it contains fewer than four schools and thus does not include all four curricula.

[15] See Mahalanobis (1936) for more information on the distance measure.

Mahalanobis distance will be used to determine the similarity of schools along several measures that are predictive of student achievement and indicative of school size—including proportion of students receiving free or reduced-price lunch, proportion of students proficient in math, proportion of white students, proportion of Hispanic students, and the number of first- and second-grade students.

4. From the remaining unassigned schools, select a third school for the block by identifying the one that has the smallest average distance between itself and the schools already assigned to the block.

5. Repeat step 4 once more to select a fourth school for the block.

6. If there are exactly four remaining schools, they will constitute block #2. If there are more than four schools, assign the first remaining school to block #2 and repeat steps 3 to 5 to identify the other three schools that will be part of block #2.

7. After the second block has been created, examine the number of remaining schools.

    a. If there are four or more remaining schools, follow the same procedure used to create block #2, to create subsequent blocks.

    b. If there are less than four remaining schools (that is, one to three schools), use the Mahalanobis distance to compare each of these schools to the schools in previously constructed blocks. Assign each remaining school to the block that is most similar.

As mentioned above, the procedure is repeated for all possible school orderings until the optimal configuration of blocks is identified. The optimal configuration takes into account how well matched schools are within all the blocks. This overall measure of within-block similarity is calculated using two steps. First, we calculate the average distance between all schools in each block, which provides a measure of the similarity of the schools in each block. Second, we add up the similarity values for all of the blocks. The optimal configuration of blocks is the one with the smallest sum of the block similarity values.

When the blocking procedure is complete, one or more blocks are created for each district. Each block will contain from four to seven schools that are similar to each other in poverty levels, proficiency rates, race/ethnicity, and school size. The random assignment of curricula to schools will then proceed as described below.

b. Random Assignment Within Blocks of Schools

When randomly assigning curricula to schools, our goal is to ensure that:

- ***Each school has an equal chance of being assigned to each curriculum.*** This ensures there are no systematic differences in the schools assigned to each curriculum.

- ***Each curriculum is represented in each block.*** When a relatively small number of schools are assigned to each curriculum group, conducting random assignment within blocks (where the schools in each block are similar) helps minimize chance differences in school characteristics and sample sizes of each group.

- ***Block-specific impacts are statistically independent of one another.*** This reduces the complexity of calculating the statistical significance of overall impacts. If block-specific impacts were correlated, the correlation would have to be accounted for when calculating statistical significance.[16]

- ***The total number of schools assigned to each curriculum is similar.*** As described in the previous section, a design that assigns an equal number of schools to each curriculum can detect smaller impacts than one that assigns different numbers of schools.

If the number of schools in each block always equals four, all four goals are met by randomly assigning (without replacement) the four curricula to the four schools in each block. If some blocks contain more than four schools, the first three goals are met, but the fourth one is not.

The following procedure helps us meet all four goals with blocks that contain any number of schools:

1. Randomly order the schools in each block.

2. Randomly order the four curricula.

[16]Block-level impacts would be correlated if the assignment of specific schools in one block is dependent on the assignment of specific schools in another block. This cannot occur if there are four schools (or a multiple of four schools) in each block, because assignments in one block are completely independent of assignments in another block. If the number of schools in each block is not a multiple of four, however, assignments in one block could depend on assignments in another block if the assignment procedure is not carefully designed. Our random assignment procedure prevents such dependencies, as described below.

3. Repeat step 2 for each block, thereby creating a list of four curriculum assignments for each block. Stack these lists into a single assignment list. Call this "assignment list 1."

4. Repeat steps 2 and 3, but call the second list "assignment list 2."

5. Perform the following steps for each block:

   a. Take the first four curricula from the top of "assignment list 1" and assign them to the first four schools in the block (and remove the curricula from "assignment list 1"). If there are only four schools in the block, the assignment for the block is complete. If there are more than four schools, continue to the next step.

   b. If there are one to three unassigned schools remaining in the block, take the appropriate number of curricula from the top of "assignment list 2" and assign them to the remaining schools (and remove the curricula from "assignment list 2").

3. Selecting a Sample of Students for Testing

Longitudinal Group. The study's main results will examine curriculum effects for students who were in a study school during the entire implementation period included in the analysis (hereafter, the "longitudinal" group). Class rosters will be collected at the beginning, middle, and end of each school year of curriculum implementation. Students who appear on all three rosters during the first year of curriculum implementation will be used to examine first-year effects. If the option to examine second-year effects is exercised, a separate analysis will be conducted based on students who appear on all six rosters (three rosters from each of the two school years).[17] Results based on the longitudinal group will be useful for understanding effects for students who had the *opportunity* to experience their school's assigned curriculum for one and two years. Whether or not these students *actually* experienced the curriculum depends on whether teachers used their assigned curriculum throughout the school year. This issue is discussed further in Chapter IV and, for reasons mentioned in that chapter, we expect that most schools will use their assigned curriculum.

To examine effects during the first year of curriculum implementation (at both the first and second grades), an average of nearly 11 students selected at random will be tested in

[17] Basing the analysis on students in the school at the end of the school year raises a potential bias issue. For example, if a particular curriculum leads to increased mobility out of schools among weak students, the sample for that curriculum will include only the stronger students who will be likely to have better outcomes. It may be unlikely that a math curriculum causes students to change schools; nevertheless, we will examine attrition rates across the four curricula. In particular, among students still in study classrooms in the spring, we will examine their baseline characteristics (particularly pre-test math scores) across the curricular groups. Weights could be used to adjust for any differential attrition rates.

each study classroom in both the fall and spring. This sample size (a total of about 3,500 students, based on three classrooms per grade in each of 108 schools) will enable the study to detect its target effect size for first-year effects at each grade level.

As described below, we expect that 9 of the 11 students from each classroom sample will be in a study classroom during the spring of a second year of curriculum implementation. To support the analysis of second-year effects, we will test these students in the spring. The statistical power of the second-year analysis will depend on the number of schools willing to participate in the evaluation for a second year.

Cross-Sectional Group. Curriculum effects also will be examined for students who were in a study school at the end of each school year during which implementation occurred, whether or not they were present during the entire period (hereafter, the "cross-sectional" group). Results based on this group will help us understand the effects of the curricula along a measure often used to judge school performance—spring achievement of all students in a school, whether or not they were in the school the entire year.

To support the cross-sectional analysis, students who were not enrolled in a study class in the fall of each implementation year, but were enrolled in the spring (that is, new to the school), will be added to the longitudinal sample during spring testing. Our experiences on other studies at the early grade levels suggest that one to two students per class (about 5 percent of each class) will be new to each study class during spring of the first implementation year, and about five students per class (about 20 percent of each class) will be new during spring of the second year.[18] Adding these students to the longitudinal sample creates a representative cross-section of the class at the time of each spring testing, thereby supporting the cross-sectional analysis.[19]

Accounting for Parental Nonconsent and Student Attrition. To obtain completed tests for the required number of students, the possibility of parental nonconsent for student testing must be considered. The study will obtain parental consent before testing students. Passive consent will be used when permitted; active consent will be used otherwise.

For the longitudinal analysis, the possibility of student attrition also must be considered, because the study will not track students who were tested in the fall but are no longer in a study classroom during spring testing of the first or second implementation year. This within- and between-school-year attrition is relevant for using the longitudinal sample to examine first- and second-year curriculum effects, respectively.

[18] Based on first-grade data from the Evaluation of Educational Technology Interventions.

[19] First-year effects based on the longitudinal and cross-sectional groups may not be significantly different because, as described above, only five percent of the cross-sectional sample is expected to be students new to the school; the rest of the sample will be longitudinal students. Second-year effects based on the two samples, however, may differ, because 20 percent of the cross-sectional sample is expected to be new students.

Our experiences with nonconsent and attrition indicate that an average of 12 students must be selected from each classroom in the fall of the first implementation year to support the longitudinal analysis. On the other studies mentioned above, 90 percent of students enrolled in a classroom during the fall testing completed both a fall and spring test during a particular school year—about 5 percent did not complete because of parental nonconsent, and another 5 percent did not provide a spring test because of attrition. We also found that 75 percent completed a spring test during the next school year. With these response rates in mind, we need to sample an average of 12 students per classroom in the fall of the first implementation year, to obtain both fall and spring tests from nearly 11 students during the first year and spring tests from 9 of them during the second year.

C. ASSESSING STUDENT MATH ACHIEVEMENT

1. Desirable Test Properties

Estimating the relative effects of the curricula depends heavily on the successful assessment of student math achievement. The knowledge and skills assessed should include those that mathematicians, math educators, and math researchers feel are important for early elementary students to develop. They also should reflect goals shared by early elementary math curricula in general and commonalities among the four curricula in the study. The measure must accurately capture information about the learning that results from exposure to each curriculum in the study without being biased toward any single curriculum or subset of curricula.

Ideally, the assessment can measure achievement gains over the full grade range of the study (first through third grade) and therefore avoids the need to equate scores from, say, two different tests. An individually administered test also is more desirable than a group-administered one because the latter can be problematic for young students, particularly first graders, who typically do not have experience taking a group-administered test. Another advantage of an individually administered test is that modifications, such as giving a student with special needs more time to respond, are not required. This is because the tests usually are not timed, and children with special needs receive the time they need.

2. The Test Selected for the Study

The study will assess student math achievement using the assessment developed for the Early Childhood Longitudinal Study (ECLS). The assessment meets the study's requirements regarding validity, reliability, individual administration, ability to measure achievement gains over the study's grade range, and accuracy in capturing achievement of students from a wide range of backgrounds and ability levels. The assessment also is adaptive, which limits the amount of time that children are away from their classrooms and reduces the risk of ceiling or floor effects in the test score distribution, which can have adverse effects on measuring achievement gains (Rock and Pollack 2002).

The assessment includes an overall score derived from all the assessment items, as well as proficiency-level scores (based on subsets of items) that indicate specific knowledge and skills mastered by students. The overall score provides useful information for comparing one curriculum group's overall achievement to that of another. The proficiency levels range from simple naming of numbers and shapes, to using knowledge about measurement and rate to solve word problems. Proficiency scores are useful for studying the details of achievement, which can be useful for evaluating whether a single curriculum or set of curricula influences some math skills more than others.

The study team will administer the assessment. The pre-test will be administered soon after the first day of school, and the post-test as close to the end of the school year as possible. Testers will pull students from their classrooms one at a time and take them to a quiet place (such as the school library) to administer the assessment.

As explained in Section B of this chapter, the sample of students in each classroom will be selected randomly from those who meet two criteria: (1) enrolled in the classroom at the time of testing, and (2) eligible for testing. Testers will inquire about any students who have special testing needs and will work to accommodate those needs. For example, if a student needs an aide to be present, testers can make this accommodation. Accommodations also would be made for classes where at least some instruction is conducted in Spanish, such as English-Spanish (bilingual) or Spanish-only classes. For those classes, testing could be conducted in Spanish. Put differently, a student would be considered *ineligible* for testing if they (1) have a physical or other impairment that prevents them from being able to take the test; or (2) are in a class where all instruction is conducted in English, but they do not speak enough English to take the test.

D. RESPONSIBILITIES SURROUNDING CURRICULUM IMPLEMENTATION

Because the study team is responsible for recruiting schools to participate in the study, the team will need to introduce participating schools and teachers to the publishers. Publishers are responsible for implementation of their curricula. However, to facilitate a strong connection between school staff and publishers, the study team will help coordinate the initial curriculum training for teachers.

The study team also will be responsible for notifying publishers of any issues about implementation that the schools raise. Similarly, publishers will be responsible for notifying the study about any issues that the schools raise about the study's design or data collection plan. We provide more details about these roles and responsibilities next.

1. Study Team Responsibilities

In addition to conducting the evaluation, the study team has two responsibilities related to curriculum implementation:

1. Supporting teacher training provided by the publishers

2. Alerting publishers to any curriculum issues that schools raise

The study is involved in these aspects of curriculum implementation to minimize district burden of participating in the study.

Supporting Teacher Training. Study support for training will begin before the initial training sessions and will continue through all follow-up sessions scheduled during the school year. When teachers are asked to provide consent to participate in the study, they also will be asked about their availability to attend initial training that typically occurs during the summer, right before school starts. This information will be provided to publishers to help them identify training dates that teachers can attend. Publishers will work directly with each district or school to schedule the initial trainings and will notify the study team of the scheduled sessions. The study will send registration packets to teachers for the initial trainings. If teachers indicate they cannot attend the training on dates that publishers established with the districts or schools, the study will notify the publishers so they can schedule make-up training sessions.

Publishers will suggest to the schools that initial training occur during the summer (preferably close to the start of the school year), and the study will support the trainings by compensating teachers for time spent in training during noncontract days. The study also will provide meals during the trainings and can, if necessary, cover travel expenses for teachers. Some districts or schools may prefer that initial training occurs before the end of the previous school year and, possibly, during the school day. The study can support those trainings by paying for substitute teachers.

The study will take attendance at each initial training to document which teachers attended and to help publishers identify teachers who could not attend and therefore need to be scheduled for make-up training. The study will support all make-up training sessions in the same way as the initial sessions.

During the school year, publishers will work directly with schools and teachers to schedule follow-up trainings. Publishers will notify the study team of the scheduled follow-up sessions, and the study will support those sessions in the same way as described above, unless training occurs during in-service time, in which case the study can pay for substitute teachers if necessary. While the study will ask publishers to document all follow-up training dates with attendance forms, publisher representatives may recognize that documenting trainings that occur during in-service time and do not require substitute teachers is not as important as ones that require payment. The study team will send frequent reminders to the publishers requesting that they let us know about such follow-up trainings.

Information collected on the two teacher surveys (one administered in the fall and another toward the end of the school year) will help provide complete information about follow-up training. The surveys will ask teachers to indicate whether follow-up training was provided, if they attended, and the amount of time spent in the follow-up sessions. The surveys also will collect information on the types of support available (such as telephone support, online support, and electronic or printed reference materials) and the extent to which teachers used the supports.

Alerting Publishers About Curriculum Issues. Several organizations, and many people from the study team and publishers, will work directly with participating schools and teachers. The study team will clearly explain to school staff that questions about the study design or data collection plan should be directed to the study team, and questions about the curricula and implementation should be directed to the publishers. Nevertheless, because so many people will be involved, it will be easy for school staff to confuse who is who and inadvertently direct questions about the curricula to the study team, and questions about the study to the publishers.

Any issues about the curricula that are brought to the attention of the study team will quickly be passed along to publishers, who will be responsible for following up with the schools to address the issues. Schools may notify the study about a variety of implementation issues, ranging from long-term substitutes in study classrooms to teachers encountering challenges using their assigned curriculum.

Similarly, publishers will be responsible for notifying the study about any issues that schools raise about the study's design or data collection plan. Because the publishers will be on-site with teachers more frequently than the study team, teachers may ask publishers questions about the study. The study team will follow up with the schools to address any such issues.

2. Publisher Responsibilities

Each publisher is responsible for curriculum implementation in its assigned schools. Implementation responsibilities include providing all teacher and student curriculum materials to study classrooms, providing teachers with initial and follow-up training on the curricula, and resolving any implementation issues that may arise during the school year. Publishers will also be responsible for providing additional curriculum materials if new students enter study classrooms during the school year.

Publishers will determine the amount and type of training to provide teachers, and the study will support each publisher's desired level of training. Initial trainings will likely occur in group settings, but follow-up training may take other forms. Some follow-up sessions can involve trainers working individually with teachers in their classrooms, or with small groups of teachers during their break time or lunch time. For example, follow-up training may involve publishers observing a teacher's math lesson and providing the teacher with feedback on his or her use of the curriculum. Follow-up training may also include publishers teaching a model lesson for the teachers, or group meetings with teachers after school or on weekends

CHAPTER III

ASSESSING CURRICULUM IMPLEMENTATION

The study has two goals for assessing curriculum implementation. The first is to set a context for the student achievement results, by examining fidelity of implementation to each of the study's curricula. Implementation fidelity examines the degree to which the instruction delivered to students for a particular curriculum resembles what the developers of the curriculum intended. This depends, in part, on how publishers work with teachers and how teachers work with students. For example, did teachers assigned to a particular curriculum follow the day's lesson plan for that curriculum? Such an assessment also can help in understanding which curricula teachers implement easily and well, whether a particular level of fidelity to a curriculum is related to improved student achievement, and how the specific features of a curriculum are related to achievement growth.

The second goal is to develop implementation measures that can be defined consistently across the study's curricula, both for assessing implementation and for examining the relationship between the cross-curriculum measures and the relative effects of the curricula. For example, do teachers in two different curriculum groups differ in the extent to which they use open- and closed-ended questions? Are these differences related to differences in achievement gains made by students of the two groups of teachers?

The study will use a three-part plan to meet these goals. The plan includes (1) observing classroom math instruction, (2) surveying teachers about curriculum implementation, and (3) observing initial curriculum training and surveying teachers about follow-up training. Because the study is scheduled to conduct one observation per classroom, the observation data alone may not provide comprehensive information about how teachers work with students. A teacher survey about implementation will be administered late in the school year to collect information that helps provide comprehensive information about teacher-student interactions. To understand how publishers worked with teachers, thereby rounding out information about implementation, the study will observe a sample of initial teacher trainings provided by each publisher and will collect information about follow-up training through the end-of-year teacher survey.

Scales will be developed to support the fidelity assessment and correlational analysis of implementation and impacts. Fidelity scales will be based on items that indicate the extent to which teachers adhered to both the routines and critical features of their assigned curriculum, as well as to the curriculum's instructional approach. Because adherence to a curriculum's instructional approach (such as use of open- and closed-ended questions) can be defined consistently for each of the study's curricula, it also serves as a cross-curriculum measure useful for the correlational analysis. Other cross-curriculum scales (such as ratings of student behavior management and use of instructional time) also will be created and used for the correlational analysis of implementation and impacts.

As part of the implementation analysis, the study will compare classroom observation data to teacher survey data about implementation to examine the usefulness of the two data sources. Because of the relatively high cost of collecting observation data, it is important to determine if it is possible to obtain comparable data through a teacher survey, which is considerably cheaper. To support this analysis, the teacher survey will duplicate as much of the information collected through classroom observations as possible. For example, some items will allow comparison of teacher perceptions of adherence to the curriculum with classroom observer accounts of adherence (keeping in mind that the observation occurs in a single day in each classroom and the teacher perceptions are based on an entire school year).

This chapter describes the three-part plan for collecting implementation data and the scales that will be constructed from the data. To ensure that reliable scales are constructed, information will be collected for several items that appear to be related to each scale. The chapter concludes by describing the techniques that will be used to turn the many items that will be collected into the few scales of interest. The conclusion also describes scales based on the classroom observation and teacher survey data that will be examined to assess the comparability of the two data sources.

A. THREE-PART DATA COLLECTION PLAN FOR ASSESSING IMPLEMENTATION

Various approaches have been used to collect data useful for assessing implementation. The most widely used approach has been classroom observations, where an observer codes behaviors of students and teachers during a specified time interval (Hilberg et al. 2004). The protocols for classroom observations have included rating scales, checklists, time samples, interactive coding, and narrative descriptions. Other studies have used teacher logs or diaries (Correnti and Rowan 2007; Rowan et al. 2004; Unrau and Wehrmann 2001); teacher assignments and student work (Clare 2000); and teacher interviews and surveys (Mowbray et al. 2003).

As mentioned above, we plan to use observations of classroom math instruction, teacher survey data about curriculum implementation, and observations and survey data about teacher training. Classroom observations and teacher surveys about implementation will help us understand how teachers worked with students. Information about teacher training will help us understand how publishers worked with teachers to support successful implementation.

The study is scheduled to conduct one observation per class, where randomly selected groups of classes are observed at various points during the school year. Observers will use the protocol to observe all math instruction that occurs on a particular day, which can include math routines (such as calendar time and center activities) and the lesson taught that day. Observers will remain in the room as long as mathematics instruction is occurring (as defined by the teacher) that day.[20]

The study's classroom observation plan has two implications. First, one observation per classroom allows the study to assess average implementation for the group of teachers using each curriculum, not implementation for each individual teacher. Assessing implementation for each teacher would require more than one observation per class. Second, even at the curriculum level, it may be challenging to obtain comprehensive information about certain aspects of implementation (such as student exposure to math content across the school year) with one observation per class. The teacher survey will help collect information about exposure to content, as well as information about implementation in a variety of areas, with an emphasis on adherence to curriculum.

1. Observations of Classroom Math Instruction

In designing the study's classroom observation protocol, we reviewed the literature to examine the methods that have been used for assessing implementation fidelity and quality of instruction. We looked at literature that spanned the range of grades from preschool to high school and across different academic areas, paying special attention to protocols pertaining to mathematics.

a. Framework for Developing the Protocols

The framework we chose for developing the study's protocols is based on the structure developed by Dane and Schneider (1998), and later updated by Dusenbury et al. (2003) and Lynch and O'Donnell (2005). Five domains make up the framework: (1) adherence, (2) exposure, (3) quality of delivery, (4) participant responsiveness, and (5) program differentiation. We describe these domains next:

- ***Adherence.*** This area of fidelity is most often addressed in implementation studies. It addresses questions such as: Did the teacher adhere to the strategies and activities as described in the developer's materials? Did the teacher adhere to the pedagogical approach, the sequence of the lesson, use of recommended materials, and the nature and intent of the lesson?

- ***Exposure.*** Sometimes referred to as "dosage," exposure is described in the 2004 National Research Council (NRC) report as the "extent" of curricular implementation. With one observation per classroom, we can examine the extent to which instructional strategies are implemented in a given lesson and rate the apparent ease with which teachers implement those strategies. The

[20] Observations will not be conducted on days when the instructional focus is on student testing or preparation for testing, or when major schoolwide social activities are planned.

teacher survey will provide additional information about the extent of implementation, particularly in reference to exposure to content and number of lessons taught.

- ***Quality of Delivery.*** Areas of teacher quality that previous research has identified include student behavior management, use of instructional time and how it is organized for learning, emotionally supportive environments, and high-quality feedback (Baker 1999; Pianta et al. 2006).

- ***Participant Responsiveness.*** As noted in the NRC (2004) report, studies of mathematics curricula by Baxter and colleagues (Woodward and Baxter 1997; Baxter et al. 2001) illustrated the importance of examining student engagement or participant responsiveness, as have other studies (Padron and Waxman 1999).

- ***Program Differentiation.*** Information for this domain helps answer the question, "How do I know it when I see it?" (Huntley 2005). This domain examines features that distinguish one curriculum from another. Some practices that are required in one curriculum (for example, telling a student when an answer is incorrect) are discouraged in another. Sometimes the differences between curricula are more subtle. For example, each of the study's curricula include some questions about how a student knows an answer is correct. However, in some curricula, this question is asked frequently in a variety of contexts, while in others, this question is asked once with a single correct answer accepted. Capturing whether these and other characteristics of the curricula are being implemented as the developers intended requires looking closely at the differences in curriculum implementation.

Before using this framework to create the study's protocols, we carefully reviewed the curriculum materials, observed trainings by the publishers, and observed classrooms outside of the study implementing the curricula. We identified critical features of each curriculum and asked publishers for feedback on the accuracy of these features. Once confirmed, we used the critical features as a basis for developing adherence measures and practices included in the protocol.

b. The Study's Protocols

Based on our review of the literature and on the analysis of the study's curricula, we developed protocols that use both interactive coding (coding clearly defined behaviors as they occur) and ratings completed at the end of the observation (rating how evident different behaviors or characteristics are in the classroom). The protocols are contained in Appendix B. Combining these approaches allows an observer to focus on the teacher-student interactions that occur and captures information about the frequency of those clearly defined interactions, while also gathering information about how evident or characteristic different behaviors are in the classroom.[21]

The combined interactive coding and ratings provide information on several categories, including teacher-initiated instruction; type of feedback provided to students; use of representations for mathematical ideas; student engagement in the lessons and activities; classroom management; use of time in relation to math instruction; materials available; and the activity setting (independent, small group, or large group). Because of the different approaches among the curricula, the protocol also codes behaviors related to a content-focus in instruction (which typically concentrates on obtaining correct answers) or a process-focus (which typically is more metacognitive).

Observers will rate items that address two components: (1) one that examines instructional quality and student engagement using cross-curriculum items, and (2) another that includes curriculum-specific items to examine adherence to each curriculum. These components are described below.[22]

Cross-Curriculum Component. The cross-curriculum component includes two forms: (1) the Observation of Math Instruction (OMI) form, and (2) the Classroom Characteristics (CC) form. Observers will use the OMI to collect data during the math lesson, noting starting and ending time for instruction, teacher instructional behaviors (both initiated and feedback), student behaviors, materials used, problem-solving approaches and types of representation, and activity setting.

An important aspect of the OMI is that it includes behaviors that may occur in implementation of all the curricula, as well as behaviors that are considered distinctive of one or more curricula. For many behaviors, the differentiation among the curricula is how often the behavior is used. Thus, while some items require a yes/no response, most ask observers to tally the frequency of each behavior. Items requiring tallies are those that may occur with different frequency across the curricula and therefore may be most important for differentiating the curricula.

After the lesson, observers will use the CC form to rate the lesson they observed along different behaviors that are characteristic of instructional quality and student engagement. The CC asks observers to rate how characteristic a statement is of the class they observed on a scale that ranges from 1 (“not at all”) to 4 (“extremely characteristic or almost always evident”). The behaviors described on the CC examine behavior management, student

[21] Frequency alone would not capture whether the behaviors occur throughout the class and at the appropriate times. For example, a teacher might ask several open-ended questions at the beginning of class and then not do so again for the rest of the class period. In another classroom, the use of open-ended questions may occur with the same frequency, but the questions are evident throughout the lesson. Ratings completed after the class will be used to characterize such teacher behaviors.

[22] The protocols were piloted with videotapes of classrooms, as well as in live classrooms. Members of the study’s panel of advisors and IES reviewed the protocols. Revisions were made based on feedback received from each review.

responsiveness or engagement, use of instructional time, emotional supportiveness of the classroom, and quality of adherence (for example, teacher monitoring of instruction, fluid delivery of instruction, and differentiation of curriculum).

Curriculum-Specific Component. The curriculum-specific component includes a separate form for each curriculum—called the Adherence Rating (AR) form—that examines both the routines and critical features of the lesson, as well as delivery of the curriculum. The observers rate how characteristic a statement is of the class they observed using the same scale as the CC form—from 1 ("not at all") to 4 ("extremely characteristic or almost always evident"). Some items can be rated as "not applicable" when the lesson does not require a particular instructional practice.

During the observation, the observers will have a copy of the lesson to be taught and, if applicable, student work pages as well. If needed, they can make notations on the lesson—for example, checking off what the teacher does from the lesson, or numbering the order in which the teacher completes activities if sequence is important to the lesson.

c. Noteworthy Aspects of Observer Training

Classroom observer training will last three days. The first day will begin with an item-by-item review of the OMI protocol and a brief review of questions from pretraining exercises.[23] Observers will then be trained on the CC and will practice coding both the OMI and CC, using lesson plans and videotaped classroom examples. During the second day, observers will be trained on the AR. Each observer will be trained on two curricula, given an overview of each curriculum and its specific protocol, and practice coding videotaped classrooms where that curriculum is being used. The videotapes will illustrate both ideal practice and more typical practice. Practice will continue on the third day.

At the end of the training, observers will be required to pass a reliability test for each of the curricula on which they were trained in order to conduct observations in classrooms using those curricula. Observers will be trained to 80 percent agreement on coding the categories on the observation forms and ratings.

To assess the reliability of observers in the field, the plan is to pair each observer with a "master coder" for one observation. Master coders are study team members with direct experience in developing and piloting the observation form, as well as significant experience coding the protocols. After each reliability observation, master coders will review and discuss with observers their coding of the protocol and identify any items of significant

[23] In preparation for the classroom observer training, pretraining packets will be sent to each observer. The packets will include exercises designed to familiarize observers with the initial page of the OMI. Each exercise will consist of a lesson plan from one of the four curricula, an OMI form to be used to code each lesson plan, and an answer key for the exercise. The pretraining packet will also include instructions for completing the exercises, as well as a coding guide for the OMI.

discrepancy between the two observers. If significant discrepancies are identified, retraining will be provided.

2. Teacher Survey About Curriculum Implementation

As mentioned above, the one observation per classroom scheduled by the study may not be sufficient for assessing implementation. For example, with one observation per class, it may be difficult to obtain comprehensive information about student exposure to math content across the school year, or the lesson observed on a single day may not be representative of the range of strategies a teacher uses.

A teacher survey will be used to supplement the observational data and to examine the relationship of the group estimates of instructional practice obtained from the two sources. The survey will be administered to teachers late in the school year. The survey will include items that collect information about the number of lessons teachers devoted to different areas and topics in mathematics, and the extent to which they progressed through their assigned curriculum. Teachers will also be asked to report their commitment to the curriculum and overall satisfaction with it. The teacher survey appears in Appendix B.

Section B of this chapter describes the scales that can be created from the teacher survey, as well as comparable scales from the teacher survey and classroom observation data. The study will examine the relationship of the comparable scales.

3. Observations and Teacher Survey About Curriculum Training

Observations of initial teacher training and survey data about follow-up training will be used to characterize the training teachers receive. As mentioned in the previous chapter, initial training typically will occur in the summer before the start of the school year and will last one to two days, depending on the curriculum. Follow-up training sessions will occur throughout the school year, and each session is expected to last no more than half a day.

For each curriculum, initial training sessions in four sites will be observed—for a total of 16 observations. The observation protocol includes an appraisal of the quality of the training, as well as recordings of the training content and process. Observers will note the amount of time spent on 11 key activities generally considered to be important features of professional development programs—these activities include features that are key components of two or more of the study's curricula.[24] The form asks observers to note any concerns that teachers express about the curricula that may affect implementation during the school year. At the end of training, observers will make an overall assessment of the quality

[24] For example, the amount of time the facilitator spends on the following activities will be collected: instructing teachers how to differentiate instruction, providing teachers with an opportunity to develop lesson plans, modeling key instructional activities, providing teachers an opportunity to practice instructional activities in a role as a student, and providing teachers with an overview of the research that supports the curriculum.

of the training, by considering how effective the facilitators were and the extent to which teachers were engaged.

Information about follow-up training that occurs during the school year will be obtained from the teacher survey. Survey items will ask teachers about the type of instructional support publishers offered during the year, whether they attended, and the amount of time attended. Information about other available supports provided by the publishers (such as telephone or online support) will also be collected.

B. Analyzing Implementation Data and Assessing Its Usefulness

Both traditional data reduction techniques (factor analysis, cluster analysis) and Item Response Theory (IRT) techniques will be used to analyze the classroom observation and teacher survey data. In this section, we describe the approach for creating scales from the two data sources, as well as scales from the classroom observation and teacher survey data that can be compared to assess the usefulness of the two data sources. Appendix C lists examples of the scales that will be constructed and items included in each one.

1. Developing Scales

Reliable scales that are cross-curricular and substantively important (for example, feedback to students, student engagement, classroom management, and productivity) will be created from information on the OMI and CC forms. The extent to which instruction adhered to both the routines and critical features of the study's curricula will be created from information on the AR form. We will conduct an exploratory factor analysis of the data to see if different aspects of adherence are represented in the data (for example, completion of activities versus adherence to instructional strategies), or whether adherence in one area is so strongly related to adherence in the other areas that it is a single scale.

We also will conduct a cluster analysis of information on the OMI. Initial exploration of the data will be conducted (examining variance, histograms, scatter plots of the data) to determine whether, for example, the tallies on the OMI should be categorized or maintained as continuous variables. We expect that high-frequency categories (such as asking closed-ended questions) will be recoded into four or six categories. The recoded data would then be entered into a cluster analysis.

We expect that up to four clusters will be derived that represent the different instructional approaches among the study's curricula:

1. High use of closed-ended questions with more direct or explicit instruction/reinforcement of responses (Saxon)

2. High use of open-ended questions requiring more metacognitive reasoning and use of feedback that shapes students' understanding (Investigations)

3. High use of representations with high metacognitive reasoning required in feedback (Math Expressions)

4. A mixed approach that is moderate in all these areas (Scott Foresman-Addison Wesley).

These clusters also are shared by curricula outside of the study, making them useful for assessing instruction by any teachers who stop using their assigned curriculum and instead use another one.

The reliability and construct validity of the scales will be examined using IRT techniques, and by looking at the item-total correlations of the items and the coefficient alpha for each of the scales. We will use a one-parameter Rasch model and check the fit of the items to the model, the reliability of the measure, and the ordering of the items from those practices observed most frequently to those observed least frequently. The frequency with which the practices are observed should match expectations for different curricula based on the training and directions provided to the teachers. For example, it is expected that in Saxon, a direct instruction approach, instructional practices such as asking closed questions and taking children through procedures step by step would be observed frequently, and practices such as providing hints would be less frequent than a directed correction procedure. After we have reliable scales, we will examine the validity of all the constructed scales by examining the correlation between the scores on the scales and student math achievement. We discuss these correlational analyses in the next chapter.

2. Comparing Classroom Observation and Teacher Survey Data

The teacher survey includes questions that correspond to items on the classroom observation protocol, and comparable scales will be created from the survey data. The same approach used to construct scales based on the classroom observation data will be used to construct scales based on the teacher survey data.

Table III.1 presents comparable scales that can be created from the teacher survey and classroom observation data, and that we expect will be correlated. Some items on the teacher survey correspond to items on the AR forms, which makes it possible to develop comparable scales about adherence. For example, we expect that the score obtained on the "Adherence to Curriculum" scale from the AR data will be strongly related to the "Adherence to Curriculum" scale from the teacher survey data. Additional comparable scales from the teacher survey will be developed, including measures that represent emphasis on contructivist/metacognitive practices, use of representations, student engagement with the curriculum, and peer learning.[25]

[25] The study will examine both convergent and divergent relationships between the two data sources (that is, whether the scales derived from the survey correlate most strongly with the similar scale derived from the OMI and CC, and have weak or negative correlations with scales that represent the other end of a continuum). For example, the teacher survey metacognitive scale should be most strongly correlated with the OMI cluster score on the metacognitive practices (high use of open-ended questions with feedback requiring more metacognitive reasoning), and should show a weaker or negative relationship to the OMI direct/explicit cluster.

Table III.1. Scales From Classroom Observation And Teacher Survey Data That Are Expected To Be Correlated

Classroom Observation Scales	Teacher Survey Scale
Adherence to Curriculum (all AR items)	Adherence to Curriculum (all subitems in question 30) Commitment to Curriculum (all subitems in question 21)
Student Engagement/Responsiveness (4 CC items) Behavior Management (7 CC items)	Student Engagement (question 22 a, b, c)
Social Environment of Classroom (14 CC items) and Peer Collaboration/Leadership (7 OMI items)	Peer Collaboration (question 23 a, c, h, i)
Metacognitive with High Representation Cluster (16 OMI items)	Use of Representations (questions 20 d, and 23 k, l, n, p) Guided Discovery (questions 23 f, g, and 24 b, d
Guided Discovery Approach (14 OMI items)	Guided Discovery (questions 23 f, g, and 24 b, d)

The table also illustrates that a limited number of comparable scales can be defined from the two data sources. Some items are difficult to ask of teachers in a survey because there is a response that is clearly more socially acceptable. For example, the productivity of the classroom is difficult to measure on a survey. Teachers are not likely to report that they use math instructional time poorly or that they do not have smooth transitions.

Among the comparable scales, those derived from the classroom observation data often are based on more items than those from the teacher survey data. For example, the “social environment of classroom” scale is based on 14 items on the classroom observation protocols but only 4 items on the teacher survey. To maintain a reasonable level of burden on the teacher survey, fewer items are collected for some scales.

Alternatively, a teacher survey can be used to capture some information not easily obtained through the study’s planned classroom observations. For example, we can observe whether the teacher adheres to the curriculum on a given day, but not how committed the teacher is to implementing the curriculum or what content areas are addressed throughout the school year. The teacher survey also includes items that examine the emphasis on different math content areas throughout the school year as reported by teachers, the involvement of teachers in professional development activities, and the commitment of teachers to the curricula (including how often they supplement with other materials and practices)—information not collected through the classroom observations.

CHAPTER IV

MEASURING THE RELATIVE EFFECTS OF THE CURRICULA

To date, the study team has recruited 12 districts with a total of 111 schools to participate in the evaluation—three more schools than the 108 target mentioned earlier. Four districts with a total of 40 schools began participation during the past school year (2006-07), where curriculum implementation began in the first grade. Among this initial cohort of participants, three districts with all 28 of their schools plan to continue participating in the study this coming school year (2007-08). In these schools, curriculum implementation would (1) continue in the first grade with a new cohort of first graders; and (2) be expanded to the second grade, which, for the most part, would include students who used their school's assigned curriculum during the previous year (when they were first graders). Another eight districts with a total of 71 schools also plan to join the study this coming school year. Curriculum implementation in these additional schools would roll out in the first and second grades. Table IV.1 summarizes this information.

Table IV.1. Number of Schools Participating in the Study, Their Timing of Enrollment, and Curriculum Implementation Plans

	Curriculum Implementation			
	2006-07 School Year		2007-08 School Year	
Cohort	First Grade	Second Grade	First Grade	Second Grade
Initial 40 Schools	40 schools	--	28 schools[a]	28 schools[b]
Additional 71 Schools	--	--	71 schools	71 schools

[a]Most first-grade teachers in these schools will have participated for two years by the end of the 2007-08 school year.

[b]Most second-grade students in these schools will have participated for two years by the end of the 2007-08 school year.

-- Indicates that no schools participated during the specified school year and grade level.

Given the current curriculum implementation plans of the participating schools, four main impact analyses can be conducted—two related to first-year effects and two related to second-year effects. The first-year analyses will examine impacts separately on first and second graders, when the students and their teachers are first exposed to the curricula. The second-year analyses will examine (1) impacts on first graders when they are exposed to the curricula for the first time by teachers who already have a year of experience, and (2) impacts on second graders who already had a year of curriculum experience as first graders but have teachers who are using the curricula for the first time.

Specifically, the study can examine:

First-year effects for:

- ***First graders who experienced the curricula for one year, as did their teachers (minimum detectable effect = 0.20).*** This analysis would be based on all 111 schools recruited for the study—that is, 2006-07 school year data for first graders in the initial 40 schools, and 2007-08 school year data for first graders in the additional 71 schools.

- ***Second graders who experienced the curricula for one year, as did their teachers (minimum detectable effect = 0.25).*** This analysis would be based on 2007-08 school year data for second graders in the additional 71 schools.

Second-year effects for:

- ***First graders with one year of curriculum experience, but who had teachers with two years of experience (minimum detectable effect = 0.42).*** This analysis would be based on 2007-08 school year data for first graders in the 28 schools that initially joined the study a year earlier and continued to participate for a second year. These first graders would be new to the study during the 2007-08 school year, but most of their teachers will have participated in the study for two years by the end of that year.

- ***Second graders with two years of curriculum experience, but who had teachers with one year of experience (minimum detectable effect = 0.43).*** This analysis would be based on 2007-08 school year data for second graders in the 28 schools described above. Most of these second graders will have participated in the study for two years by the end of the 2007-08 school year, but their teachers would be new to the study that year.

This chapter describes the frameworks for estimating first- and second-year effects. The approach for estimating second-year effects can also be used for analyzing data from the study option that would extend implementation to the third grade. The main effects are based on all schools in the study, whether or not they actually use their assigned curriculum. Although we expect that most schools will use their assigned curriculum, we discuss an approach for estimating effects that result from actual curriculum usage if some schools end up not using their curriculum. The chapter concludes by describing analyses that will be conducted to explore baseline conditions and teacher practices that may be related to any observed variation in impacts.

A. Framework for Estimating Main Effects

As described in earlier chapters, an experimental design is being used to examine the relative effects of the study's four curricula on student math achievement. The design involves randomly assigning participating schools in each district to the study's four curricula. Random assignment means that valid impacts can be calculated by simply comparing average spring math achievement of students in the four curriculum groups.

Although a simple approach can be used to estimate impacts, calculating the statistical significance of the impacts requires that the nested structure of the data is incorporated in the calculations. The nested structure includes students clustered in classrooms, classrooms clustered in schools, and schools clustered in districts. Because of clustering, the variance of the impact estimates is larger than would be the case if students were randomly assigned to the curricula, regardless of the school or classroom in which they are enrolled.[26]

Statistical significance calculations also must take into consideration the multiple pairwise comparisons of curriculum effects that will be made. With four curricula included in the study, six pairwise comparisons of effects can be made: curriculum 1 relative to 2, 1 relative to 3, 1 relative to 4, 2 relative to 3, 2 relative to 4, and 3 relative to 4.

1. Estimating First-Year Effects

A statistical model with three inter-related equations can be used to produce the impact estimates, and incorporate the nested structure of the data when estimating standard errors of the impacts. The first equation assumes that spring math achievement can differ among students in each class:

$$(1) \qquad Y_{ijk} = \alpha_{0jk} + \varepsilon_{ijk},$$

where Y_{ijk} equals spring math achievement of student *i* in classroom *j* in school *k*, α_{0jk} equals average spring math achievement of all students in classroom *j*, and ε_{ijk} is an error term that represents the difference in achievement between student *i* and average achievement of all students in classroom *j*. We assume that ε_{ijk} is normally distributed with the same variance across classrooms.

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[26] Such a random assignment process would mean that each classroom could include more than one curriculum, with the possibility of all four curricula represented in each classroom—a design that was rejected because it would be difficult, if not impossible, for teachers to implement.

The second equation assumes that average classroom achievement from the first equation (α_{0jk}) can differ across classrooms:

(2) $$\alpha_{0jk} = \beta_{0k} + \mu_{jk} ,$$

where β_{0k} equals average spring math achievement of school k, and μ_{jk} is an error term that represents the difference in average achievement of classroom j and average achievement of all classrooms in school k. We assume that μ_{jk} is normally distributed with the same variance across schools.

The third and final equation assumes that average school achievement from the second equation (β_{0k}) can differ across schools and may depend on the curriculum assigned to schools:

(3) $$\beta_{0k} = \delta_1 + \sum_{T=2}^{4} \delta_T T_k + \nu_k ,$$

where δ_1 equals average spring math achievement of schools assigned to curriculum 1. A separate set of terms δ_T and T_k are included in the model for curricula 2, 3, and 4, where δ_T represents the difference in average achievement between curriculum T and curriculum 1, and T_k is an indicator variable that equals one for schools assigned to curriculum T and zero otherwise. ν_k is an error term that represents the difference in average achievement of school k and average achievement of all schools, holding constant the influence of the curricula assigned to the schools.

Substituting equation (3) into equation (2), and then the combined equation into equation (1), results in the combined model:

(Combined Model)

$$Y_{ijk} = \delta_1 + \sum_{T=2}^{4} \delta_T T_k + \nu_k + \mu_{jk} + \varepsilon_{ijk} .$$

Because curriculum 1 is included in the model as the reference category, the effect of each of the other three curricula (2, 3, and 4) is expressed relative to curriculum 1, as described above. To make pairwise comparisons among curricula 2, 3, and 4, we subtract coefficients for the comparisons we want to make. In particular, to determine the effect of curriculum 2 relative to curriculum 3, we subtract δ_2 minus δ_3; the effect of curriculum 2 relative to curriculum 4, we subtract δ_2 minus δ_4; and the effect of curriculum 3 relative to curriculum 4, we subtract δ_3 minus δ_4. Hierarchical linear modeling (HLM) techniques can be used to estimate the model.

School, teacher, and student characteristics measured at baseline will be included in the model to increase the precision of the impact estimates, and explore whether impacts vary along subgroups defined using these baseline characteristics. Most importantly, the model will include student math achievement measured at the beginning of the school year—that is, right around the time teachers began using their assigned curriculum. Baseline achievement typically explains a significant amount of the variation in spring achievement, thereby increasing the study's statistical power. To further increase the power of the design, other student characteristics, as well as teacher and school characteristics, will also be included in the model.[27] The approach for investigating the moderating effect of these baseline characteristics is described in Section C of this chapter. That section also describes how the study will examine the relationship between impacts and teacher practices measured during the implementation period.

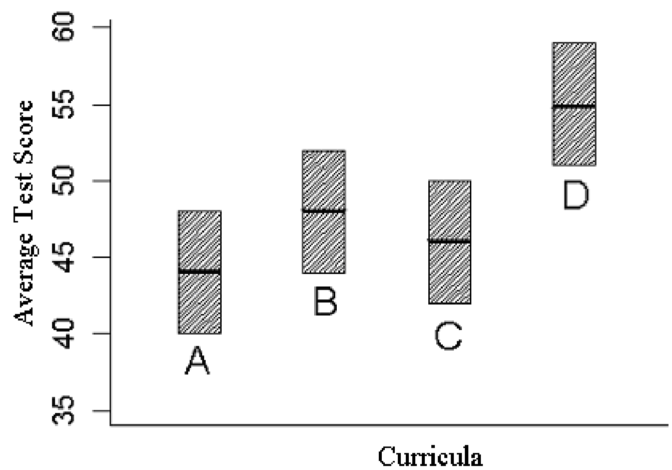
The study can examine results based on (1) an analysis that pools all the schools together to produce a single set of impacts, and (2) an analysis that produces a separate set of impacts for each block of schools defined during random assignment.[28] The block-specific impacts represent the results of "mini experiments" and are useful for examining whether results based on all schools pooled together mask any variation in impacts. Section C discusses analyses that will be conducted to explore factors that may be related to any observed variation in block-level impacts.

Figure IV.1 uses hypothetical data to illustrate how effects based on all the schools pooled together can be reported. The figure shows average spring math achievement of students in the four curriculum groups, and whether differences in their achievement are statistically significant. In particular, the rectangles represent the 95 percent confidence interval around the average spring test score of students who experienced each curriculum—the average test score is denoted by the horizontal line in the middle of each rectangle. In the sample figure, the positive difference in achievement of curriculum D relative to curricula A and C is statistically significant because the confidence interval for D has a different range than the confidence intervals for A and C. However, the difference in achievement of A relative to C is not statistically significant because the confidence intervals of A and C have similar ranges.

[27] Other student characteristics will be obtained from class rosters, teacher characteristics will be obtained from the teacher surveys administered by the study, and school characteristics will be obtained from information publicly available for schools.

[28] As mentioned in Chapter II, random assignment will be conducted within blocks of schools, where each block contains at least four schools that are similar to each other along several characteristics related to student achievement. Because the study is assigning a relatively small number of schools to each curriculum, the blocking procedure helps reduce chance differences in school characteristics and sample sizes of each curriculum group. Reducing these chance differences increases the face validity and statistical power of the design. When computing the single set of impacts based on all the schools pooled together, the degrees of freedom used to calculate the statistical significance of the impacts will be reduced to reflect the number of blocks constructed during random assignment. The degree of freedom loss will have a minimal effect on the study's statistical power, because the number of units randomly assigned (111 schools) is relatively large when compared to the number of blocks we expect to construct (about 25 blocks).

Figure IV.1. Relative Effects of the Study's Curricula on Student Math Test Scores



Source: Hypothetical data.

2. Testing Hypotheses About Sustained Effects

As described above, the study will conduct two analyses to examine second-year effects of the curricula. The first analysis will be based on a new cohort of first graders who have teachers that already participated in the study for a year. The second analysis will be based on second graders who participated in the study both as first and second graders.

The framework for estimating first-year effects can be used to conduct both analyses about second-year effects. In particular, the "combined model" above could be estimated using the new cohort of first graders—math achievement of these students will be assessed in both the fall and spring, just like the initial cohort. Parameter estimates of the curricula (δ_1, δ_2, δ_3, and δ_4) based on these students would indicate how the curricula affect student achievement among teachers who already had a year of curriculum experience. The model also could be estimated with second graders who participated in the study as both first and second graders—math achievement of these students would be assessed in both fall and spring of the first grade, and again in spring of the second grade. Parameter estimates of the curricula based on these students would indicate how the curricula affect achievement during a second year of exposure.

Statistical tests of the two sets of first-grade effects (based on the two cohorts of first graders) could also be conducted to determine if effects change as teachers acquire more experience with their assigned curriculum. Similar statistical tests could be conducted for the first- and second-grade effects (based on students who participated in the study for two years) to determine if effects change as students are exposed to the curricula for more than one year. Similar analyses could be conducted using data from the study option that would extend implementation to the third grade.

B. ADDRESSING POTENTIAL ISSUES SURROUNDING THE INTERPRETATION OF MAIN EFFECTS

Technically speaking, the main effects of the curricula (as described in the previous section) are useful for understanding effects for students who had the *opportunity* to experience their school's assigned curriculum. Whether or not these students *actually* experienced the curriculum depends on whether teachers continued to use it throughout the implementation period.[29] If all teachers use their assigned curriculum during the entire implementation period, the study's main results about the effect of *offering* the curricula is the same as the impact of actually *using* the curricula.[30]

The point at which random assignment was conducted helps increase the likelihood that teachers will use their assigned curriculum during the entire implementation period. Recruitment focused on districts that were comfortable will all four of the study's curricula and on participating schools that agreed to implement any one of them. In addition, random assignment was conducted after teacher consent to participate in the study was obtained, which also helped identify teachers willing to participate, regardless of the curriculum to which they are assigned.

The challenges of replacing a curriculum during the school year also help to increase the likelihood of teachers using their assigned curriculum the entire time. A school's ability to replace a curriculum after the start of a school year could be limited, because curriculum decisions typically must be made far in advance of a school year so materials can be ordered and, if necessary, teachers can be trained. Replacing a curriculum during the school year also could be disruptive to students.

Because of all these factors, we expect that complete rejection of the study's curricula will be rare. Nevertheless, the possibility exists that some schools, or individual teachers within a school, will refuse to use their assigned curriculum or stop using it during the school year. Some districts (both inside and outside of the study) may find information based on these schools useful because they may want to know what effects to expect if they directed all of their schools to use a particular curriculum, taking into account that not all schools or individual teachers would implement it. Other districts, where the teachers would implement whatever curriculum was selected, may want to know what effects to expect when all teachers use the curriculum.

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[29] The impact of *offering* the curricula to schools is sometimes called the "intent to treat" impact. The impact of actually *using* the curricula is sometimes called the "treatment on the treated" impact.

[30] A student's experience can also depend on how teachers use their assigned curriculum. Teachers may use the curriculum throughout the implementation period but deviate from the developer-recommended implementation. In Section C of this chapter, we describe analyses that will be conducted to examine the relationship between teacher implementation and impacts. In the present section, we focus on the more extreme case in which teachers may completely reject their assigned curriculum.

1. Analytical Challenge of Estimating Effects from Actual Curriculum Usage

If some teachers do not use their assigned curriculum, a significant challenge in providing information about effects from actual usage is providing causal evidence. For example, it may not be appropriate to compare student achievement of the subgroup of teachers who used their assigned curriculum, because some of those teachers may have used their assigned curriculum only because (as luck would have it) they were assigned the curriculum they like. Put differently, if those teachers had been assigned a different curriculum, they might not have used it throughout the implementation period.

Consider, for example, a study that includes only two curricula in which some teachers do not use their assigned curriculum. When calculating the effects of curriculum 1 relative to curriculum 2, we will observe only two types of teachers: (1) those who used their assigned curriculum, and (2) those who did not. However, there are potentially four different groups of teachers in the study:

1. ***Group A:*** Those who will use whichever curriculum is assigned to them

2. ***Group B:*** Those who will only use curriculum 1

3. ***Group C:*** Those who will only use curriculum 2

4. ***Group D:*** Those who would not use either curriculum

To provide information useful to schools and teachers that would implement whatever curriculum was selected, the goal is to examine student achievement of teachers in Group A—those who would use whichever curriculum was assigned to them. However, it is difficult to identify these teachers. Among teachers assigned to curriculum 1, it is difficult to distinguish teachers in Group A from those in Group B (both of which used curriculum 1) or to distinguish teachers in Group C from those in Group D (both of which did not use curriculum 1). Similarly, among teachers assigned to curriculum 2, it is difficult to distinguish between teachers in Groups A and C, and those in Groups B and D.

2. Bounding the Effect from Actual Usage

We can calculate an upper and lower bound for the true impact that results from actual usage—that is, the impact that would be based on teachers in Group A, as defined above.[31] Information from the teacher surveys and classroom observations will be used to assess the number of teachers who used their assigned curriculum throughout the implementation period.

[31] Our approach to addressing non-compliance with curriculum assignment does not depend on the curriculum that the school or teacher uses in place of the assigned curriculum. For example, a school could revert to their original curriculum or switch to another curriculum, and in either case it could be a curriculum that is part of the study or one that is not part of the study. Our approach can be used in all of these cases.

To illustrate how the bounds are calculated, consider the example of a study that includes 25 schools assigned to curriculum 1, and 25 schools assigned to curriculum 2. Also, assume that all the teachers in one of the schools assigned to curriculum 1 refuse to use it, and all the teachers in the schools assigned to curriculum 2 use their assignment.

Because of random assignment, we can assume that the schools assigned to curricula 1 and 2 are identical (within a known degree of statistical precision) before using their assigned curriculum. This implies that there is 1 school assigned to Curriculum Two that, if assigned to Curriculum One, would have refused to use it. If we could identify that school, we could exclude it from the analysis and calculate impacts for the remaining 24 schools in each curriculum group. Since we cannot identify that school, an alternative approach is to calculate 25 separate impacts, where each impact is calculated by removing a different school from the group assigned to Curriculum Two. The largest of those 25 impacts is the upper bound, and the smallest is the lower bound. The true impact (that is, the impact we would calculate if we could identify the correct school to exclude) must lie between those two bounds.[32]

The appealing aspect of this approach is that the true impact lies between the upper and lower bounds. However, as the number of schools that refuse to use their assigned curriculum increases, calculating the bounds becomes more computationally demanding and the results can become less useful. Up to a point, it is possible for a computer to enumerate all possible combinations of exclusions of the type made in the example above. However, if enough schools refuse to use their assigned curriculum, the number of combinations may become too large to process. The results also can become less useful, because the difference between the upper and lower bounds can become too large to be meaningful. If this situation occurs, we can explore the feasibility of using a matching approach to identify teachers who are likely to be in Group A, thereby calculating a non-experimental estimate of impacts from actual usage. The matching approach will depend on the availability of baseline data that predict teacher compliance with their curriculum assignment. Without such data, matching will not be feasible.

[32] For this simple example, it is not actually necessary to calculate every possible impact. (Instead, we would only need to compute two impacts that bound the true impact. Each impact is based on the subtraction of two terms. The first term is the same for each impact and equals average student achievement of the 24 curriculum-1 schools that used their assignment. For the impact that represents the lower bound, the second term equals average achievement of the 24 curriculum-2 schools with the highest achievement; for the impact that represents the upper bound, the second term equals average achievement of the 24 curriculum-2 schools with the lowest achievement.) However, in more complex examples, it may be necessary to calculate a large number of possible impacts. For example, if non-compliers exist in both curriculum groups, it is not possible to identify which non-compliers are in Groups B/C or D. In that case, we need to calculate all possible impacts because the true impact will lie among those possibilities, and the largest and smallest possible impacts will bound the true impact.

C. EXAMINING CONDITIONS AND PRACTICES RELATED TO EFFECTIVENESS

The conditions in which the curricula are used, and the practices of the teachers who implement them, may vary considerably both in our study and more broadly in classrooms throughout the country. Given such diversity of conditions and practices, it is possible that a single math curriculum may not be appropriate in all settings—that is, one size may not fit all. For example, impacts may depend on the prior curriculum used at a school. In schools where implementing one of the study's curricula represents a substantial change from the curriculum that has been used thus far, making the change may be more difficult than it is for schools where the new curriculum is similar to the preexisting one. Because of the potential for variation in the relative effects of curricula, it may be valuable for teachers and principals to understand which curriculum appears most effective in different settings.

We will examine how conditions and practices are related to impacts. Conditions will be measured at baseline and generally at the school level, including student characteristics aggregated to the school level. Examining the relationship between impacts and school-level conditions may be more useful to administrators (than student-level conditions), because curricula are generally implemented schoolwide.[33] The exceptions are prior teacher education, experience, and knowledge of math content and pedagogy, which will be measured at the teacher level, because the way in which impacts vary with these teacher characteristics may be useful for professional development and hiring decisions.[34]

Practices will be measured after baseline and at the teacher level. Information about the way in which impacts vary with teacher practices could be useful to school districts for curriculum adoption decisions and to developers for establishing curriculum implementation guidelines.

Examples of the conditions and practices that can be examined include:

- ***Conditions.*** School math proficiency measured at baseline, the trajectory of school math proficiency before baseline, prior math curriculum used at the school, percentage of students eligible for free or reduced-price lunch, racial/ethnic composition of the school, and teacher education, experience, and knowledge of math content and pedagogy measured at baseline

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[33] For example, examining the relationship between impacts and free/reduced-price lunch participation measured at the student level may not be useful to a school administrator, because it would be challenging to use different curricula among students with different free/reduced-price lunch participation. Examining how impacts vary among schools with different fractions of students participating in free/reduced-price lunch may be more useful.

[34] Teacher knowledge will be assessed using a measure developed and pilot tested with support from NSF grants and a subcontract to the Consortium for Policy Research on an ED award. The measure includes closed-response items (multiple choice and true/false) that assess teacher knowledge of math content and knowledge of student learning of mathematics, both of which span kindergarten through fifth grade. The developers report reliability estimates of 0.82, derived from analyses employing methods from item response theory (Hill 2004).

- ***Practices.*** Time spent on math instruction, time spent preparing lessons, scales about curriculum implementation, breadth of math topics covered, use of other curricula as a supplement to the assigned curriculum, experiences with publisher-provided training and support

The study will use descriptive and regression analyses to examine how impacts are related to conditions and practices. The descriptive analysis will be used to identify conditions and practices that are candidates for regression analyses of impacts.[35] Details about the two types of analyses are described below.

Because the conditions are measured at baseline, they can be viewed as subgroup analyses for which causal evidence is supported by the study's experimental design, whereas the analysis about practices—which are measured after baseline—will provide correlational evidence. The challenge associated with providing causal evidence for the practices analysis is discussed at the end of the chapter.[36]

1. Descriptive Analyses

The study will use descriptive analyses to identify the conditions and practices that are suitable candidates for the regression analysis of impacts. For the conditions analysis, we will examine the variation of each condition across all schools in the study.[37] For example, it would be useful to examine how free/reduced-price lunch participation is related to impacts, provided that the level of participation varies across the study's schools. The number of schools at each level of free/reduced-price lunch participation also will be examined, to ensure that a sufficient number of schools can be placed in at least two groups with different levels of participation that can be analyzed.

For the practices analysis, we will examine average values of the practices among schools assigned to each of the four curricula. Specifically, we will examine tables of statistics, where the columns of the table will correspond to the curricula, the rows will correspond to practices, and the cells will report the average practice for each curriculum. These tables will include cross-curriculum implementation measures because they can be defined consistently across the study's curricula. Practices that vary across the curricula would be suitable candidates for the regression analysis of impacts. Practices that vary also

[35] Before any of the measures about teacher practice are included in an analysis, we will first assess the validity of the measures by examining their relationship with student achievement. These analyses will be conducted separately for each of the curricula, to avoid the potential confound of any curriculum effects with relationships between the measures and student achievement.

[36] If we find any statistically significant relationships between conditions/practices and impacts, we will examine the sensitivity of those findings when adjusting the statistical tests for all the conditions and practices that were examined.

[37] It is not necessary to examine the variation of each condition across curriculum groups, because random assignment provides groups that are similar to each other (within a known degree of statistical precision).

would provide evidence that the curricula had an effect on those practices, and, because the curricula were randomly assigned to schools, the evidence would be causal.

2. Regression Analyses

The regression analyses of impacts will examine the following questions:

- ***Given a set of conditions, which curricula appear most effective?*** For example, do some curricula appear to be more effective in schools with low baseline math proficiency? Are impacts related to teacher knowledge of math content and pedagogy?

- ***Does the relationship between teacher practices and student achievement differ across the curricula?*** For example, does the relationship between time spent on math instruction and student achievement differ across the curricula? Does the relationship between scales about curriculum implementation and student achievement differ across the curricula?

One approach will be used for the analysis about conditions and another for the analysis about practices. The conditions analysis relates block-level impacts computed as part of the main impact analysis, with block-level conditions. The practices analysis calculates the relationship between teacher practices and student achievement separately for each curriculum group, and then compares those relationships across curriculum groups.

a. Relating Block-Level Conditions to Block-Level Impacts

The approach for examining conditions draws on the design of the experiment. Each block in the study can be regarded as a mini-experiment with its own set of impacts, so block-level impacts can be compared to block-level conditions. For example, we can calculate the achievement effect of curriculum 1 relative to curriculum 2 for each block, and examine the relationship between these impacts and average baseline math achievement of the schools in each block.[38]

In equation form, this approach models the relative curriculum impacts, δ_{Td} shown earlier in equation (3), as an effect that varies across blocks, where blocks are indexed by *d*. These block-specific effects are expressed as a linear function of block-level conditions, by adding a fourth equation to the model:

$$(4) \qquad \delta_{Td} = \lambda_{T0} + \lambda_{T1} C_d + \tau_{Td},$$

[38] Prior to conducting this analysis, we will test whether variation in impacts across blocks is statistically significant, using tests described in Lipsey and Wilson (2001) and in Bryk and Raudenbusch (1992). If the variation in impacts across blocks is not significant, we would not expect to be able to explain that variation using characteristics of the blocks.

where C_d represents conditions in block d, τ_{Td} represents unexplained variation in block-level impacts, T ranges from 1 to 4, and λ_{T0} and λ_{T1} are parameters to be estimated. After incorporating this additional level into the model, the combined model becomes:

(Combined Model with block-level conditions)

$$Y_{ijkd} = \lambda_{10} + \lambda_{11}C_d + \tau_{1d} + \sum_{T=2}^{4}\left(\lambda_{T0} + \lambda_{T1}C_d + \tau_{Td}\right)\cdot T_{kd} + \nu_{kd} + \mu_{jkd} + \varepsilon_{ijkd}.$$ [39]

This approach is better suited to examining conditions that were used to form the blocks, because there will be less within-block variation for those conditions. If this approach was used with conditions that were not used to form the blocks, the results could mask any within-block variation that exists among the conditions. For example, consider examining average teacher knowledge at the school level—a condition that was not used to form the blocks because random assignment had to be conducted before the study could measure teacher knowledge. A block that has four schools, where teachers at two of the schools received high scores on the knowledge assessment and teachers at the other two schools received low scores, would appear to be the same as a block in which teachers at all four schools received average scores.

This approach also is more useful for examining conditions that can be analyzed independently of other conditions. Relatively uncorrelated conditions are better candidates for inclusion in the analysis, because it will be possible to more reliably estimate their relationships with impacts. For example, the racial/ethnic composition of schools may be highly correlated with poverty level (as measured by the proportion of students receiving free/reduced-price lunch). Because the analysis will be based on only a small number of blocks (approximately 25), including both conditions in the analysis may result in imprecise estimates. Put differently, if impacts vary by racial/ethnic composition and by poverty level, we may not be able to examine how each of these conditions is related to impacts, while taking into account the other condition. The small number of blocks that can be used to test these hypotheses also means that the analysis will have limited statistical power.

b. A Correlational Look at Teacher Practices and Impacts

The approach for examining practices calculates the relationship between student achievement and teacher practices separately for each curriculum group, and then compares those relationships across the groups. For example, we can estimate the relationship between student achievement and the time teachers spend preparing lessons in each

[39] With fewer than eight schools per block, we will not be able to separately estimate all the variance components in this equation. In particular, school-level variance components cannot be completely separated from block-level components. One way to express this in equation form is to remove the school level from the model, place the curriculum indicators at the classroom level, and treat impacts as random coefficients that vary at the block level. For ease of exposition, we continue to include a school level. This technical issue will not affect our ability to accurately calculate any of the statistics of interest to the study.

curriculum group. We can then test to see if this relationship differs between curriculum groups. Such a comparison would indicate whether the amount of time teachers spend preparing lessons is more important for one curriculum than for another.

This approach can also be used to conduct a more refined examination of the relationship between student achievement and prior teacher education, experience, and knowledge of math content and pedagogy. Because this approach takes advantage of within-school variation in teacher knowledge, it will be better able to detect a relationship between these teacher characteristics and student achievement than the block-level analysis described above.

The approach is operationalized by adding to the "combined model with block-level conditions" above a term that interacts practices, *P*, and curriculum assignment, *T*. The measure of practices may be a continuous scale of several related practices, or it may be a binary indicator of a specific practice. This is accomplished by first adding a term representing classroom practices to equation 2 shown earlier:

$$(5) \qquad \alpha_{0jkd} = \beta_{0kd} + \beta_{1kd} P_{jkd} + \mu_{jkd} \,,$$

where β_{1kd} (the only new parameter in the equation) represents the relationship between student achievement and teacher practices. We can examine how this relationship varies across curriculum groups by adding a new equation to the model that expresses β_{1kd} as a linear function of curriculum group assignments:

$$(6) \qquad \beta_{1kd} = \phi_{1d} + \sum_{T=2}^{4} \phi_{Td} T_{kd} + \omega_d \,,$$

where ϕ_{Td} indicates how the relationship between student achievement and teacher practices varies across curricula.

This analysis is based on measures of practices that can be defined consistently across the curricula, though we can also explore whether some curriculum-specific measures of fidelity are related to impacts. The cross-curriculum measures of implementation may not capture some important aspects of implementation that the curriculum-specific measures of fidelity capture. We can explore whether curriculum-specific measures can be included in the analysis to address this potential issue. For example, we can transform curriculum-specific implementation measures into a percentile rank and then analyze the percentile rank as we would analyze any other measure in the model.

Because many explanations may exist for the patterns we observe, we will interpret the results from the practices analysis carefully. Curriculum usage may be related to decisions made by teachers after implementation began and may be related to student achievement observed by teachers during the school year.[40] For these reasons, the practices analysis is best viewed as an exploratory analysis that may raise interesting questions which could be explored by other studies designed to provide rigorous evidence about the influence of practices on curriculum effectiveness.

[40] Baron and Kenny (1986) provide more details about the challenge of provide causal evidence of the influence of practices, when confronted with the possibility that the outcome measure (student achievement) causes changes in practices.

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Appendix A

Technical Working Group Members

Richard Askey
University of Wisconsin-Madison
Department of Mathematics
480 Lincoln Drive
Madison, WI 53706
(608) 263-7901, (608) 263-3053
askey@math.wisc.edu

Douglas Clements
University at Buffalo,
The State University of New York
Graduate School of Education
572 Baldy Hall
Buffalo, NY 14260
(716) 645-2455 ext. 1124
clements@buffalo.edu

Thomas D. Cook
Northwestern University
Institute for Policy Research
2040 Sheridan Road
Evanston, IL 60208
Telephone: (847) 491-3776
Fax: (847) 491-9916
tcook@northwestern.edu

Lynn Fuchs
Peabody College of Vanderbilt
Peabody # 328
230 Appleton Place
Nashville, TN 37203-5721
(615) 343-4782
lynn.fuchs@vanderbilt.edu

Tom Loveless
The Brookings Institution,
1775 Massachusetts Ave., NW
Washington, DC 20036
(202) 797-6426
tloveless@brookings.edu

Kevin F. Miller
University of Michigan, School of Education
Combined Program in Education and Psychology
610 East University Avenue, Room 1418
Ann Arbor, Michigan 48109-1259
(734) 647-0626
kevinmil@umich.edu

Don Rock
9357 Blind Pass Road, #503
St. Pete Beach, FL 33706
(727) 363-3717
DonaldR706@aol.com

Hung-Hsi Wu
University of California
Department of Mathematics #3840
Berkeley, CA, 94720-3840
(510) 642-2071
wu@berkeley.edu

Appendix B

Data Collection Forms

Protocol for Observing Initial Teacher Training

EVALUATION OF MATHEMATICS CURRICULA

PROFESSIONAL DEVELOPMENT OBSERVATION PROTOCOL

GENERAL INSTRUCTIONS

Reminders:

- Please collect an agenda and all handouts
- Submit agenda, handouts, field notes and completed protocol to:

Section A: Field Notes

This section is used to keep field notes on each topic area covered in the training, such as the research supporting the curriculum, curricular structure, instructional techniques, mathematical content, lesson protocol, pacing, and teachers' questions/concerns. Remember to record the format of the training (e.g., lecture, demonstration, discussion) as well.

Note: Please take time to attend to and describe any content of the training related to the items under Section B *Content of Training*. These are activities that you will be asked to code for from your field notes following the trainings.

Field notes can be kept in a format unique to the observer; however, an example format is included. You may use this form or construct your own. Handwritten or electronic versions are acceptable. If submitting handwritten notes, please write legibly. Please take notes on all days of the training. Indicate the topic and the amount time for each topic.

[**Note for laptop users:** You can insert your notes directly into the tables included under Section A. Use one table row per note. Rows will expand in height as additional lines of text are inserted. Add rows to the table for each day, as required.]

Section B: Content of Training

This section is to get a snapshot of important instructional activities covered in the training. Use your field notes to help complete this section accurately. For each instructional activity, indicate how much time (not covered, less than 30 minutes, 30 minutes of more) if any. For trainings that last more than 1 day, only one summary form for the entire training is needed (not one for each day).

Any item checked as being covered during the training should be supported in your field notes with a description of the activity.

Note on items 6, 7, 8, and 9: Only check these items as being covered if the trainer actually spends time teaching the teachers on how to differentiate instruction, respond to student errors or use the assessments. For example, if a facilitator does not instruct participants on how to implement differentiated instruction for English Language Learners, but instead only shows teacher where to find the curriculum resource material for English Language Learners or suggests that teachers review the material, then the observer must mark "Not Covered" for item 6, regardless of how much time is spent on this activity.

Section C: Participant Concerns and Overall Appraisal

In this section you are asked to:

1. Record concerns that participants raise related to either the general approach of the curriculum or implementation of the curriculum. Having a record of participants' concerns will support the development of other protocols and inform the research team about potential issues that might impact implementation fidelity during the study.
2. Provide your overall appraisal of the training. It might be helpful to review your field notes (section A) and the content of the training (section B) to provide a basis for your overall appraisal of this training. We would like you to comment on how well you think the training went, how effective the facilitators were, and how engaged the teachers were. You may comment on any overall observations you had about the training as well.

Training Information

Curriculum:____

Location of Training:____

Date(s) of Training:____

Observer:____

Start Time: ___________________ End Time: __________________________

Length of Training (hours/minutes): ______________________________________

SECTION A: FIELD NOTES

[**Note for laptop users:** Use one table row per note. Rows will expand in height as additional lines of text are inserted. Add rows to the table for each day, as required.]

OBSERVATION – DAY 1

Topic	Notes	Starting/ Ending Times

OBSERVATION – DAY 2

Topic	Notes	Starting/ Ending Times

SECTION B: CONTENT OF TRAINING

* Please read note on items 6-9 under *General Instructions*.

		Coverage		
		Not Covered	Covered Briefly (Less than 30 Minutes)	Extended Coverage (30 Minutes or More)
1.	Facilitator models or role plays instructional activities			
2.	Participants practice key instructional activities in the role of the teacher			
3.	Participants practice key instructional activities in the role of the students			
4.	Participants watch a video of key instructional activities			
5.	Participants plan actual lessons			
6.	Facilitator instructs participants on how to differentiate instruction for English Language Learners			
7.	Facilitator instructs participants on how to differentiate instruction for students with different abilities, including special education			
8.	Facilitator instructs participants on how to address incorrect student responses			
9.	Facilitator instructs participants on the use of curriculum assessments			
10.	Facilitator reviews actual math content covered in the curriculum (e.g., *What is an ordinal number?*; Does NOT include a listing of math topics covered i.e., scope and sequence).			
11.	Facilitator provides overview of research supporting the curriculum			

SECTION C: PARTICIPANT CONCERNS AND OVERALL APPRAISAL

During the training, what concerns and issues did participants raise related to the general approach of the curriculum or implementing the curriculum?

Please provide your overall appraisal of the training below. It might be helpful to review your field notes (section B) and the content of the training (section A) to provide a basis for your overall appraisal of this training. We would like you to comment on how well you think the training went, how effective the facilitators were, and how engaged the teachers were.

Fall (Baseline) Teacher Survey

FALL 2006 TEACHER SURVEY

NATIONAL EVALUATION OF ELEMENTARY MATHEMATICS CURRICULA

U.S. DEPARTMENT OF EDUCATION

TEACHERS: IF ABOVE INFORMATION IS INCORRECT, PLEASE MAKE CORRECTIONS DIRECTLY ON LABEL

Please return the completed form to:	If you have questions, please contact:

This survey is authorized by the U.S. Department of Education (P.L. 20 U.S.C. 1221e-1) and the Confidential Information Protection and Statistical Efficiency Act of 2002. These laws require that the survey sponsor treat all information you provide as confidential. The information you provide will be used only for research and statistical purposes by the survey sponsor, its contractors, and collaborating researchers for the purpose of analyzing data and preparing scientific reports and articles. Any information publicly released (such as statistical summaries) will be in a form that does not personally identify you. Your response is voluntary. According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless such collection displays a valid OMB number. The OMB control number for this survey is 1850-0813. The time required to complete this survey is estimated to average 20-25 minutes per response. If you have any comments concerning the accuracy of the time estimate or suggestions for improving this form, please write to: U.S. Department of Education, Washington, DC 20202-4651. If you have comments or concerns about the content of this questionnaire, contact Sheila Heaviside (phone: 866-869-3187, e-mail: sheaviside@mathematica-mpr.com).

OMB NO: 1850-0813
EXPIRATION DATE: 09/30/2008

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INSTRUCTIONS

Many of the questions on this survey ask for information about the **assigned curriculum**. This refers to the math curriculum you were assigned to use this year as a participant in the *Evaluation of Elementary Mathematics Curricula*.

Some of the questions on this survey ask for information about your **target class**.

- If you teach math to one class or one group of first-grade students, this is your target class.

- If you teach math to more than one class or to multiple groups of first-grade students, please answer questions about your target class for ONE of these classes. You will be mailed additional forms that allow you to provide class-specific information for your other first-grade math classes.

This survey is designed to collect information from teachers who provide either primary math instruction or supplemental math instruction (e.g., as a resource teacher or as someone who works with English language learners, students with special learning needs, etc.) to first-grade students.

IMPORTANT NOTE:
Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.
Sample: ☒ Right ☑ Wrong
Use block printing when you complete any text or numeric responses. If you wish to change a response, please mark the correct response and CIRCLE it.

YOUR ROLE IN MATH INSTRUCTION

1. Do you teach math to first-grade students at this school?

☐ Yes

☐ No → If you do not teach math to first-grade students, you do not need to complete this survey. Please describe your duties at the school or district, and return the survey in the enclosed envelope.

2. Which of the following best describes your role at this school? *Mark (X) only one box.*

☐ Regular classroom teacher → SKIP to Question 4

☐ Resource or special education teacher who provides primary math instruction → SKIP to Question 4

☐ Resource or special education teacher who provides supplemental math instruction

☐ English language learner (ELL) teacher

☐ Teacher's aide

☐ Student teacher

☐ Other → Please specify:

3. If you provide supplemental math instruction to first-grade students, list the different teachers of the students with whom you work, and indicate the number of first-grade students you work with from each teacher's class.

	Regular classroom teacher	Number of first-grade students
Name		
Name		
Name		
Name		
Name		

If you work with first-graders from more than five classrooms, please mark (X) this box: ☐

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CURRICULUM TRAINING AND RESOURCES FOR TEACHING MATH

4. Did you participate in the initial training on how to use the assigned math curriculum?

☐ Yes

☐ No → SKIP to Question 6a

5. Overall, how well did the initial training and/or support you received from the publisher prepare you to use the assigned curriculum with your students? *Mark (X) only one box.*

☐ Very well

☐ Adequately

☐ Somewhat

☐ Not at all

6a. Since the start of this school year, has any follow-up training or on-site support from the publisher of the assigned curriculum been available to assist you in teaching math?

☐ Yes

☐ No → SKIP to Question 7

☐ Don't know → SKIP to Question 7

6b. Since the start of this school year, have you participated in follow-up training or on-site support from the publisher of the assigned curriculum?

☐ Yes

☐ No → SKIP to Question 7

6c. Since the start of this school year, how many hours have you spent participating in follow-up training or on-site support from the publisher of the assigned curriculum?

☐☐☐ hours

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7. To what extent are the following materials from the assigned curriculum available for your use in teaching math? Please choose the answer that best describes the extent to which you have access to these materials. *Mark (X) one box for each row.*

	NOT APPLICABLE - The curriculum does not have such materials	Materials are not available	Materials are dedicated for use with my students only	Materials are shared with other teachers at my school
a. Teaching guide or teacher's manual	NA ☐	☐	☐	☐
b. Student textbooks, workbooks, or worksheets	NA ☐	☐	☐	☐
c. Manipulatives	NA ☐	☐	☐	☐
d. Supplemental student materials recommended by the publisher (math literature, calculators, etc.)	NA ☐	☐	☐	☐
e. Supplemental classroom materials recommended by the publisher (number line, calendar, etc.)	NA ☐	☐	☐	☐

PRIOR PROFESSIONAL DEVELOPMENT IN MATH

8. During the 12 months prior to the start of this school year (2006-07), have you participated in any professional development activities on the following math topics that were NOT provided by the publisher of the assigned curriculum (COLUMN A)? If yes, how many hours did you spend on these activities (COLUMN B)? Include courses you have taken for recertification or advanced certification, workshops sponsored by your school or district, conferences, or other training that is relevant to your teaching of math.

For each row, mark (X) one box in Column A. If you answer "Yes," then mark (X) one box in Column B for that row.

Professional development topic	COLUMN A: Participation		COLUMN B: Number of hours of participation: 8 or fewer	9-16	17-32	33-40	More than 40
a. Math instruction	Yes ☐	No ☐	☐	☐	☐	☐	☐
b. Math content	Yes ☐	No ☐	☐	☐	☐	☐	☐
c. Performance standards in math education	Yes ☐	No ☐	☐	☐	☐	☐	☐
d. Other math-focused professional development	Yes ☐	No ☐	☐	☐	☐	☐	☐

9. During the 12 months <u>prior</u> to the start of <u>this</u> school year (2006-07), what were the sources of your professional development in math? *Mark (X) all that apply.*

- ☐ Workshops or training provided by your school or district
- ☐ Coursework taken toward a credential for teaching
- ☐ University coursework in math or math instruction, not including coursework for a credential
- ☐ Activities such as conferences or working groups about math
- ☐ Meeting with colleagues on a regular basis about math (e.g., to discuss instructional approaches, assessment, etc.)
- ☐ Other → Please specify: ______
- ☐ Did not participate in professional development in math

PREPARATION FOR MATH INSTRUCTION

10. How well prepared are you to do the following during math instruction, based on your experience, education, and training? *Mark (X) one box for each row.*

	Not prepared	Somewhat prepared	Adequately prepared	Very well prepared
a. Demonstrate mathematical concepts and procedures to students.	☐	☐	☐	☐
b. Respond to students' mathematical errors.	☐	☐	☐	☐
c. Prompt students to explore a concept or procedure, before it is first demonstrated.	☐	☐	☐	☐
d. Prompt students to demonstrate a procedure or explain a concept to other students.	☐	☐	☐	☐
e. Teach a class in which students use manipulatives.	☐	☐	☐	☐
f. Teach a class in which small groups of students work on collaborative activities.	☐	☐	☐	☐
g. Differentiate instruction for individual students or small groups.	☐	☐	☐	☐
h. Allow students to practice math facts using manipulatives, pictures, or diagrams.	☐	☐	☐	☐

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11. In this item, we are interested in the types of discussions you are prepared to facilitate during math instruction. Please indicate how well prepared you are to do the following, based on your experience, education, and training. *Mark (X) one box for each row.*

	Not prepared	Somewhat prepared	Adequately prepared	Very well prepared
a. Facilitate discussions that allow students to explain their answers.	☐	☐	☐	☐
b. Facilitate discussions that enable students to offer or share multiple approaches to solving a problem.	☐	☐	☐	☐
c. Facilitate discussions that enable students to raise mathematical questions and/or discuss mathematical concepts.	☐	☐	☐	☐
d. Facilitate discussions that encourage students to reference other students' ideas in their comments.	☐	☐	☐	☐

12. Please read the options below. Indicate which <u>best</u> describes your role as a math instructor, and follow the instructions associated with that response.
Mark (X) only one box.

☐ I am a teacher or aide who <u>is responsible for providing regular math instruction</u> to <u>one</u> target class. → Proceed to Question 13

☐ I am a teacher or aide who <u>is responsible for providing regular math instruction</u> to <u>more than one</u> target class. → Proceed to Question 13, AND answer questions about your target class with one of these classes in mind. You will be mailed additional forms that allow you to provide information for Questions 13-22c, 25, and 26 for each of your target classes separately.

☐ I am a teacher or aide who <u>provides supplemental math instruction</u> to students in one or more target classes. (This includes resource teachers and those who work with English language learners, students with special learning needs, etc..)
→ SKIP to Question 29

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MATH INSTRUCTION IN YOUR TARGET CLASS

13. Which of the following best describes the grade(s) you teach in your target class? If you teach more than one target class, please think of ONE of these classes.
Mark (X) only one box.

☐ Kindergarten and Grade 1
☐ Grade 1 only
☐ Grade 1 and Grade 2
☐ Other → Please specify: ______

14. How many first-grade students are currently enrolled in your target class? If you teach more than one target class, please also specify on the line provided the name of the class you are considering your target class on this survey (e.g., Period 1 math, or Mrs. Tanaka's class).

☐☐ first-grade students   Name of target class: ______

15. Approximately how many first-grade students in your target class are:

High math achievers ☐☐

Average math achievers ☐☐

Low math achievers ☐☐

16. Approximately how many first-grade students in your target class have an Individualized Education Plan (IEP)?

Students with an IEP ☐☐

17. Approximately how many first-grade students in your target class are:

Limited English proficient ☐☐

English proficient or native English speakers ☐☐

18. On average, how many minutes per week do you spend preparing to teach math to your target class, using the assigned curriculum (including lesson planning, grading student work, etc.)?

☐☐☐ minutes per week

19. On average, how many days per week do you teach math to your target class?

☐ days per week

20. For approximately how many minutes each day do you teach math to your target class (on the days that you teach math)?

☐☐☐ minutes per week (on the days you teach math)

21a. Are you using the assigned curriculum as your core math curriculum?

☐ Yes

☐ No → If no, please specify the name/publisher of your core curriculum and PROCEED to Question 21b

21b. If you are not using the assigned curriculum as your core math curriculum, please explain why:

22a. Do you use other math curricula in addition to the core curriculum with your target class? This can include materials that are teacher-created or not-yet-published.

☐ No → SKIP to Question 23a

☐ Yes → Please specify the name(s) and publisher(s) of the curricula:

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22b. For what purpose(s) are the curricula specified in Question 22a being used with your target class? *Mark (X) all that apply.*

☐ Remediation with a small group of students

☐ Remediation with the entire class

☐ Enrichment with a small group of students

☐ Enrichment with the entire class

☐ As a replacement for selected units or lessons in the assigned curriculum

☐ As a supplement to units or lessons in the assigned curriculum

☐ Other → Please specify:

22c. How often do you supplement the core curriculum with materials or math problems from other sources? *Mark (X) only one box.*

☐ Almost daily

☐ Once or twice a week

☐ Once or twice a month

☐ Less than once a month

☐ Never

23a. Have you used the curriculum assigned to you by the study in a primary grade (K-3) prior to this school year?

☐ Yes

☐ No

23b. If you taught math in a primary grade (K-3) last year (in 2005-06), please indicate the math curriculum you used. *Mark (X) only one box.*

☐ I did NOT teach math in a primary grade (K-3) last year → SKIP to Question 24a

☐ I used the following math curriculum last year (please specify the name and publisher of the curriculum). If you used more than one curriculum last year, please list them in order of most used to least used:

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23c. **Please indicate the approximate number of years that you used the curriculum listed first in Question 23b.**

☐☐ years

YOUR SCHOOL'S INSTRUCTIONAL CLIMATE

24a. **Is there a school math coach or district specialist available to assist you in teaching math?** *Mark (X) only one box.*

☐ Yes

☐ No → SKIP to Question 25

☐ Don't know → SKIP to Question 25

24b. **How accessible to you is the school math coach or district specialist?** *Mark (X) only one box.*

☐	☐	☐	☐	☐
Not at all	Rarely	Sometimes	Almost always	Don't know

24c. **Is the school math coach or district specialist knowledgeable about the assigned curriculum you are using?** *Mark (X) only one box.*

☐ Yes

☐ No

☐ Don't know

25. **Is there another teacher (such as a math resource teacher, special education teacher, or English language learner teacher) who routinely assists in teaching math to your target class?**

☐ Yes

☐ No

26. **Is there another adult (such as an aide, assistant, or volunteer) who routinely assists you when you are teaching math to your target class?**

☐ Yes

☐ No

27. This question concerns how teachers interact in your school. Please indicate about how many teachers in your school do each of the following. *Mark (X) one box for each row.*

	No teachers	Some teachers	Most teachers	All teachers	Don't know
a. Work together to develop curriculum and instructional materials	☐	☐	☐	☐	☐
b. Observe each other teaching	☐	☐	☐	☐	☐
c. Offer advice or help to each other	☐	☐	☐	☐	☐
d. Share ideas on teaching	☐	☐	☐	☐	☐
e. Promote new or innovative teaching practices	☐	☐	☐	☐	☐

28. Consider the conditions for teaching math in your school. Indicate how strongly you agree or disagree with the following statements. For questions that ask about teachers, please think about all other teachers at your school. *Mark (X) one box for each row.*

	Strongly disagree	Disagree	Agree	Strongly agree
a. I feel supported by other teachers to try out new ideas in teaching math.	☐	☐	☐	☐
b. Administrators at this school promote innovations in math education.	☐	☐	☐	☐
c. Teachers in this school regularly share ideas about math instruction.	☐	☐	☐	☐
d. There is a lot of disagreement among teachers about how to teach math.	☐	☐	☐	☐
e. I regularly work with other teacher(s) at my school on math curriculum and instruction.	☐	☐	☐	☐
f. A specialist in math education regularly works with teachers in this school.	☐	☐	☐	☐
g. Most curriculum changes introduced at this school gain little support among teachers.	☐	☐	☐	☐

APPROACHES TO TEACHING MATH

29. Please indicate how strongly you agree or disagree with the following general statements about teaching math. *Mark (X) one box for each row.*

	Strongly disagree	Disagree	Agree	Strongly agree
a. Whenever students ask how to solve a math problem, teachers should provide a thorough explanation.	☐	☐	☐	☐
b. Formative assessments are an important means of documenting students' learning (e.g., observations of student work to gauge student progress).	☐	☐	☐	☐
c. It is important that students *not* have mathematical misconceptions at the end of a lesson.	☐	☐	☐	☐
d. Students learn from one another when they work together on math problems.	☐	☐	☐	☐
e. Students should demonstrate mastery of one math concept before proceeding to the next concept.	☐	☐	☐	☐
f. Students learn math best when they share their reasoning about a math problem with other students.	☐	☐	☐	☐
g. It is important that teachers observe and listen to how students think about math.	☐	☐	☐	☐
h. A math concept is learned best if it grounded in real life when it is first introduced.	☐	☐	☐	☐
i. Teachers should emphasize computational skills.	☐	☐	☐	☐
j. Teachers should clearly model to students how to solve a type of problem they have never seen before.	☐	☐	☐	☐
k. Students should primarily work individually in math to ensure that they master skills and are able to work on their own.	☐	☐	☐	☐

YOUR BACKGROUND

30. Including the 2006-07 academic year, how many years have you worked <u>full-time</u> as a teacher? If you have not taught full-time, please enter "00."

Total years ☐☐

Years in primary grades (K-3) ☐☐

Years at your present school ☐☐

31a. Which of the following describes the teaching certificate you currently hold in this state? *Mark (X) only one box.*

- ☐ Regular or standard state certificate or advanced professional certificate
- ☐ Probationary certificate (the initial certificate issued after satisfying all requirements except the completion of a probationary period)
- ☐ Provisional or other type given to persons who are still participating in an "alternative certification program"
- ☐ Temporary certificate (requires some additional college coursework and/or student teaching before regular certification can be obtained)
- ☐ Emergency certicate or waiver (issued to teachers who do not have regular certification who need to complete a regular certification program in order to continue teacher)
- ☐ I do not have any of the above certifications in this state → SKIP to Question 32a

31b. In what content area does the teaching certificate specified in Question 31a allow you to teach in this state? For some teachers, the content area may be the grade level (elementary general, secondary general, etc.).

Record the 4-digit code and content area from Table 1 on page 15.

Code ☐☐☐☐ Content area: ☐

31c. To which of the following grade ranges does the teaching certificate specified in Question 31a apply? If the teaching certificate applies to grades K-12, please select both "Elementary grades" and "Secondary grades." *Mark (X) all that apply.*

- ☐ Elementary grades (may include early childhood, preschool, and/or kindergarten)
- ☐ Secondary grades (may include middle school)
- ☐ Ungraded

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Table 1
Certification Content Area Codes

Elementary Education
4101 Early childhood/Pre-K, general
4102 Elementary grades, general

Secondary Education
4103 Middle grades, general
4104 Secondary grades, general

K-12 Education
4105 Grades K-12, general

Special Education
4111 Special education, general
4112 Autism
4113 Deaf and hard-of-hearing
4114 Developmentally delayed
4115 Early childhood special education
4116 Emotionally disturbed or behavior disorders
4117 Learning disabilities
4118 Mentally retarded
4119 Mildly/Moderately disabled
4120 Orthopedically impaired
4121 Severely/Profoundly disabled
4122 Speech/Language impaired
4123 Traumatically brain-injured
4124 Visually impaired
4125 Other special education

Arts & Music
4141 Art/Arts or crafts
4143 Dance
4144 Drama/Theater
4145 Music

English and Language Arts
4151 Communications
4152 Composition
4153 English
4154 Journalism
4155 Language arts
4156 Reading
4157 Speech

English as a Second Language
4160 ESL/Bilingual education: General
4161 ESL/Bilingual education: Spanish
4162 ESL/Bilingual education: Other languages

Foreign Languages
4171 French
4172 German
4173 Latin
4174 Spanish
4175 Other foreign language

Health Education
4181 Health education
4182 Physical education

Mathematics and Computer Science
4190 Mathematics
4197 Computer science

Natural Sciences
4210 Science, general
4211 Biology/Life sciences
4212 Chemistry
4213 Earth sciences
4216 Physical science
4217 Physics
4218 Other natural sciences

Social Sciences
4220 Social studies, general
4221 Anthropology
4225 Economics
4226 Geography
4227 Government/Civics
4228 History
4231 Native American studies
4233 Psychology
4234 Sociology
4235 Other social sciences

Vocational/Technical Education
4241 Agriculture and natural resources
4242 Business/Office
4243 Keyboarding
4244 Marketing and distribution
4245 Health occupations
4246 Construction trades
4247 Mechanics and repair
4248 Drafting/Graphics/Printing
4249 Metals/Woods/Plastics, and other precision production (electronics, leatherwork, meatcutting, etc.)
4250 Communications and other technologies (not including computer science)
4251 Culinary arts/Hospitality
4252 Child care and education
4253 Personal and other services (including cosmetology, custodial services, clothing and textiles, and interior design)
4254 Family and consumer sciences education
4255 Industrial arts/Technology education
4256 Other vocational/technical education

Miscellaneous
4262 Driver education
4263 Humanities/Liberal studies
4264 Library/Information science
4265 Military science/ROTC
4266 Philosophy
4267 Religious studies/Theology/Divinity

Other
4268 Other

32a. Do you have a bachelor's degree?

☐ Yes

☐ No → SKIP to Question 38

32b. In what year did you receive your bachelor's degree? ☐☐☐☐

32c. What was your major field of study? *Record the major code and name from Table 2 on page 17.*

Code ☐☐☐ Major field: ________

33a. Did you have a second major field of study?

☐ Yes

☐ No → SKIP to Question 34a

33b. What was your second major field of study? *Record the major code and name from Table 2 on page 17.*

Code ☐☐☐ Major field: ________

34a. Do you have a master's degree?

☐ Yes

☐ No → SKIP to Question 35a

34b. In what year did you receive your master's degree? ☐☐☐☐

34c. What was your major field of study? *Record the major code and name from Table 2 on page 17.*

Code ☐☐☐ Major field: ________

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Table 2
Major Field of Study Codes

Elementary Education
101 Early childhood/Pre-K, general
102 Elementary grades, general

Secondary Education
103 Middle grades, general
104 Secondary grades, general

K-12 Education
105 Grades K-12, general

Special Education
106 Special education, any

Other Education
131 Administration
132 Counseling and guidance
133 Educational psychology
134 Policy studies
135 School psychology
136 Other non-subject-matter-specific education

Arts & Music
141 Visual art
142 Dance
143 Drama/Theater
144 Music

English and Language Arts
151 Communications
152 Composition
153 English
154 Journalism
155 Language arts
156 Reading
157 Speech

English as a Second Language
160 ESL/Bilingual education: General
161 ESL/Bilingual education: Spanish
162 ESL/Bilingual education: Other languages

Foreign Languages
171 French
172 German
173 Latin
174 Spanish
175 Other foreign language

Health Education
181 Health education
182 Physical education

Mathematics and Computer Science
190 Mathematics
191 Computer science

Natural Sciences
211 Biology/Life sciences
212 Chemistry
213 Earth sciences
214 Engineering
215 Physics
216 Other

Social Sciences
221 Anthropology
222 Area/Ethnic studies (excluding Native American studies)
223 Criminal justice
224 Cultural studies
225 Economics
226 Geography
227 Government/Civics
228 History
229 International studies
230 Law
231 Native American studies
232 Political science
233 Psychology
234 Sociology
235 Other social science

Vocational/Technical Education
241 Agriculture and natural resources
242 Business/Office
243 Keyboarding
244 Marketing and distribution
245 Health occupations
246 Construction trades
247 Mechanics and repair
248 Drafting/Graphics/Printing
249 Metals/Woods/Plastics, and other precision production (electronics, leatherwork, meatcutting, etc.)
250 Communications and other technologies (not including computer science)
251 Culinary arts/Hospitality
252 Child care and education
253 Personal and other services (including cosmetology, custodial services, clothing and textiles, and interior design)
254 Family and consumer sciences education
255 Industrial arts/Technology education
256 Other vocational/technical education

Miscellaneous
261 Architecture
262 Humanities/Liberal studies
263 Library/Information science
264 Military science/ROTC
265 Philosophy
266 Religious studies/Theology/Divinity

Other
268 Other

35a. Have you earned any of the degrees listed below in Question 35b?

☐ Yes

☐ No → SKIP to Question 36

35b. Please indicate your major field(s) of study and the year in which your degree was received. *Record the major code and name from Table 2 on page 17.*

Degree:	Code for major field of study	Major field of study	Year received
a. Second bachelor's degree	Code ☐☐☐		☐☐☐☐
b. Second master's degree	Code ☐☐☐		☐☐☐☐
c. Educational specialist or professional diploma (at least one year beyond a master's degree)	Code ☐☐☐		☐☐☐☐
d. Certificate of Advanced Graduate Studies	Code ☐☐☐		☐☐☐☐
e. Doctorate (Ph.D. or Ed.D.)	Code ☐☐☐		☐☐☐☐

36. As part of either your undergraduate or graduate coursework, how many <u>advanced math</u> courses did you take (such as trigonometry, calculus, or statistics)? *Mark (X) only one box.*

☐ None

☐ 1 or 2 courses

☐ 3 or 4 courses

☐ 5 or more courses

37. As part of either your undergraduate or graduate coursework, how many <u>math education</u> courses did you take? *Mark (X) only one box.*

☐ None

☐ 1 or 2 courses

☐ 3 or 4 courses

☐ 5 or more courses

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38. **Please indicate whether you are male or female.**

☐ Male

☐ Female

39. **Are you Hispanic or Latino?**

☐ Yes

☐ No

40. **What is your racial background?** *Mark (X) one or more boxes.*

☐ American Indian or Alaska Native

☐ Native Hawaiian or other Pacific Islander

☐ Asian

☐ Black or African American

☐ White

41. **In what year were you born?** ☐☐☐☐

42. **Please indicate today's date (DD/MM/YYYY):** ☐☐ / ☐☐ / ☐☐☐☐

THANK YOU VERY MUCH FOR COMPLETING THIS SURVEY.

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Spring (Follow-Up) Teacher Survey

SPRING 2007 TEACHER SURVEY

NATIONAL EVALUATION OF ELEMENTARY MATHEMATICS CURRICULA

U.S. DEPARTMENT OF EDUCATION

TEACHERS: IF ABOVE INFORMATION IS INCORRECT, PLEASE MAKE CORRECTIONS DIRECTLY ON LABEL

Please return the completed form to:	If you have questions, please contact:

This survey is authorized by the U.S. Department of Education (P.L. 20 U.S.C. 1221e-1) and the Confidential Information Protection and Statistical Efficiency Act of 2002. These laws require that the survey sponsor treat all information you provide as confidential. The information you provide will be used only for research and statistical purposes by the survey sponsor, its contractors, and collaborating researchers for the purpose of analyzing data and preparing scientific reports and articles. Any information publicly released (such as statistical summaries) will be in a form that does not personally identify you. Your response is voluntary. According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless such collection displays a valid OMB number. The OMB control number for this survey is 1850-0813. The time required to complete this survey is estimated to average 25-30 minutes. If you have any comments concerning the accuracy of the time estimate or suggestions for improving this form, please write to: U.S. Department of Education, Washington, DC 20202-4651. If you have comments or concerns about the content of this questionnaire, contact Sheila Heaviside (phone: 866-869-3187, e-mail: sheaviside@mathematica-mpr.com).

OMB NO: 1850-0813
EXPIRATION DATE: 09/30/2008

INSTRUCTIONS

Many of the questions on this survey ask for information about the **assigned curriculum**. This refers to the math curriculum you were assigned to use this year as a participant in the *Evaluation of Elementary Mathematics Curricula*. (Your assigned curriculum is indicated on the label of the survey cover.)

Some of the questions on this survey ask for information about your **target class**.

- If you teach math to one class or one group of first-grade students, this is your target class.

- If you teach math to more than one class or to multiple groups of first-grade students, please answer questions about your target class for ONE of these classes. You will be mailed additional forms that allow you to provide class-specific information for your other first-grade math classes.

This survey is designed to collect information from teachers who provide either primary math instruction or supplemental math instruction (e.g., as a resource teacher or as someone who works with English language learners, students with special learning needs, etc.) to first-grade students.

On questions that ask about the extent to which you are implementing features of the assigned curriculum or using instructional materials provided by the publisher, please reflect in your responses what you are truly implementing. As you complete the survey, do not worry about whether your practices are consistent with instructions from the publisher. This will help us more fully understand teachers' experiences with, and implementation of, each curriculum.

IMPORTANT NOTE:
Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.
Sample: ☒ Right ☑ Wrong
Use block printing when you complete any text or numeric responses.
If you wish to change a response, please mark the correct response and CIRCLE it.

YOUR ROLE IN MATH INSTRUCTION

1. Do you teach math to first-grade students at this school?

☐ Yes

☐ No → If you do not teach math to first-grade students, you do not need to complete this survey. Please describe your duties at the school or district, and return the survey in the enclosed envelope.

2a. Have you been teaching math to the same class(es) of first-grade students at this school since the beginning of this school year (2006-07)?

☐ Yes → SKIP to Question 3a

☐ No

2b. If you replaced a teacher mid-year, please indicate below who you replaced, the month you took over the class, and whether you expect to lead the class through the end of the year.

I replaced the following teacher(s):

Month when I took over the class:

☐ Aug ☐ Sep ☐ Oct ☐ Nov ☐ Dec ☐ Jan ☐ Feb ☐ Mar ☐ Apr

I expect to lead the class through the end of the year: ☐ Yes ☐ No

PUBLISHER-PROVIDED CURRICULUM TRAINING, RESOURCES, AND SUPPORT

3a. Since the start of this school year, has any in-person follow-up training or on-site support from the publisher of the assigned curriculum been <u>available</u> to assist you in teaching math?

☐ Yes

☐ No → SKIP to Question 4a

☐ Don't know → SKIP to Question 4a

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3b. Since the start of this school year, have you participated in any in-person follow-up training or on-site support from the publisher of the assigned curriculum?

☐ Yes

☐ No → SKIP to Question 4a

3c. Since the start of this school year, how many hours have you spent participating in this in-person follow-up training or on-site support from the publisher of the assigned curriculum?

☐☐☐ hours

4a. Are the following types of support available from the publisher of the assigned curriculum to assist you in teaching math? *Mark (X) one box for each row.*

	Yes	No	Don't know
a. Phone support	☐	☐	☐
b. Online support	☐	☐	☐
c. CD or DVD-based or printed reference materials (not including textbooks)	☐	☐	☐
d. Other support → Please specify in the box below:	☐	☐	☐

4b. How often have you used each type of support from the publisher of the assigned curriculum? *Mark (X) one box for each row.*

	Never	Less than once a month	Once a month	2-3 times a month	Weekly or more	Not applicable
a. Phone support	☐	☐	☐	☐	☐	☐
b. Online support	☐	☐	☐	☐	☐	☐
c. CD or DVD-based or printed reference materials (not including textbooks)	☐	☐	☐	☐	☐	☐
d. Other support → Please specify below:	☐	☐	☐	☐	☐	☐

OTHER PROFESSIONAL DEVELOPMENT IN MATH THIS SCHOOL YEAR

5. Since the start of this school year, have you participated in any <u>math</u> professional development activities NOT provided by the publisher of the assigned curriculum?

☐ Yes

☐ No → SKIP to Question 8

6. Since the start of this school year, have you participated in any professional development activities on the following math topics that were NOT provided by the publisher of the assigned curriculum (COLUMN A)? If yes, how many hours did you spend on these activities (COLUMN B)? This includes but is not limited to courses you have taken for recertification or advanced certification, workshops sponsored by your school or district, conferences, or other training that is relevant to your teaching of math.

For each row, mark (X) one box in Column A. If you answer "Yes," then mark (X) one box in Column B for that row.

Professional development topic	COLUMN A: Participation		COLUMN B: Number of hours of participation				
			8 or fewer	9-16	17-32	33-40	More than 40
a. Math instruction	Yes ☐	No ☐	☐	☐	☐	☐	☐
b. Math content	Yes ☐	No ☐	☐	☐	☐	☐	☐
c. Performance standards in math education	Yes ☐	No ☐	☐	☐	☐	☐	☐
d. Other math-focused professional development	Yes ☐	No ☐	☐	☐	☐	☐	☐

7. Since the start of this school year, what have been the sources of your professional development in <u>math</u>? *Mark (X) <u>all</u> that apply.*

☐ Math-focused workshops or training provided by your school or district

☐ Math-focused coursework taken toward a credential for teaching

☐ University coursework in math or math instruction, <u>not including</u> coursework for a credential

☐ Activities such as conferences or working groups about math

☐ Meeting with colleagues <u>on a regular basis</u> about math (e.g., to discuss instructional approaches, assessment, etc.)

☐ Other professional development in math → Please specify:

MATH INSTRUCTION IN YOUR TARGET CLASS

8. Which of the following best describes the grade(s) you teach in your target class? If you teach more than one target class, please think of ONE of these classes.
Mark (X) only one box.

- ☐ Kindergarten and Grade 1
- ☐ Grade 1 only
- ☐ Grade 1 and Grade 2
- ☐ Other → Please specify: ____________

9. How many <u>first-grade</u> students are currently enrolled in your target class? If you teach more than one target class, please also specify in the box provided the name of the class you are considering your target class on this survey (e.g., Period 1 math, or Mrs. Tanaka's class).

☐☐ first-grade students   Name of target class: ____________

10. Approximately how many <u>first-grade</u> students in your target class are:

High math achievers ☐☐

Average math achievers ☐☐

Low math achievers ☐☐

11. Approximately how many <u>first-grade</u> students in your target class have an Individualized Education Plan (IEP)?

Students with an IEP ☐☐

12. Approximately how many <u>first-grade</u> students in your target class are:

Limited English proficient ☐☐

English proficient or native English speakers ☐☐

13. On <u>average</u>, how many minutes per week do you spend <u>preparing</u> to teach math to your target class, <u>using the assigned curriculum</u> (including lesson planning, grading student work, etc.)?

☐☐☐ minutes per week

14. On average, how many days per week do you teach math to your target class?

☐ days per week

15. For approximately how many minutes each day do you teach math to your target class (on the days that you teach math)?

☐☐☐ minutes per day (on the days you teach math)

16a. Are you using the assigned curriculum as your <u>core</u> math curriculum?

☐ Yes → SKIP to Question 17a

☐ No → If no, please specify the name/publisher of your core curriculum:

16b. If you are not using the assigned curriculum as your core math curriculum, please explain why:

17a. Do you use other math curricula in addition to the core curriculum with your target class? This can include materials that are teacher-created or not yet published.

- ☐ No → SKIP to Question 18
- ☐ Yes → Please specify the name(s)/publisher(s) of the curricula:

17b. For what purpose(s) are the curricula specified in Question 17a being used with your target class? *Mark (X) all that apply.*

- ☐ Remediation with a small group of students
- ☐ Remediation with the entire class
- ☐ Enrichment with a small group of students
- ☐ Enrichment with the entire class
- ☐ As a replacement for selected units or lessons in the assigned curriculum
- ☐ As a supplement to units or lessons in the assigned curriculum
- ☐ Other → Please specify:

17c. How often do you supplement the core curriculum with materials or math problems from other sources? *Mark (X) only one box.*

- ☐ Almost daily
- ☐ Once or twice a week
- ☐ Once or twice a month
- ☐ Less than once a month
- ☐ Never

18. So far this year with your target class, approximately how many lessons have you taught that cover each of the following topics? We are interested in your best estimate of the number of lessons you have spent on the following topics up to this point in the school year. Include all lessons, regardless of whether you used the assigned curriculum.
Mark (X) one box for each row.

Approximate number of lessons on…	**None - I did not teach this topic**	**1-5 lessons**	**6-10 lessons**	**11-15 lessons**	**More than 15 lessons**
a. Counting, with whole numbers	☐	☐	☐	☐	☐
b. Understanding numbers less than 10	☐	☐	☐	☐	☐
c. Adding and subtracting, with whole numbers	☐	☐	☐	☐	☐
d. Addition and subtraction facts, with whole numbers	☐	☐	☐	☐	☐
e. Multiplying and dividing, with whole numbers	☐	☐	☐	☐	☐
f. Multiplication and division facts, with whole numbers	☐	☐	☐	☐	☐
g. Place value, with whole numbers	☐	☐	☐	☐	☐
h. Fractions	☐	☐	☐	☐	☐
i. Decimals	☐	☐	☐	☐	☐
j. Percents	☐	☐	☐	☐	☐
k. Geometric shapes or spatial relationships	☐	☐	☐	☐	☐
l. Creating, continuing, or predicting patterns	☐	☐	☐	☐	☐
m. Word problems	☐	☐	☐	☐	☐
n. Collecting or analyzing data	☐	☐	☐	☐	☐
o. Graphs	☐	☐	☐	☐	☐
p. Probability	☐	☐	☐	☐	☐
q. Measurement of length or capacity with standard tools (e.g., rulers, measuring cups)	☐	☐	☐	☐	☐
r. Non-standard measurement of length or capacity	☐	☐	☐	☐	☐
s. Time	☐	☐	☐	☐	☐
t. Money	☐	☐	☐	☐	☐

19. So far this year, approximately what percentage of the lessons from the assigned curriculum have you used with your target class? *Mark (X) only one box.*

☐ Less than 20%

☐ 20-49%

☐ 50-79%

☐ 80-100%

20. How often do you use the following materials from the assigned curriculum with your target class? *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Student worksheets	☐	☐	☐	☐	☐	☐
b. Student workbooks or textbooks	☐	☐	☐	☐	☐	☐
c. Student assessments	☐	☐	☐	☐	☐	☐
d. Manipulatives	☐	☐	☐	☐	☐	☐
e. Lesson plans or lesson scripts	☐	☐	☐	☐	☐	☐
f. Supplemental student materials recommended by the publisher (math literature, calculators, etc.)	☐	☐	☐	☐	☐	☐
g. Supplemental classroom materials recommended by the publisher (number line, calendar, etc.)	☐	☐	☐	☐	☐	☐

21. Please indicate the extent to which you agree or disagree with the following statements about the assigned curriculum. *Mark (X) one box for each row.*

	Strongly disagree	Disagree	Agree	Strongly agree
a. I have had adequate opportunities to learn about the curriculum.	☐	☐	☐	☐
b. I can explain to other teachers how to use the curriculum.	☐	☐	☐	☐
c. The curriculum corresponds well with the math understandings I want my students to demonstrate.	☐	☐	☐	☐
d. The curriculum is aligned well with our state curriculum standards.	☐	☐	☐	☐
e. The curriculum conflicts with my preferred approach to math instruction.	☐	☐	☐	☐
f. The curriculum assumes major changes in the way I teach math.	☐	☐	☐	☐
g. The curriculum has prompted me to change some of my teaching practices in math.	☐	☐	☐	☐
h. The curriculum is more trouble than it is worth.	☐	☐	☐	☐
i. I am committed to the implementation of the curriculum.	☐	☐	☐	☐
j. All first-grade teachers in my school are committed to the implementation of the curriculum.	☐	☐	☐	☐
k. Administrators at my school are committed to the implementation of the curriculum.	☐	☐	☐	☐
l. I believe my students will score better on required accountability tests because of their experience with the curriculum.	☐	☐	☐	☐

22. Please indicate the extent to which you agree or disagree with the following statements about the response of your target class to math instruction. For each row, choose the option that best reflects your experience. *Mark (X) one box for each row.*

	Strongly disagree	Disagree	Agree	Strongly agree
a. Students frequently misbehave during math instruction.	☐	☐	☐	☐
b. Students seem excited about learning math.	☐	☐	☐	☐
c. Students are attentive during math instruction.	☐	☐	☐	☐
d. Students seldom make errors during math instruction.	☐	☐	☐	☐

23. About how often do students in your target class take part in the following activities? (Include only activities that take place during math instruction.)
Mark (X) one box for each row.

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Work in small groups or with a partner	☐	☐	☐	☐	☐	☐
b. Practice or take tests on computational skills	☐	☐	☐	☐	☐	☐
c. Work individually on math problems from worksheets, or a textbook/workbook	☐	☐	☐	☐	☐	☐
d. Work on investigations or problems that extend for several days	☐	☐	☐	☐	☐	☐
e. Write about how to solve a problem	☐	☐	☐	☐	☐	☐
f. Do problems that have more than one correct solution	☐	☐	☐	☐	☐	☐
g. Discuss different ways of solving a problem	☐	☐	☐	☐	☐	☐
h. Reference other students' ideas in their contributions to class discussions	☐	☐	☐	☐	☐	☐
i. Explain a math concept or procedure to the other students	☐	☐	☐	☐	☐	☐
j. Ask mathematical questions of other students	☐	☐	☐	☐	☐	☐
k. Use manipulatives, pictures, or diagrams to solve problems	☐	☐	☐	☐	☐	☐
l. Use manipulatives, pictures, or diagrams to support explanations	☐	☐	☐	☐	☐	☐
m. Work on activities that integrate math with other subjects	☐	☐	☐	☐	☐	☐
n. Write in math journals (e.g., explain their mathematical reasoning or create their own math problems)	☐	☐	☐	☐	☐	☐
o. Take part in activities designed to develop rapid recall of math facts	☐	☐	☐	☐	☐	☐
p. Practice math facts using manipulatives, pictures, or diagrams for support	☐	☐	☐	☐	☐	☐

24. How often do you do the following with your target class? *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	Once or twice a week	1-2 times a day	3 or more times a day
a. Prompt students to explain their answers.	☐	☐	☐	☐	☐	☐
b. Invite students to use multiple strategies or solutions to a problem.	☐	☐	☐	☐	☐	☐
c. Ask students to demonstrate a procedure or concept to other students.	☐	☐	☐	☐	☐	☐
d. Ask students to explore a concept or procedure before it is modeled.	☐	☐	☐	☐	☐	☐
e. Demonstrate or model math concepts or procedures for students.	☐	☐	☐	☐	☐	☐
f. Differentiate math instruction for students at different ability levels.	☐	☐	☐	☐	☐	☐

25a. What strategies do you use to respond to students' errors during math instruction?
Mark (X) all that apply.

☐ Correct the student’s mistake as soon as possible.

☐ Ask the student questions that guide him/her to the correct answer.

☐ Ask another student for the correct answer.

☐ Use the incorrect response as a basis for an exercise or class discussion about the misconception.

☐ Re-teach the procedure and/or concept.

☐ Other → Please specify:

25b. Of the strategies selected in Question 25a (above), which one do you use the most often? *Mark (X) only one box.*

- ☐ Correct the student's mistake as soon as possible.
- ☐ Ask the student questions that guide him/her to the correct answer.
- ☐ Ask another student for the correct answer.
- ☐ Use the incorrect response as a basis for an exercise or class discussion about the misconception.
- ☐ Re-teach the procedure and/or concept.
- ☐ Other → Please specify:

26. What percentage of math instructional time do students in your target class spend practicing math procedures and the recall of math facts?

☐☐ % of math instructional time

27. If given your choice of math curriculum to use next year, how likely are you to choose the assigned curriculum over other curricula available in your district? *Mark (X) only one box.*

- ☐ Very likely
- ☐ Likely
- ☐ Not at all likely

28. Please enter today's date (MM/DD/YYYY): ☐☐ / ☐☐ / ☐☐☐☐

29. If your name is not printed on the label on the cover of this survey, please write your name in the spaces below

First name

Last name

The final pages of the survey include items that collect specific information for each curriculum. All the curriculum-specific items are included in the following pages. When administering the survey, teachers only receive items for the curriculum to which they were assigned.

INVESTIGATIONS CURRICULUM IMPLEMENTATION

30. How often do you do the following activities with your target class? Please note that not all of the activities listed are meant to be done every day, and consider your practices over the course of the year. *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Do the *Classroom Routines* (e.g., time, weather, counting during attendance)	☐	☐	☐	☐	☐	☐
b. Introduce the tasks for the session	☐	☐	☐	☐	☐	☐
c. Conduct at least one activity from the current *Investigation*	☐	☐	☐	☐	☐	☐
d. Do the *Choice Time* activities	☐	☐	☐	☐	☐	☐
e. Use guidelines in the lesson for individualizing instruction for struggling students	☐	☐	☐	☐	☐	☐
f. Use students' correct responses as a basis for discussion	☐	☐	☐	☐	☐	☐
g. Use students' incorrect responses as a basis for discussion	☐	☐	☐	☐	☐	☐
h. Make manipulatives accessible to students at all times during the lesson	☐	☐	☐	☐	☐	☐
i. Allow students to choose manipulatives for use during the activity	☐	☐	☐	☐	☐	☐
j. Refer to the *100 Chart*	☐	☐	☐	☐	☐	☐
k. Ask students to do drill-and-practice worksheets and/or flashcards	☐	☐	☐	☐	☐	☐
l. Use *Teacher Checkpoints* and *Embedded Assessments*	☐	☐	☐	☐	☐	☐
m. Introduce the homework	☐	☐	☐	☐	☐	☐
n. Review homework with the class	☐	☐	☐	☐	☐	☐
o. End each lesson by asking students to share their thinking	☐	☐	☐	☐	☐	☐
p. End each lesson by explaining the day's math objective	☐	☐	☐	☐	☐	☐
q. Communicate with parents about math activities	☐	☐	☐	☐	☐	☐

31. Please indicate how successful you are at facilitating the following types of discussion during math instruction. *Mark (X) one box for each row.*

	Not at all successful	Somewhat successful	Moderately successful	Very successful
a. Discussions that allow students to explain their answers	☐	☐	☐	☐
b. Discussions that enable students to offer or share multiple approaches to solving a problem	☐	☐	☐	☐
c. Discussions that enable students to raise mathematical questions and/or discuss mathematical concepts	☐	☐	☐	☐
d. Discussions that encourage students to reference other students' ideas in their comments	☐	☐	☐	☐

THANK YOU VERY MUCH FOR COMPLETING THE SURVEY.

If you have additional comments, please feel free to write them below.

MATH EXPRESSIONS CURRICULUM IMPLEMENTATION

30. How often do you do the following activities with your target class? Please note that not all of the activities listed are meant to be done every day, and consider your practices over the course of the year. *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Complete the *Daily Routines* for the unit	☐	☐	☐	☐	☐	☐
b. Use student leaders during the *Daily Routines*	☐	☐	☐	☐	☐	☐
c. Use *Quick Practice* activity	☐	☐	☐	☐	☐	☐
d. Use student leaders during the *Quick Practice* activity	☐	☐	☐	☐	☐	☐
e. Use *Differentiated Instruction* activities	☐	☐	☐	☐	☐	☐
f. Use *Math Writing Prompts*	☐	☐	☐	☐	☐	☐
g. Use *Teaching the Lesson* activities	☐	☐	☐	☐	☐	☐
h. Assign homework	☐	☐	☐	☐	☐	☐
i. Assign the *Remembering* worksheet	☐	☐	☐	☐	☐	☐
j. Group students for each activity as recommended in the teachers' guide	☐	☐	☐	☐	☐	☐
k. Use *Solve and Discuss* at the board	☐	☐	☐	☐	☐	☐
l. Use *Scenarios*	☐	☐	☐	☐	☐	☐
m. Use *Step-by-step* at the board	☐	☐	☐	☐	☐	☐
n. Use proof drawings	☐	☐	☐	☐	☐	☐
o. Conduct *Ongoing Assessment* activities	☐	☐	☐	☐	☐	☐
p. Administer *Quick Quizzes*	☐	☐	☐	☐	☐	☐
q. Administer *Unit Tests*	☐	☐	☐	☐	☐	☐

31. Please indicate how successful you are at facilitating the following types of discussion during math instruction. *Mark (X) one box for each row.*

	Not at all successful	Somewhat successful	Moderately successful	Very successful
a. Discussions that allow students to explain their answers	☐	☐	☐	☐
b. Discussions that enable students to offer or share multiple approaches to solving a problem	☐	☐	☐	☐
c. Discussions that enable students to raise mathematical questions and/or discuss mathematical concepts	☐	☐	☐	☐
d. Discussions that encourage students to reference other students' ideas in their comments	☐	☐	☐	☐

THANK YOU VERY MUCH FOR COMPLETING THE SURVEY.

If you have additional comments, please feel free to write them below.

SAXON MATH CURRICULUM IMPLEMENTATION

30. How often do you do the following activities with your target class? Please note that not all of the activities listed are meant to be done every day, and consider your practices over the course of the year. *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Complete all parts of the *Meeting* specified in the lesson	☐	☐	☐	☐	☐	☐
b. Complete *Fact Practice* specified in the lesson	☐	☐	☐	☐	☐	☐
c. Complete *Fact Assessment* if specified in the lesson	☐	☐	☐	☐	☐	☐
d. State the lesson's objective from the script	☐	☐	☐	☐	☐	☐
e. Complete all activities specified in the lesson	☐	☐	☐	☐	☐	☐
f. Use the manipulatives and visual representations specified in the lesson	☐	☐	☐	☐	☐	☐
g. Ask students to respond to your questions as a whole group	☐	☐	☐	☐	☐	☐
h. Model completion of the *Guided Class Practice* chart	☐	☐	☐	☐	☐	☐
i. Ask students to complete the *Guided Class Practice* worksheet	☐	☐	☐	☐	☐	☐
j. Preview the homework for students	☐	☐	☐	☐	☐	☐
k. Administer written assessments	☐	☐	☐	☐	☐	☐
l. Administer oral assessments and record student responses	☐	☐	☐	☐	☐	☐
m. Group students for each activity as specified in the lessons	☐	☐	☐	☐	☐	☐
n. Ask students at the end of the lesson to summarize what they learned	☐	☐	☐	☐	☐	☐
o. Adhere to the lesson script	☐	☐	☐	☐	☐	☐
p. Prepare all required materials in advance of the lesson	☐	☐	☐	☐	☐	☐

THANK YOU VERY MUCH FOR COMPLETING THE SURVEY.

If you have additional comments, please feel free to write them on the back page of the survey.

SCOTT FORESMAN-ADDISON WESLEY CURRICULUM IMPLEMENTATION

30. How often do you do the following activities with your target class? Please note that not all of the activities listed are meant to be done every day, and consider your practices over the course of the year. *Mark (X) one box for each row.*

	Never	Less than once a month	Once or twice a month	1-2 times a week	3-4 times a week	Daily
a. Do the *Spiral Review*	☐	☐	☐	☐	☐	☐
b. Do the *Investigating the Concept* activity	☐	☐	☐	☐	☐	☐
c. Use manipulatives during the lesson	☐	☐	☐	☐	☐	☐
d. Group students into small groups for collaborative activities	☐	☐	☐	☐	☐	☐
e. State the objective of the lesson	☐	☐	☐	☐	☐	☐
f. Do the *Warm Up* activity	☐	☐	☐	☐	☐	☐
g. Use the *Talk About It* questions	☐	☐	☐	☐	☐	☐
h. Provide the recommended *Error Intervention* for struggling students	☐	☐	☐	☐	☐	☐
i. Use the *Think About It* questions	☐	☐	☐	☐	☐	☐
j. Introduce the vocabulary specified in the lesson	☐	☐	☐	☐	☐	☐
k. Provide step-by-step instructions and guidance to students on how to complete the practice page	☐	☐	☐	☐	☐	☐
l. Provide additional activities for "early finishers"	☐	☐	☐	☐	☐	☐
m. Ask students to complete the Learn! section of student worksheets	☐	☐	☐	☐	☐	☐
n. Use the *Leveled Practice* provided for students at varying levels (below, on level, above)	☐	☐	☐	☐	☐	☐
o. Provide reading assistance to students as they complete the practice page	☐	☐	☐	☐	☐	☐
p. Use *Instant Check Mat*	☐	☐	☐	☐	☐	☐
q. Provide opportunities for students to use online materials or other supplemental materials provided by SFAW	☐	☐	☐	☐	☐	☐
r. Ask students to complete the journal activity	☐	☐	☐	☐	☐	☐
s. Ask students to complete the test-taking practice	☐	☐	☐	☐	☐	☐
t. Administer SFAW assessments	☐	☐	☐	☐	☐	☐

THANK YOU VERY MUCH FOR COMPLETING THE SURVEY.

If you have additional comments, please feel free to write them on the back page of the survey.

Classroom Observation Protocol

Observation of Math Instruction (OMI) Form with Classroom Characteristics (CC) Form Imbedded

Reliability Observation: ☐ Yes ☐ No

Teacher Barcode Label

Observer Barcode Label

Evaluation of Mathematics Curricula

OBSERVATION OF MATH INSTRUCTION

Lesson Form

IMPORTANT NOTE

Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.

Sample: ☒ Right ☑ Wrong

If you wish to change a response, please mark the correct response and CIRCLE it.

Use block printing as shown below when you complete any numeric or text responses.

0	1	2	3	4	5	6	7	8	9

SAMPLE TEXT

Teacher Name - First Last

Site Visitor Name - First Last

School Name

District Name

Date of Observation

__ __ / __ __ / __ __ __ __
mo day year

11251

LESSON - specify number or name: ____ Time: Begin __ : __ ☐ AM ☐ PM End __ : __ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

Frequency of Instructional Behaviors (tally frequency for instructional (not directions or class management) behaviors) (enter total of "21" for 21 or more tallies)

	Total		Tally
1		Asks **close-ended** questions (teacher accepts only one answer)	
2		Poses **open-ended** questions (teacher accepts multiple answers or solutions)	
3		**Tells** information, models procedures, or shows students how to represent concepts	
4		**Guides** practice on **problems** (tally number of problems)	
5		Elicits ***multiple* strategies**/solutions (number of problems >1 elicited solutions)	
6		Elicits **representations** (# of types of representation)	

B. Teacher Feedback

How did the teacher provide feedback to students?
Teacher Response to individual student answers:

1		States if **correct** or not without elaborating or repeats what child said with indication of right or wrong	
2		**Calls on other students** until the "correct" answer is given	
3		**Provides correct** answer right away (no probing for thinking or hinting)	
4		Asks class if they **agree or disagree** with student's response	
5		Takes student through **step-by-step** procedure	
6		**Tells** student **strategy** to use	
7		**Elicits** other students' **questions** about the student's response	
8		**Labels** math strategy, problem, or concept	
9		**Repeats** student answer in a **neutral** way (no indication of right or wrong)	

Teacher Guidance and follow up questions:

10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
13		**Extends** what student says	

Teacher Praise:

14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

C. Student Work

	Total		Tally
1		Demonstrated work to peers (tally **# of students**)	
2		Number of different **types** of visual or 3D **representations** created	

D. Evidence of Instructional Behaviors

1	☐ Yes ☐ No	States lesson **objective** at the beginning of class
2	☐ Yes ☐ No	Connects lesson to **prior knowledge**/instruction
3	☐ Yes ☐ No	Demonstrates how to play **game**
4	☐ Yes ☐ No	Guides children in **acting out a problem**
5	☐ Yes ☐ No	Leads children in a rap, **song**, or fingerplay to illustrate math concept or practice
6	☐ Yes ☐ No	Uses children's **book** to make connections to math concept
7	☐ Yes ☐ No	Connects math to **real life** problems or situations
8	☐ Yes ☐ No	Directs or encourages students to **help one another** with math
9	☐ Yes ☐ No	Prompts child to guide practice or **lead class** in a routine
10	☐ Yes ☐ No	Leads **summary** of what was learned or asks students to lead/share summary
11	☐ Yes ☐ No	Administered a **written assessment**

NOTES

11251

E. Student Actions

Teacher provided students with the following opportunities to learn:
(note the fractional of class involved in these activities)

1	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Wrote equations or number sentences
2	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Wrote about math concepts, strategies, or solutions
3	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Wrote story for equation
4	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Created math problems
5	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Practiced number facts or procedures
6	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Played math games
7	☐ 0 ☐ 1/4 ☐ 1/3 ☐ 1/2 ☐ 2/3 ☐ 3/4 ☐ All	Curricula specific activity (e.g., quick image) Specify activity:
8	☐ Never ☐ Sometimes ☐ Frequently	**Asked peers questions (about math)**
9	☐ Never ☐ Sometimes ☐ Frequently	**Discussed strategies/solutions with partner or small group**
10	☐ Never ☐ Sometimes ☐ Frequently	**Choral response to questions**
11	**Counting** ☐ Yes ☐ No	**By:** ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other, specify:

F. Math Practice

			Tally
1	☐☐	Number of **practice problems** focused on **today's objective**	
2	☐☐	Number of **problems** focused on review of **previously learned** material	
3	☐ Yes ☐ No	**Review of homework (together in class or marked answers only)**	

G. Materials used by children: (check all that apply today)

☐ Pattern blocks	☐ Base ten blocks/bean sticks
☐ Linking cubes	☐ Fingers
☐ Geoboards	☐ Calculators
☐ Blank cubes	☐ Dot cubes
☐ Coins	☐ Counters
☐ Number lines	☐ Other, specify:
☐ Hundreds (120) charts	

11251

H. Problem solving approach and/or Representations (check all those used)

☐ Drawing picture/diagram	☐ Solve simpler problem	☐ Keywords	☐ Guess and check
☐ Graphs	☐ Make 3D model	☐ Act it out	☐ Logical reasoning
☐ Equation/number sentence	☐ Look for pattern	☐ Tables	☐ Number line

I. Percent of time in each groups size:

1	☐ Not at all	☐ 5-25%	☐ 26-49%	☐ 50-74%	☐ 75-100%	**Large group**
2	☐ Not at all	☐ 5-25%	☐ 26-49%	☐ 50-74%	☐ 75-100%	**Small group**
3	☐ Not at all	☐ 5-25%	☐ 26-49%	☐ 50-74%	☐ 75-100%	**Pairs**
4	☐ Not at all	☐ 5-25%	☐ 26-49%	☐ 50-74%	☐ 75-100%	**Individual**

NOTES

J. Classroom Characteristics

Rate how characteristic the statement is of the class that you observed (check one box for each statement)

1 = **Not at All** (almost never)
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

1	Students are cooperative and attentive to the lesson.	☐ 1 ☐ 2 ☐ 3 ☐ 4
2	Teacher spends a lot of time managing behavior.	☐ 1 ☐ 2 ☐ 3 ☐ 4
3	Student behavior disrupts the classroom.	☐ 1 ☐ 2 ☐ 3 ☐ 4
4	Students are perfectly behaved.	☐ 1 ☐ 2 ☐ 3 ☐ 4
5	Teacher used praise or rewards to maintain positive behavior.	☐ 1 ☐ 2 ☐ 3 ☐ 4
6	Teacher utilized nonverbal methods (that don't disrupt class) to manage misbehaviors (or no misbehavior was evident).	☐ 1 ☐ 2 ☐ 3 ☐ 4
7	Class runs without disruption from student behavior.	☐ 1 ☐ 2 ☐ 3 ☐ 4
8	Students appear excited by the lesson (smiling, leaning forward, waving hands, starting easily and quickly on activity).	☐ 1 ☐ 2 ☐ 3 ☐ 4
9	Students are actively engaged (asking questions, responding, working with materials, writing)	☐ 1 ☐ 2 ☐ 3 ☐ 4
10	Students attended to the lesson in a passive way (looking at the speaker, sitting up, but with limited opportunity to talk or write or manipulate materials).	☐ 1 ☐ 2 ☐ 3 ☐ 4
11	Students are off-task.	☐ 1 ☐ 2 ☐ 3 ☐ 4
12	Teacher and students have a warm, positive relationship.	☐ 1 ☐ 2 ☐ 3 ☐ 4
13	Teacher encourages students to help one another understand the math.	☐ 1 ☐ 2 ☐ 3 ☐ 4
14	Students help one another to understand math concepts or procedures.	☐ 1 ☐ 2 ☐ 3 ☐ 4
15	Peer to peer interaction about math occurs.	☐ 1 ☐ 2 ☐ 3 ☐ 4
16	Teacher has techniques for gaining class attention in less than 10 seconds.	☐ 1 ☐ 2 ☐ 3 ☐ 4
17	Students spend little time waiting or transitioning between topics.	☐ 1 ☐ 2 ☐ 3 ☐ 4
18	Transitions are smooth and students get to work quickly.	☐ 1 ☐ 2 ☐ 3 ☐ 4
19	Students do **not** need to wait for the teacher to begin or for other students to finish working before they work on next problem or activity.	☐ 1 ☐ 2 ☐ 3 ☐ 4
20	Teacher spends a lot of time giving directions.	☐ 1 ☐ 2 ☐ 3 ☐ 4

J. Classroom Characteristics (continued)

Rate how characteristic the statement is of the class that you observed (check one box for each statement)

1 = **Not at All** (almost never)
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

21	Teacher has materials prepared and ready for students.		☐ 1	☐ 2	☐ 3	☐ 4
22	Class time is spent on understanding or practicing math.		☐ 1	☐ 2	☐ 3	☐ 4
23	Students had easy access and permission to use manipulatives when working.		☐ 1	☐ 2	☐ 3	☐ 4
24	The teacher is fluid in her presentation of the lesson.		☐ 1	☐ 2	☐ 3	☐ 4
25	Students appear familiar with the materials and procedures used.		☐ 1	☐ 2	☐ 3	☐ 4
26	Students are given the opportunity to think and respond (i.e., adequate wait time is given).		☐ 1	☐ 2	☐ 3	☐ 4
27	During independent work time the teacher monitored student work.	☐ N/A	☐ 1	☐ 2	☐ 3	☐ 4
28	In monitoring student work, teacher followed through to ensure understanding.		☐ 1	☐ 2	☐ 3	☐ 4
29	Teacher differentiated curriculum for children who were **above** level.		☐ 1	☐ 2	☐ 3	☐ 4
30	Teacher differentiated curriculum for children who were **below** level.		☐ 1	☐ 2	☐ 3	☐ 4
31	Teacher differentiated curriculum for children who were English language learners.		☐ 1	☐ 2	☐ 3	☐ 4

K. Please describe any supplementary materials or activities that you observed being used (if possible attach copies. Be sure to note the objective for the materials (reteaching concepts, extra focused practice, mixed practice or fluency on facts or procedures):

L. Additional comments (unexpected observations):

Adherence rating (AR) Form, Investigations

Reliability Observation: ☐ Yes ☐ No

Teacher Barcode Label

Observer Barcode Label

Evaluation of Mathematics Curricula

OBSERVATION OF MATH INSTRUCTION

Routine Form:
Investigations (green)

IMPORTANT NOTE

Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.

Sample: ☒ Right ☑ Wrong

If you wish to change a response, please mark the correct response and CIRCLE it.

Use block printing as shown below when you complete any numeric or text responses.

0	1	2	3	4	5	6	7	8	9

SAMPLE TEXT

Teacher Name - First ____________ Last ____________

Site Visitor Name - First ____________ Last ____________

School Name ____________

District Name ____________

Date of Observation

__ __ / __ __ / __ __ __ __
mo day year

Draft

ROUTINE 1 - specify: ______ Time: Begin __ __ : __ __ ☐ AM ☐ PM End __ __ : __ __ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

Frequency of Instructional Behaviors (tally frequency for instructional (not directions or class management) behaviors) (enter total of "21" for 21 or more tallies)

	Total		Tally
1		Asks **close-ended** questions (teacher accepts only one answer)	
2		Poses **open-ended** questions (teacher accepts multiple answers or solutions)	
3		**Tells** information, models procedures, or shows students how to represent concepts	
4		**Guides** practice on **problems** (tally number of problems)	
5		Elicits ***multiple*** **strategies**/solutions (number of problems >1 elicited solutions)	
6		Elicits **representations** (# of types of representation)	

B. Teacher Feedback

How did the teacher provide feedback to students?
Teacher Response to individual student answers:

1		States if **correct** or not without elaborating or repeats what child said with indication of right or wrong	
2		**Calls on other students** until the "correct" answer is given	
3		**Provides correct** answer right away (no probing for thinking or hinting)	
4		Asks class if they **agree or disagree** with student's response	
5		Takes student through **step-by-step** procedure	
6		**Tells** student **strategy** to use	
7		**Elicits** other students' **questions** about the student's response	
8		**Labels** math strategy, problem, or concept	
9		**Repeats** student answer in a **neutral** way (no indication of right or wrong)	

Teacher Guidance and follow up questions:

10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
13		**Extends** what student says	

Teacher Praise:

14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

Draft

C. Evidence of Instructional Behaviors

1	☐ Yes ☐ No	Connects lesson to **prior knowledge**/instruction
2	☐ Yes ☐ No	Guides children in **acting out a problem**
3	☐ Yes ☐ No	Leads children in a rap, **song**, or fingerplay to illustrate math concept or practice
4	☐ Yes ☐ No	Uses children's **book** to make connections to math concept
5	☐ Yes ☐ No	Connects math to **real life** problems or situations
6	☐ Yes ☐ No	Directs or encourages students to **help one another** with math
7	☐ Yes ☐ No	Prompts child to guide practice or **lead class** in a routine
8	☐ Yes ☐ No	**Counting** By: ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other:

NOTES

ROUTINE 2 - specify: ____ Time: Begin __ __ : __ __ ☐ AM ☐ PM End __ __ : __ __ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

Frequency of Instructional Behaviors (tally frequency for instructional (not directions or class management) behaviors) (enter total of "21" for 21 or more tallies)

	Total		Tally
1		Asks **close-ended** questions (teacher accepts only one answer)	
2		Poses **open-ended** questions (teacher accepts multiple answers or solutions)	
3		**Tells** information, models procedures, or shows students how to represent concepts	
4		**Guides** practice on **problems** (tally number of problems)	
5		Elicits ***multiple* strategies**/solutions (number of problems >1 elicited solutions)	
6		Elicits **representations** (# of types of representation)	

B. Teacher Feedback

How did the teacher provide feedback to students?
Teacher Response to individual student answers:

	Total		Tally
1		States if **correct** or not without elaborating or repeats what child said with indication of right or wrong	
2		**Calls on other students** until the "correct" answer is given	
3		**Provides correct** answer right away (no probing for thinking or hinting)	
4		Asks class if they **agree or disagree** with student's response	
5		Takes student through **step-by-step** procedure	
6		**Tells** student **strategy** to use	
7		**Elicits** other students' **questions** about the student's response	
8		**Labels** math strategy, problem, or concept	
9		**Repeats** student answer in a **neutral** way (no indication of right or wrong)	

Teacher Guidance and follow up questions:

	Total		Tally
10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
13		**Extends** what student says	

Teacher Praise:

	Total		Tally
14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

Draft

C. Evidence of Instructional Behaviors

1	☐ Yes ☐ No	Connects lesson to **prior knowledge**/instruction
2	☐ Yes ☐ No	Guides children in **acting out a problem**
3	☐ Yes ☐ No	Leads children in a rap, **song**, or fingerplay to illustrate math concept or practice
4	☐ Yes ☐ No	Uses children's **book** to make connections to math concept
5	☐ Yes ☐ No	Connects math to **real life** problems or situations
6	☐ Yes ☐ No	Directs or encourages students to **help one another** with math
7	☐ Yes ☐ No	Prompts child to guide practice or **lead class** in a routine
8	☐ Yes ☐ No	**Counting** By: ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other:

NOTES

Draft

INVESTIGATIONS

A. Conducts Routine Activities

1	Counting	☐ Yes ☐ No
2	Time	☐ Yes ☐ No
3	Weather	☐ Yes ☐ No
4	Exploring data	☐ Yes ☐ No
5	Making pairs	☐ Yes ☐ No
6	Other (specify):	☐ Yes ☐ No

7	Math lesson had an opening introductory activity	☐ Yes ☐ No
	(if yes, complete the following):	
	with teacher guidance	☐ Yes ☐ No
	with story or visual representation	☐ Yes ☐ No
	and children shared their ideas	☐ Yes ☐ No

8	Math lesson had a closing activity	☐ Yes ☐ No
	(if yes, complete the following):	
	with teacher guidance	☐ Yes ☐ No
	and children shared their ideas	☐ Yes ☐ No

(if yes, mark below):

- ☐ No students
- ☐ 1-2 students
- ☐ 3-4 students
- ☐ 5 or more students

Draft

B. Rate how characteristic the statement is of the class that you observed (check one box for each statement)

Not at all
Minimally characteristic (sometimes evident)
Strongly characteristic (frequently evident)
Extremely characteristic (almost always evident)

		Not at all	Minimal	Strong	Extreme
1	Children worked extended periods of time on a small number of problems discussing and representing the concepts or solutions in multiple ways.	☐	☐	☐	☐
2	Children work collaboratively on representing ideas and solving problems.	☐	☐	☐	☐
3	Practice of number facts (math fluency) occurred through games/activities.	☐	☐	☐	☐
4	Practice of number facts occurred through worksheets and flashcards.	☐	☐	☐	☐
5	Students had access to manipulatives of their choosing.	☐	☐	☐	☐
6	When a solution was incorrect, the teacher immediately told the student the correct solution.	☐	☐	☐	☐
7	Teacher accepted student responses with no indication of correct/incorrect.	☐	☐	☐	☐
8	Teacher clarified students' ideas for class (for example, repeating what the child said).	☐	☐	☐	☐
9	Teacher built on child's mathematical ideas extending understanding of the concept.	☐	☐	☐	☐
10	When students made errors, teacher used questions and activities ("show me how you did that") to guide thinking and self-correction.	☐	☐	☐	☐
11	Teacher asked students to explain reasoning or thinking for "correct" responses.	☐	☐	☐	☐
12	Teacher asked students to explain reasoning or thinking for "incorrect" responses.	☐	☐	☐	☐
13	Teacher probed for multiple strategies.	☐	☐	☐	☐
14	Teacher told the student the strategy to use.	☐	☐	☐	☐
15	Teacher gave children time to think before providing hints.	☐	☐	☐	☐
16	Children appeared familiar with the type of interaction that occurred today.	☐	☐	☐	☐

NOTES

Draft

Adherence Rating (AR) Form, Math Expressions

Reliability Observation: ☐ Yes ☐ No

Teacher Barcode Label

Observer Barcode Label

Evaluation of Mathematics Curricula

OBSERVATION OF MATH INSTRUCTION

Routine Form:
Math Expressions (pink)

IMPORTANT NOTE

Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.

Sample: ☒ Right ☑ Wrong

If you wish to change a response, please mark the correct response and CIRCLE it.

Use block printing as shown below when you complete any numeric or text responses.

0 1 2 3 4 5 6 7 8 9 SAMPLE TEXT

Teacher Name - First Last

Site Visitor Name - First Last

School Name

District Name

Date of Observation

__ / __ / ____
mo day year

Draft

ROUTINE 1 - specify: ______ Time: Begin __ __ : __ __ ☐ AM ☐ PM End __ __ : __ __ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

Frequency of Instructional Behaviors (tally frequency for instructional (not directions or class management) behaviors) (enter total of "21" for 21 or more tallies)

	Total		Tally
1		Asks **close-ended** questions (teacher accepts only one answer)	
2		Poses **open-ended** questions (teacher accepts multiple answers or solutions)	
3		**Tells** information, models procedures, or shows students how to represent concepts	
4		**Guides** practice on **problems** (tally number of problems)	
5		Elicits ***multiple* strategies**/solutions (number of problems >1 elicited solutions)	
6		Elicits **representations** (# of types of representation)	

B. Teacher Feedback

How did the teacher provide feedback to students?
Teacher Response to individual student answers:

	Total		Tally
1		States if **correct** or not without elaborating or repeats what child said with indication of right or wrong	
2		**Calls on other students** until the "correct" answer is given	
3		**Provides correct** answer right away (no probing for thinking or hinting)	
4		Asks class if they **agree or disagree** with student's response	
5		Takes student through **step-by-step** procedure	
6		**Tells** student **strategy** to use	
7		**Elicits** other students' **questions** about the student's response	
8		**Labels** math strategy, problem, or concept	
9		**Repeats** student answer in a **neutral** way (no indication of right or wrong)	

Teacher Guidance and follow up questions:

	Total		Tally
10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
13		**Extends** what student says	

Teacher Praise:

	Total		Tally
14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

Draft

C. Evidence of Instructional Behaviors

1	☐ Yes ☐ No	Connects lesson to **prior knowledge**/instruction
2	☐ Yes ☐ No	Guides children in **acting out a problem**
3	☐ Yes ☐ No	Leads children in a rap, **song**, or fingerplay to illustrate math concept or practice
4	☐ Yes ☐ No	Uses children's **book** to make connections to math concept
5	☐ Yes ☐ No	Connects math to **real life** problems or situations
6	☐ Yes ☐ No	Directs or encourages students to **help one another** with math
7	☐ Yes ☐ No	Prompts child to guide practice or **lead class** in a routine
8	☐ Yes ☐ No	**Counting** By: ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other:

NOTES

Draft

ROUTINE 2 - specify: [ ] Time: Begin [ ][ ] : [ ][ ] ☐ AM ☐ PM End [ ][ ] : [ ][ ] ☐ AM ☐ PM

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Draft

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NOTES

Draft

MATH EXPRESSIONS

A.

1	Daily routine for the unit are used.	☐ None ☐ Some ☐ Most ☐ All
2	Teaching the Lesson activities completed.	☐ None ☐ Some ☐ Most ☐ All
3	Teacher follows recommended grouping for the activities in the lesson.	☐ None ☐ Some ☐ Most ☐ All
4	Students worked on a math writing prompt.	☐ None ☐ Some ☐ Most ☐ All
5	Teacher assigned homework.	☐ Yes ☐ No
6	Teacher used the "Extending the lesson activity".	☐ Yes ☐ No
7	Teacher used the "remembering activities"	☐ Yes ☐ No

B. **Rate how characteristic the statement is of the class that you observed** (check one box for each statement)

1 = **Not at All**
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

1	Teacher fosters peer discussion of mathematical thinking by directing students to ask each other questions or to talk about a concept together.		☐ 1 ☐ 2 ☐ 3 ☐ 4
2	Teacher used hints and questions to guide children in solving problems.		☐ 1 ☐ 2 ☐ 3 ☐ 4
3	Teacher used the solve, explain, ask questions, justify model of instruction.		☐ 1 ☐ 2 ☐ 3 ☐ 4
4	Teacher used student pairs.		☐ 1 ☐ 2 ☐ 3 ☐ 4
5	Teacher used scenarios to demonstrate mathematical relationships.		☐ 1 ☐ 2 ☐ 3 ☐ 4
6	Teacher used 'step-by-step' at the board.		☐ 1 ☐ 2 ☐ 3 ☐ 4
7	Teacher used whole class practice with student leaders.		☐ 1 ☐ 2 ☐ 3 ☐ 4
8	Students worked together in small groups.		☐ 1 ☐ 2 ☐ 3 ☐ 4
9	Teacher clarified and/or extended student thinking by rephrasing what the student said or labeling a strategy or pointing out part of the solution or asking a question.		☐ 1 ☐ 2 ☐ 3 ☐ 4
10	Teacher prompted and encouraged children to share strategies/thinking.		☐ 1 ☐ 2 ☐ 3 ☐ 4
11	Teacher used errors as opportunities for learning.	N/A ☐	☐ 1 ☐ 2 ☐ 3 ☐ 4
12	Students lead the designated daily routines for the day independently.		☐ 1 ☐ 2 ☐ 3 ☐ 4
13	Students questioned one another about math solutions, representations, or ideas.		☐ 1 ☐ 2 ☐ 3 ☐ 4

Draft

B. Rate how characteristic the statement is of the class that you observed (continued)

1 = **Not at All**
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

		N/A				
14	Students built on one another's ideas trying out what another student did.		☐ 1	☐ 2	☐ 3	☐ 4
15	Students used proof drawings to represent mathematical ideas.		☐ 1	☐ 2	☐ 3	☐ 4
16	Students used visual representations, finger, or manipulative to show conceptual understanding.		☐ 1	☐ 2	☐ 3	☐ 4
17	Students wrote equations to represent mathematical ideas.		☐ 1	☐ 2	☐ 3	☐ 4
18	Students explained math concepts or solutions to one another.		☐ 1	☐ 2	☐ 3	☐ 4
19	Students participated in Quick Practice using group responses (choral or hand signals) or individual boards.	☐	☐ 1	☐ 2	☐ 3	☐ 4
20	Students wrote about math concepts .		☐ 1	☐ 2	☐ 3	☐ 4
21	Teacher used student ideas as the basis of mini-lessons		☐ 1	☐ 2	☐ 3	☐ 4
22	Teacher uses real world situations to illustrate math ideas.		☐ 1	☐ 2	☐ 3	☐ 4

NOTES

ADHERENCE RATING (AR) FORM, SAXON

Reliability Observation: ☐ Yes ☐ No

Teacher Barcode Label

Observer Barcode Label

Evaluation of Mathematics Curricula

OBSERVATION OF MATH INSTRUCTION

Routine Form:
Saxon (blue)

IMPORTANT NOTE

Please use a BLACK pen. Blue or red pens and pencil cannot be read by our scanners.
When asked to mark boxes, make an "X" through the box.

Sample: ☒ Right ☑ Wrong

If you wish to change a response, please mark the correct response and CIRCLE it.

Use block printing as shown below when you complete any numeric or text responses.

0 1 2 3 4 5 6 7 8 9   SAMPLE TEXT

Teacher Name - First ____________ Last ____________

Site Visitor Name - First ____________ Last ____________

School Name ____________

District Name ____________

Date of Observation

__ __ / __ __ / __ __ __ __
mo / day / year

Draft

ROUTINE 1 - specify: | Time: Begin __ __ : __ __ ☐ AM ☐ PM | End __ __ : __ __ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

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Teacher Guidance and follow up questions:

	Total		Tally
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11		Provides **hint** to students	
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Teacher Praise:

	Total		Tally
14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

Draft

C. Evidence of Instructional Behaviors

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8	☐ Yes ☐ No	**Counting** By: ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other:

NOTES

Draft

ROUTINE 2 - specify: ______ Time: Begin ☐☐ : ☐☐ ☐ AM ☐ PM End ☐☐ : ☐☐ ☐ AM ☐ PM

A. Teacher Initiated Instructional Behaviors

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10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
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Teacher Praise:

14		Uses praise or makes **positive comments** focused on **content**	
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Draft

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NOTES

Draft

SAXON

A. **Indicate the presence of following activities in today's instruction**

Math meeting activities:

1	Calendar	☐ Yes ☐ No ☐ NA
2	Counting	☐ Yes ☐ No ☐ NA
3	Number pattern	☐ Yes ☐ No ☐ NA
4	Weather graph	☐ Yes ☐ No ☐ NA
5	Lunch/attendance graph	☐ Yes ☐ No ☐ NA
6	Clock	☐ Yes ☐ No ☐ NA
7	Coin cup	☐ Yes ☐ No ☐ NA
8	Problem solving and mental computation	☐ Yes ☐ No ☐ NA
9	Right/left	☐ Yes ☐ No ☐ NA
10	Fact practice	☐ Yes ☐ No ☐ NA
11	Fact assessment	☐ Yes ☐ No ☐ NA

Lesson:

12	Teacher stated objective for lesson	☐ Yes ☐ No
13	Homework preview	☐ Yes ☐ No
14	Children practiced writing a number at least three times	☐ Yes ☐ No

15 **Children summarized at the end of lesson:** *(Mark one box)*

- ☐ Not at all
- ☐ Teacher summarized
- ☐ One child
- ☐ 2-3 children
- ☐ Multiple children

B. Rate how characteristic the statement is of the class that you observed (check one box for each statement)

1 = **Not at All**
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

1	Teacher was faithful to the script during **routines**.		☐ 1 ☐ 2 ☐ 3 ☐ 4
2	Teacher was faithful to the script during the **lesson**.		☐ 1 ☐ 2 ☐ 3 ☐ 4
3	Teacher used only the materials as described in the lesson.		☐ 1 ☐ 2 ☐ 3 ☐ 4
4	Teacher had materials prepared for lesson.		☐ 1 ☐ 2 ☐ 3 ☐ 4
5	Teacher correctly modeled the concept or procedure according to the directions in the manual.		☐ 1 ☐ 2 ☐ 3 ☐ 4
6	Teacher used the directed correction procedure - when children make errors, teacher immediately corrects the mistake telling the child or having another child tell the correct answer.	N/A ☐	☐ 1 ☐ 2 ☐ 3 ☐ 4
7	Choral or non-verbal group responses were used.		☐ 1 ☐ 2 ☐ 3 ☐ 4
8	Teacher used the materials as directed in the lesson.	N/A ☐	☐ 1 ☐ 2 ☐ 3 ☐ 4
9	Teacher demonstrated recommended strategy or procedure for lesson.		☐ 1 ☐ 2 ☐ 3 ☐ 4
10	Teacher demonstrated alternative strategies.		☐ 1 ☐ 2 ☐ 3 ☐ 4
11	Teacher guided practice in the day's objective.		☐ 1 ☐ 2 ☐ 3 ☐ 4
12	Teacher monitored student completion of "Guided Class Practice" page.		☐ 1 ☐ 2 ☐ 3 ☐ 4
13	Teacher pointed out errors.		☐ 1 ☐ 2 ☐ 3 ☐ 4
14	Teacher corrected errors during student written practice/ independent work.		☐ 1 ☐ 2 ☐ 3 ☐ 4
15	Teacher asked questions that probed thinking (for example, how do you know that?).		☐ 1 ☐ 2 ☐ 3 ☐ 4
16	Lesson was sequenced according to the manual (usually, teacher demonstrated the steps in a procedure or strategy, then guided practice in that objective, then provided distributed practice of previously taught material [using worksheet for the day]).		☐ 1 ☐ 2 ☐ 3 ☐ 4

Draft

NOTES

Draft

Adherence Rating (AR) Form, Scott Foresman-Addison Wesley

Reliability Observation: ☐ Yes ☐ No

Teacher Barcode Label

Observer Barcode Label

Evaluation of Mathematics Curricula

OBSERVATION OF MATH INSTRUCTION

Routine Form:
Scott Foresman-Addison Wesley (yellow)

IMPORTANT NOTE

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Site Visitor Name - First Last

School Name

District Name

Date of Observation

__ __ / __ __ / __ __ __ __

mo day year

Draft

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Draft

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NOTES

Draft

ROUTINE 2 - specify: ______ Time: Begin __ __ : __ __ ☐ AM ☐ PM End __ __ : __ __ ☐ AM ☐ PM

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10		Probes for **reasoning** or justification of solution	
11		Provides **hint** to students	
12		**Clarifies** what student says	
13		**Extends** what student says	

Teacher Praise:

	Total		Tally
14		Uses praise or makes **positive comments** focused on **content**	
15		**Highlights student work** *or solution* to class	
16		Praises **effort or behavior**	

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C. Evidence of Instructional Behaviors

1	☐ Yes ☐ No	Connects lesson to **prior knowledge**/instruction
2	☐ Yes ☐ No	Guides children in **acting out a problem**
3	☐ Yes ☐ No	Leads children in a rap, **song**, or fingerplay to illustrate math concept or practice
4	☐ Yes ☐ No	Uses children's **book** to make connections to math concept
5	☐ Yes ☐ No	Connects math to **real life** problems or situations
6	☐ Yes ☐ No	Directs or encourages students to **help one another** with math
7	☐ Yes ☐ No	Prompts child to guide practice or **lead class** in a routine
8	☐ Yes ☐ No	**Counting** By: ☐ One ☐ Two ☐ Five ☐ Ten ☐ One Hundred ☐ Three ☐ Ordinal ☐ Other:

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A.

1	The teacher identified the important math concept or key idea before the lesson began.	☐ Yes ☐ No
2	Math vocabulary is evident on wall board.	☐ Yes ☐ No
3	Teacher provided opportunities for students to use online materials.	☐ Yes ☐ No
4	Teacher conducted a closure activity.	☐ Yes ☐ No
5	Students who finished early were assigned other tasks.	☐ Yes ☐ No ☐ NA
6	If teacher used multisensory activities (stories, songs, acting out something) was the connection to math concepts clear and explicit?	☐ Yes ☐ No ☐ NA
7	Teacher provided the *Reading Assist* for the practice page.	☐ Yes ☐ No ☐ NA

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B. Rate how characteristic the statement is of the class that you observed (check one box for each statement)

1 = **Not at All**
2 = **Minimally** Characteristic (sometimes evident)
3 = **Strongly** Characteristic (frequently evident)
4 = **Extremely** Characteristic (almost always evident)

1	Children were engaged in completing the *Spiral Review* of previous relevant knowledge and skills.		☐ 1	☐ 2	☐ 3	☐ 4
2	Children were engaged in *Investigating the Concept* activity before workbook page was discussed.		☐ 1	☐ 2	☐ 3	☐ 4
3	Teacher asked the 'talk about it" questions.		☐ 1	☐ 2	☐ 3	☐ 4
4	Teacher asked the 'think about it" questions.	N/A ☐	☐ 1	☐ 2	☐ 3	☐ 4
5	Teacher had students write in mathematics journal.		☐ 1	☐ 2	☐ 3	☐ 4
6	Teacher identified math vocabulary and explained meaning.	N/A ☐	☐ 1	☐ 2	☐ 3	☐ 4
7	There was evidence of ongoing assessment and test-taking practice such as teacher correcting worksheets, using the test-taking practice sheet, teacher collecting checklist information about children's verbal or written responses.		☐ 1	☐ 2	☐ 3	☐ 4
8	Teacher indicated incorrect answers.	N/A ☐	☐ 1	☐ 2	☐ 3	☐ 4
9	Teacher indicated *part* of the answer that is incorrect and asks student to check again.	N/A ☐	☐ 1	☐ 2	☐ 3	☐ 4
10	Students used recommended manipulatives or visual representations (for example, workmat).	N/A ☐	☐ 1	☐ 2	☐ 3	☐ 4
11	Teacher provided error intervention with additional guided practice (or reteaching) on the area of difficulty.		☐ 1	☐ 2	☐ 3	☐ 4
12	The structure of the lesson was warm up (activating prior knowledge), teach, practice, and assess.		☐ 1	☐ 2	☐ 3	☐ 4
13	Children were grouped for activities according to the recommendation in the lesson.		☐ 1	☐ 2	☐ 3	☐ 4
14	Time devoted to different parts of the lesson followed recommendation in lesson.		☐ 1	☐ 2	☐ 3	☐ 4

Appendix C

Examples of Implementation Scales

SCALES BASED ON THE CLASSROOM OBSERVATION PROTOCOL

Behavior Management:

Students are cooperative and attentive to the lesson.
Class runs without disruption from student behavior.
Teacher spends a lot of time managing behavior.
Student behavior disrupts the classroom.
No students misbehave.
Teacher uses praise or rewards to maintain positive behavior.
Teacher uses nonverbal methods (that do not disrupt class) to manage misbehaviors (or no misbehavior was evident).

Productive Use of Time:

Teacher has techniques for gaining class attention in less than 10 seconds.
Students spend little time waiting or transitioning.
Students do not need to wait for the teacher to begin or for other students to finish working before they work on the next problem or activity.
Transitions are smooth, and students get to work quickly.
Teacher spends a lot of time giving directions.

Quality and Differentiation of Instruction:

Students appear familiar with the materials and procedures used.
Teacher is fluid in her presentation of the lesson.
In monitoring student work, teacher followed through to ensure understanding.
During independent work time, teacher monitored student work.
Students are given the opportunity to think and respond (e.g., adequate wait time is given before teacher moves on to another question or student).
Teacher differentiated curriculum for children who were above grade level.
Teacher differentiated curriculum for children who were below grade level.
Teacher differentiated curriculum for children who were English-Language Learners.

Social Environment of Classroom:

Teacher and students have a warm, positive relationship.
Teacher encourages students to help one another understand the math.
Students help one another understand math concepts or procedures.
Peer-to-peer interaction about math occurs.

Student Engagement / Responsiveness:

Students appear excited by the lesson (smiling, leaning forward, waving hands, starting easily and quickly on activity).
Students attend to the lesson in a passive way (looking at the speaker, sitting up, but with limited opportunity to talk or write or manipulate materials).
Students are actively engaged (asking questions, responding, working with materials, writing).
Students are off-task. (reverse coding)

Peer Collaboration / Leadership

Teacher elicits other students' questions about the student's response.
Teacher highlights student work or solution to class.
Teacher directs or encourages students to help one another with math.
Teacher prompts student to guide practice or lead class in a routine.
Student demonstrates work to peers.
Student asks peers questions (about math).
Student discusses strategies / solutions with partner or small group.

Communicating About Mathematics

Students write about math concepts or strategies.
Students write story for equations.
Students write equations.
Students create math problems.
Students create different types of visual and 3D representations.
Teacher elicits multiple representations.
Children use different materials.
Different problem-solving approaches / representations are used.

Direct or Highly Explicit Instructional Approaches (examples of items expected to cluster together)

Teacher states lesson objective at the beginning of class.
Teacher asks closed-ended questions (>20).
Teacher tells information, models procedures, or shows students how to represent concepts.
Teacher states whether or not student is correct.
Teacher calls on other students until correct answer is given.
Teacher provides correct answer right away.
Teacher asks class if they agree or disagree with student response.
Teacher labels math strategy, problem, or concept.
Teacher leads children in a song or fingerplay to illustrate math concept or practice.
Teacher uses a small number of types of representation (<5).

Teacher connects lesson to prior knowledge/instruction.
Choral responding to questions.
Multiple practice problems (both day's objective and distributed practice).
Limited use of materials.
Students practice number facts or procedures.

Guided Discovery Approach (examples of items expected to cluster together)

Teacher poses open-ended questions.
Teacher guides practice on only a few items (<3).
Teacher elicits multiple strategies/solutions.
Teacher probes for reasoning or justification.
Teacher provides hints to student.
Teacher clarifies what student says.
Teacher extends what student says.
Teacher highlights student work or solution to class.
Teacher connects math to real-life problems or situations.
Students discuss strategies/solutions with partners or small group.
Many different materials are used.
Multiple problem-solving approaches are used.
Students play math games.
Students write about math concepts or strategies.

Metacognitive Approach with High Use of Representations (examples of items expected to cluster together)

Teacher asks closed-ended questions.
Teacher guides practice on problems.
Teacher tells student strategy to use.
Teacher elicits other students' questions about the student response.
Teacher labels math strategy, problem, or concept.
Teacher probes for reasoning.
Teacher highlights student work or solution.
Teacher takes students through step-by-step.
Teacher guides children in acting out a problem.
Teacher directs or encourages students to help one another with math.
Students write about math concepts or strategies.
Students write story for equations.
Students write equations.
Students discuss strategies/solutions with partner.
Students ask peers questions about math.
Several different representations are used.

Adherence Forms

The curriculum-specific Adherence forms contain yes/no questions, as well as ratings of instructional behaviors that should be evident in that curriculum. A few items are reverse coded (for example, in Investigations, the teacher should not tell the student if an answer is incorrect). We expect that overall adherence to the curricula will be obtained from the items on these scales.

SCALES BASED ON THE SPRING TEACHER SURVEY

Emphasis on Different Math Content Areas (item 18)

Counting, with whole numbers
Understanding numbers less than 10
Adding and subtracting, with whole numbers
Addition and subtraction facts, with whole numbers
Multiplying and dividing, with whole numbers
Multiplication and division facts, with whole numbers
Place value, with whole numbers
Fractions
Decimals
Percents
Geometric shapes or spacial relationships
Creating, continuing, or predicting patterns
Word problems
Collecting or analyzing data
Graphs
Probability
Measurement of length or capacity with tools (such as measuring rulers, measuring cups)
Nonstandard measurement of length or capacity
Time
Money

Peer Collaboration (item 23 a, c, h, i)

Students work in small groups or with a partner.
Students work individually on math problems from worksheets or textbook/workbook. (reverse coded)
Students reference other students' ideas in their contributions to class discussions.
Teacher asks students to demonstrate a procedure or concept to other students.

Guided Discovery Approaches (item 23 f, g, and item 24 b, d)

Students do problems that have more than one correct solution.

Students discuss different ways of solving a problem.
Teacher invites students to use multiple strategies or solutions to solve a problem.
Teacher asks students to explore a concept or procedure before it is modeled.

Student Engagement (item 22 a, b, c)

Students frequently misbehave during math instruction. (reverse coded)
Students seem excited about learning math.
Students are attentive during math instruction.

Feedback Given to Students (items 25a and 25b)

Teacher corrects the student's mistake as soon as possible.
Teacher asks the student questions that guide him or her to the correct answer.

Use of Representations (item 20d; and item 23 k, l, n, and p)

Manipulatives
Students use manipulatives, pictures, or diagrams to solve problem.
Students use manipulatives, pictures, or diagrams to support explanations.
Students write in math journals (e.g., explain their mathematical reasoning or create their own math problems).
Students practice math facts using manipulatives, pictures, or diagrams for support.

Commitment to Curriculum (item 21)

I have had adequate opportunities to learn about the curriculum.
I can explain to other teachers how to use the curriculum.
The curriculum corresponds well to the math understandings I want my students to demonstrate.
The curriculum is aligned well with other state curriculum standards.
The curriculum conflicts with my preferred approach to math instruction. (reverse coded)
The curriculum assumes major changes in the way I teach math. (reverse coded)
The curriculum has prompted me to change some of my teaching practices in math.
The curriculum is more trouble than it is worth. (reverse coded)
I am committed to the implementation of the curriculum.
All first-grade teachers in my school are committed to the implementation of the curriculum.
I believe my students will score better on required accountability tests because of their experience with the curriculum.

Adherence to Curriculum (all subitems in question 30—the curriculum-specific questions)