

Section (d). Research Narrative

1.0 Contribution of Project to Solving an Education Problem

Despite recent improvements noted in mathematics achievement (NAEP, 2002), less than adequate outcomes in the U. S. have been widely documented for decades (Mathematics Learning Study Committee (MLSC), (National Research Council, 2001). Moreover, recent improvements in mathematics have not been as significant for the most struggling of learners, children from low-income backgrounds and minorities. The consequence of this history of low achievement is a pervasive lack of understanding of mathematics and its utility in everyday life as well as a lack of interest in pursuing mathematics as a profession (National Research Council, 2001; National Council on Education and the Disciplines, 2001). Poor mathematics achievement has been attributed historically to several factors including: low expectations, insufficient opportunities to apply knowledge in authentic situations, lack of fluency on computation, overemphasis on fluency of computation, poor instruction, and inability to problem solve. Attempts to address these factors have too often led to rancorous disagreements and dramatically different instructional approaches that, in the end, have not resulted in better mathematics learning or achievement, especially for the most struggling learners.

In light of state and national reform efforts in the teaching of mathematics (McLaughlin & Verstegen, 1998), expectations for all students have risen, and consequences for continued failure will only continue to become more severe. For example, in one state the standards for kindergarten mathematics development include: *(K.1) Within a well-balanced mathematics curriculum, the primary focal points at Kindergarten are developing whole-number concepts and using patterns and sorting to explore number, data, and shape; and (K.2) Throughout mathematics in Kindergarten-Grade 2, students build a foundation of basic understandings in number, operation, and quantitative reasoning; patterns, relationships, and algebraic thinking; geometry and spatial reasoning; measurement; and probability and statistics. Students use numbers in ordering, labeling, and expressing quantities and relationships to solve problems and translate informal language into mathematical symbols.*

The complex and varied knowledge and skills students, *in kindergarten*, are expected to begin building in a serious way are substantial. Unfortunately, insufficient information is available regarding how best to meet these high expectations for students as they are just beginning school, especially for students experiencing significant difficulties in mathematics, despite the past decade and a half of reforms in the area of mathematics education. The slow pace of research in this area belies the need to better understand the nature of interventions that will lead to substantially improved outcomes in foundational mathematics areas as well as prevent difficulties in learning mathematics for struggling students.

Although research is scant, sustained attention has been directed towards mathematics education. Different and improved mathematics teaching and learning objectives have been identified repeatedly as goals of mathematics reforms. Unfortunately, while standards for more sophisticated learning of early mathematics have been established, few teachers have specific instructional strategies for helping young children meet the high standards (Ma, 1999). One reason that few instructional strategies have been offered is that there is very little empirical evidence regarding the effects of mathematics reforms on learning (Heibert & Wearne, 1993). In addition, a recent meta-analysis of experimental research involving low achieving students documented that very few experimental studies had been conducted focusing on specific instructional practices for improving student learning in mathematics (Gersten, Chard, & Baker, 2000).

To address the lack of knowledge of effective instructional practices, the Committee on Developments in the Science of Learning (2000) calls for researchers, curriculum developers, and expert teachers to collaborate to develop, refine, and evaluate the effectiveness of new educational materials. Linked to the development of better materials, they stated that another critical need to improve overall teaching and learning was formative assessments closely connected with well-designed materials. These assessments, if technically adequate and instructionally useful, would help teachers make instructional decisions to re-teach and review specific knowledge and skill areas. *The three-year study we propose will answer the Committee's call directly by developing and evaluating the efficacy of a mathematics instructional intervention and progress monitoring system designed to address the instructional needs of a wide range of Kindergarten learners in four key areas of mathematics: (a) whole number and number operations, (b) measurement, (c) geometry, and (d) mathematical vocabulary.*

Our specific focus on kindergarten is also clearly supported by the Mathematics Learning and Study Committee (National Research Council, 2001). One of the most troubling aspects of the report is that already in kindergarten, there are considerable differences among students in terms of foundational mathematics knowledge and skill. Not surprisingly, these differences are linked to issues of poverty and ethnicity. Reporting data from the National Assessment of Educational Progress, the report states that while 79% of kindergarten children from middle class backgrounds were able to read numerals, count beyond 10, sequence patterns, and use non-standard units of length to compare objects, only 32% of kindergarten children from high poverty backgrounds were able to do so. And while 66% of white children were able to complete these activities, only 44% of African American children, and 48% of Latino children, were able to do so. Perhaps the most troubling aspect of the report (National Research Council, 2001) is that while the vast majority of children enter school eager to learn mathematics and see themselves as capable mathematics learners, differences quickly emerge and children soon begin to develop the erroneous notion that some children are simply good at learning math but most are not.

2.0 Research Plan

Fundamental tenets of this three-year research project are that mathematics instruction should begin early, should focus on fundamental concepts and principles important to later learning, and should prevent children who enter school with little formal knowledge of important mathematical concepts from falling behind. The purpose of our research is to develop and test a kindergarten mathematics instructional intervention designed to significantly improve students' understanding of number and number operations, measurement, geometry, and mathematical vocabulary and prevent later mathematical difficulties. We expect the following outcomes from the proposed series of studies: (1) An empirically validated instructional approach for developing kindergarten students' mathematical knowledge; (2) Curriculum materials jointly developed with expert kindergarten teachers that promote improved understanding and proficiency with key mathematical concepts and principles; (3) A computer software program that promotes student automaticity and is linked to specific curriculum objectives; and (4) A validated assessment framework for identifying students at-risk for difficulties in learning mathematics.

To achieve these objectives, a three-year project is proposed. **Figure 1 in Appendix A** provides an overview of the project phases. It depicts the major objectives of the project and the specific purposes and goals of each study. The primary focus of Year 1 is the development of a comprehensive instructional approach targeting kindergarten mathematics. We will also develop a series of interim student performance measures linked directly to intervention objectives, and

integrated within our overall assessment framework. Finally, we will develop two classroom observation systems to measure implementation fidelity and student responsiveness to a range of instructional variables. The methodology we will use to accomplish these objectives will center on the use of a *design experiment* (Gersten, Baker & Lloyd, 2000; Brown, 1992), which represents a systematic attempt to develop and formatively refine an instructional intervention framework through cycles of development, observation, analysis, and refinement.

The major objective of Year 2 is to evaluate and analyze the impact of the year-long mathematics intervention. We will conduct a formal experiment with teachers randomly assigned to experimental and comparison conditions. Experimental outcomes, plus detailed analyses of classroom instruction, student-teacher interactions, student-student interactions, and student learning will lead to empirically derived hypotheses associated with improving student learning. We will test these hypotheses in a second major experiment in Year 3. All instruction will occur in intact kindergarten classrooms, and the development of the instructional approach will be executed with particular emphasis on *feasibility* for the range of practicing teachers found in typical school settings under normal conditions. Teacher-researchers will be involved in all aspects of the research to ensure implementation feasibility. To enhance instructional fidelity, we will include in our pool of potential experimental and comparison teachers only those teachers able to make the commitment that rigorous year-long studies require. We will also ensure experimental teachers are highly trained in the relevant instructional methods.

Conceptual Overview

The conceptual framework for the proposed research is based on the integration of three major lines of research related to early mathematics teaching and learning: development of models to represent key mathematical concepts, mathematics-related vocabulary and discourse, and procedural fluency or automaticity.

Development of Mathematical Models

Historically, response to poor achievement in mathematics has been to focus heavily on some single aspect of learning. For example, in the 1980s, fears of flagging performance in mathematics fostered a move away from conceptual understanding to computational fluency. We support the notion promoted by the Mathematics Learning Study Committee (National Research Council, 2001) that mathematics proficiency involves several components, including conceptual understanding *and* procedural fluency. One of the chief components of our proposed instructional approach is explicit instruction in modeling mathematical concepts such as number and number operations, measurement, and geometry. In the following example, we use the concept of number to illustrate the contribution of modeling to this instructional approach.

Often, those who teach mathematics to young children, as well as those who develop curricula for teaching numbers and basic arithmetic concepts to kindergartners, fail to fully take into account that children develop, or fail to develop, *number sense*, i.e., an awareness of, and a feel for, the underlying logic of mathematics. Number sense is an emerging construct (Dehaene, 1997) that refers broadly to a child's fluidity and flexibility with using and manipulating numbers, the almost intuitive sense of what numbers mean, an ability to perform mental mathematics and to look at the world and make what in essence boil down to quantitative comparisons without difficulty (Berch, 1998; Gersten & Chard, 1999).

Some children acquire this conceptual structure *informally*. That is, they acquire number sense over time without intense formal instruction. These children acquire number sense before they begin kindergarten, either in preschool or familial settings that provide multiple and ongoing opportunities for the development of quantitative thinking and analysis. Other children,

who have not had these opportunities in pre-school or at home, require formal explicit instruction to develop this understanding because waiting for them to learn “on their own” the way many middle class children seem to takes too long and the risk of these at-risk students falling dangerously behind their peers before they develop it is too risky (Bruer, 1997; Griffin, 1998).

Mathematics differences among children in kindergarten are dramatic, if perhaps difficult to notice unless they are looked for specifically. For example, one child may enter school knowing that 8 is 3 bigger than 5, while a peer with less well-developed number sense may know that 8 is bigger than 5 but have no idea by how much. Some children may not know automatically that 8 is 3 bigger than 5, but have a strategy for figuring it out by using fingers or blocks. At the other extreme are children who enter kindergarten with no idea what quantities 8 or 5 represent, and find the idea that there is a fixed amount between them that they can precisely calculate on their fingers incomprehensible.

Number sense not only leads to automatic *use* of math information taught in school, but it also is a key ingredient in the ability to solve basic arithmetic problems (Griffin, Case, & Siegler, 1994). Knowing that 15 is much further away from 8 than 11 requires an instant retrieval of two number facts: ($8+7$ and $8+3$). More than 100 basic addition facts must become automatic before students can “play around” and contemplate these types of interesting problems. And students must also have the metacognitive awareness to know which number facts are relevant.

Number sense can be facilitated by environmental circumstances, both in and out of school. For example, Griffin et al. (1994) found that entering kindergartners differed on their ability to answer questions such as, “Which number is bigger, 5 or 4?”, even when they controlled for student abilities in counting and working simple addition problems in the context of visual materials. High-SES children answered the question correctly 96% of the time, compared to low SES children who answered correctly only 18% of the time. Griffin et al.(1994) carefully documented how on average, in well educated middle-class homes, there is a good deal of *informal instruction* about numbers and concepts related to numbers such as “two more” or “double” and, on average, significantly less of this type of instruction in low-income homes.

There is some support that instruction that includes number sense activities leads to significant reductions in failure in mathematics in the primary grades (Griffin et al., 1994; Griffin, 1998). Moreover, we submit that simultaneously integrating number sense activities with early measurement concepts, simple plane geometry, and related mathematical vocabulary, rather than teaching these skills sequentially as is typically done, will reduce subsequent difficulties in mathematics. For example, explicit and systematic development of number models that build on a mental number line appears to be the critical “big idea” necessary for solving addition and subtraction problems in later mathematics learning (Phillips & Crowell, 1994).

Well-constructed representations of number will allow students to solve a wide variety of addition and subtraction problems. Students will learn to represent numbers in three different ways: (a) conventional mathematical symbols (digits, addition, equal signs), (b) horizontal number lines, and (c) vertical number lines. The second and third are intended to foster the sense and understanding of the number line. The vertical representation, a thermometer, shows students that bigger corresponds to higher, smaller to lower. By utilizing only three representation modes, the students can easily trace consistencies across the three. When too many representational systems are utilized, some students, especially those with disabilities or learning problems, may not notice the similarities or retain sufficient understanding of them to know which is being applied after the period of initial learning. We envision introducing children to mathematical models starting with three-dimensional models (e.g., shapes, blocks, sticks,).

leading to two-dimensional representations (e.g., number lines, dots), and then moving to mathematical symbols. As learners develop facility with the conceptual models, they will be taught to use the representations to solve increasingly complex problems. A sample lesson illustrating the use of multiple representations is provided in Appendix B.

Mathematics-Related Vocabulary and Discourse

Students coming to kindergarten naïve of the early mathematical concepts that middle class students typically learn from informal preschool or home interactions often lack a vocabulary that is essential to make progress in formal mathematics instruction. The importance of vocabulary knowledge to school success is widely documented (Anderson & Freebody, 1981; Anderson & Nagy, 1991; Baker, Simmons, & Kameenui, 1998a). Though the Committee for the Prevention of Reading Difficulties (Snow, Burns, Griffin, 1998) concluded that vocabulary development is a fundamental goal for students in the early grades, schools do little to effectively promote the vocabulary development of children (Biemiller, 2001).

Our proposed approach for teaching vocabulary is based on research on the use of explicit vocabulary instruction to promote word learning (Kame'enui, Dixon, & Carnine, 1987; Stahl & Shiel, 1999). In addition to providing a context for learning unfamiliar words, vocabulary must be taught directly and sequentially (Biemiller, 2001). Therefore, a strategic and direct approach to teaching new vocabulary is also required for word learning.

Two specific types of vocabulary are necessary to support early mathematical learning. The first type represents basic concepts such as *before*, *next*, *last*, *after*, *how much*, and *more*. These words, while not specific to mathematics, represent important mathematical and quantitative content and concepts, or are foundational words necessary for describing mathematical ideas. Many students enter kindergarten with insufficient oral language to meet academic expectations and, specifically, lack vocabulary knowledge of these foundational words. The second type of vocabulary that is problematic for many young learners is domain specific vocabulary, in this case, words that are unique to mathematics. Concepts such as multiplication, measurement, and triangle are essential for negotiating successfully within the broad domain of mathematics. In both cases, mathematical achievement requires that these words be taught explicitly so that children can engage in classroom discourse involving expected mathematics objectives as soon as possible.

Although vocabulary knowledge alone will not result in rich and complex discussions, discourse does play an important role in children's math development. There is evidence that discourse can serve as a means of modeling how and when to use particular skills and strategies (Roehler & Cantlon, 1997) as well as to substantiate and clarify students' understandings of key concepts, vocabulary, and ideas (Pressley & McCormick, 1995; Roehler & Cantlon, 1997). Managing classroom discourse, however, is particularly challenging for teachers (NRC, 2001). In most cases, students with the richest vocabulary and most sophisticated discourse skills monopolize the conversation (Greenes, Paratore, & Chard, 1997). When struggling learners are not able to engage in the classroom discourse, they are often not part of the classroom community and cannot benefit easily from peer interactions.

To address the need for improved classroom discourse practices, we propose that an integral part of our instructional approach be a regular problem-solving routine that students work on in small peer groups. These problems will be designed to interest kindergarten learners, encourage multiple means of reaching solutions, and promote challenges to other learners' solution strategies. Initial interactions will be modeled to ensure that at-risk learners know how to engage

in math-related discourse. Instructional components that promote vocabulary development and discourse practices are included in the description of the instructional program in **Appendix B. *Procedural Fluency and Automaticity***

Much of the conceptual knowledge children are taught in kindergarten must eventually be familiar enough so that it can be used fluently and effortlessly to execute the procedures necessary to solve mathematical problems (NRC, 2001). For example, many number concepts in basic operations are initially complex and require students to represent the operation with two- or three-dimensional models. Over time, however, in order for students to free up the cognitive energy needed to focus on more complex problems, they will have to automatically recall many basic operations in executing the steps necessary to solve complex problems. This degree of automaticity often eludes students who are experiencing difficulties with mathematics, and becomes a causal variable in blocking the development of higher levels of mathematics proficiency. Because there is evidence that automaticity can be taught and developed in children to a substantially greater degree than is being achieved currently (Geary, Hoard, & Hamson, 2000), we contend that kindergarten is an opportune time to begin helping students to build automaticity with many basic concepts that can eventually promote fluent problem solving.

Neuropsychological studies of students with significant mathematics difficulties or disabilities have shown that instructional procedures that promote “direct retrieval” of basic math concepts is essential to develop representations of math concepts in working memory (Geary et al., 2000). Geary and colleagues found that in their sample of 84 second grade students, children with significant mathematics delays relied upon procedural problem solving more than their peers who were average-achieving. Woodward (2001; 2003) studied elementary school populations and found that mathematics fluency in basic operations was essential for acceptable performance. To facilitate automaticity development, Woodward and colleagues found that teachers needed to (a) link strategic understanding to visual representations, (b) give students strategies to facilitate learning facts, and (c) provide sufficient mastery practice with careful orchestration of new and reviewed facts (Woodward, 2003). Beyond these initial findings, Woodward found that the students who were experiencing the most difficulty achieving automaticity required additional direct tutoring that puts stress on the classroom teacher.

To address the need for building automaticity in children who are at risk for mathematics difficulties including ELLs, we propose the use of specially designed technology that will build the accuracy and responding rate as students solve specific problems. Hasselbring, Goin, and Bransford (1988) found that computer software was particularly beneficial in building automaticity in mathematics. In their research with 160 students identified as having mild disabilities, Hasselbring et al. (1988) documented that well-crafted software could enhance mathematical automaticity if it identified a learner’s specific knowledge level and built on that existing knowledge in providing problems for the learner. Additionally, well-designed software could reduce the stress on the classroom teacher to provide direct tutorial for automaticity building. A full description of the “Automaticity Builder” software is provided in Appendix B.

Proposed Kindergarten Mathematics Instructional Program (Independent Variable)

Based on the conceptual framework, we are proposing an intervention that will have the following features:

- Instruction organized into weekly (5-day) units that target specific math vocabulary, number and number operations, geometry, and measurement concepts and skills.
- Daily, 20-minute whole class lessons incorporating multiple mathematics strands focused on foundational knowledge and skills.

Mathematics content explicitly introduced and systematically reviewed and extended throughout the week.

Regular opportunities to engage in computer software designed to build automaticity in key skill areas.

A weekly problem solving event drawing on unit skills and concepts that challenge students to think strategically and to use classroom discourse practices to discuss their approach and possible solutions.

Explicit vocabulary instruction that is integrated across the math strands for fluency, maintenance, and generalization.

Opportunities to learn how to use mathematical vocabulary and classroom discourse in small group problem solving discussions

Overview of Research Methods

To evaluate the impact of the instructional intervention we will rely on rigorous standards for field-based, scientific research. Classrooms will be matched on important variables related to intervention and teachers randomly assigned to an intervention or comparison groups. Effects of the intervention will be analyzed on a range of psychometrically sound instructional and student performance measures. Classroom instruction will be measured directly using two observation protocols. The impact of the intervention on student mathematics learning will be measured using valid standardized instruments selected to reflect a range of important mathematics outcomes. We will investigate whether the intervention produces differential student effects, and develop hypotheses to improve learning outcomes for those students who are most at risk of mathematics difficulties, including ELLs.

Guiding Research Questions

The following research questions will be used to anchor our investigations.

Year 1: Design Experiment

Key objectives in Year 1 will be the development of the mathematics intervention, the development and integration of student performance measures linked to specific intervention objectives, and the development of observation protocols for implementation fidelity and student engagement in mathematics lessons.

- 1. What combination of instructional strategies, curriculum materials, and application activities, most effectively help students (a) develop increasingly sophisticated and different representational models of mathematics concepts, (b) build mathematics related vocabulary and discourse, and (c) enhance their procedural fluency and automaticity?**

How can are these objectives be effectively integrated within the context of a comprehensive mathematics intervention; that is, lessons taught for 20 minutes per day by practicing teachers under typical classroom instructional conditions?

- 2. What group and individually administered student performance measures can be used to assess student development of key curriculum objectives?**
- 3. What classroom observation protocols can be used to reliably assess (a) curriculum implementation fidelity and (b) engagement and participation in key curriculum objectives, at the individual student level?**

Year 2: Formal Experiment I

- 1. What is the impact of the intervention on student mathematics achievement on standardized assessments related to number knowledge, vocabulary development,**

problem solving, operations, geometry? Is there differential impact based on student status at entry into kindergarten?

- 2. What is the impact of the intervention on measures designed to assess directly student learning of specific intervention content? Is there differential impact based on student status at entry into kindergarten?**
- 3. What student engagement and participation features during mathematics instruction predict mathematics learning outcomes? We will investigate student participation factors such as overall engagement, opportunities to respond and frequency of responding, feedback provided, and use of mathematics vocabulary and discourse.**

Year 3: Formal Experiment II

Formal research questions will be developed based on Year 2 findings. We will use evidence of overall intervention impact, differential effects based on student knowledge, skill, and classroom participation, and fidelity of implementation to develop specific questions that will be addressed in this second formal experimental study. One likely question will address differential impact. We expect the intervention will be equally effective with at-risk and average-achieving students, but that at-risk students will remain significantly behind their average-achieving peers at the end of year. If this prediction is confirmed, a sample Year 3 research question might be:

- 1. What impact does highly specified intervention procedures have on the mathematics learning and achievement of students most at risk of mathematics difficulty?**

Other research questions might address specific implementation issues that may directly mediate student learning outcomes. For example, if the observation data suggest student interactions during instruction in small groups seem to be contributing substantially to better overall engagement and participation, one question might be:

- 2. What impact do instructional procedures designed to facilitate more intense small group instruction have on overall student engagement and participation rates?**

Similarly, if the data suggest that there are insufficient opportunities for students to respond during lesson instruction, we would modify intervention procedures to increase opportunities for students to respond. Then, in Year 3 we would study the effect of these modifications. Finally, because teachers will be in their second year of implementation, one research question will address the extent to which the second year of implementation results in better learning outcomes for students compared to the first year of implementation. Our hypothesis is that more experience with the intervention will lead to improvements in student learning.

In the following sections we present the rationale, participants, and measures we will use during each year of the study. At the end of these sections we will describe data analysis procedures we will use to answer each type of research question.

Year 1: Intervention Development Via Design Experiments

With complex interventions, it is extremely difficult to adequately operationalize the independent variable without extensive development (Kennedy, 1997; Kline, Deshler, & Schumaker, 1992). As intervention and curriculum developers, we have a solid conceptual sense of what we hope to see during instruction, but until we are able to field-test materials and approaches in kindergarten classrooms we will have only “half-formed images” (Kennedy, 1991) of the specific actions that constitute effective implementation. Difficulties operationalizing instructional approaches are exacerbated by efforts to design interventions that work in real classroom settings with the range of students (Chamot, Keatley, & Mazur, 1999, April; Fuchs & Fuchs, 1998; Klingner, Vaughn, & Schumm, 1998; Malouf & Schiller, 1995).

A *design experiment* is a systematic attempt to develop and formatively refine an instructional intervention through systematic observations and analysis. Because design experiments (Brown, 1992; Gersten et al., 1998) strike a balance between feasibility and fidelity, they are particularly appropriate for the development of our proposed kindergarten mathematics intervention. In Year 1, we will use design experiment methodology to guide intervention development. In between the work of our *intervention development team* in the “laboratory” so to speak, we will use periods of field testing materials and approaches in four kindergarten classrooms. During these periods of classroom testing, we will work with the range of learners in each kindergarten classroom in both whole class and small group formats. We will systematically oversample students at-risk of mathematics difficulties in small group work and place particular emphasis on these students in assessing the impact of the curriculum during whole class instruction. We will also oversample English-language learners (ELLs) and make sure the development of our intervention procedures is sensitive to the unique learning needs of these students. Drs. Baker and Gunn, who have conducted instructional intervention research with ELLs and have considerable expertise in this area, will oversee project efforts involving ELLs. Oversampling at-risk students and ELLs reflects our intent to make sure our intervention framework considers the instructional needs of these students. Our rationale for also including the range of learners in our design experiment is that successful classroom interventions and curricula need to work well with both at-risk and average learners. If kindergarten teachers are going to use the curriculum regularly and intensely as intended, it is critical that the lesson frameworks work with the range of students in their classrooms.

We will use the design experiment methodology for two additional purposes. The first purpose is to develop two classroom observation protocols. One system will be used to directly measure fidelity of implementation; the second will be used to directly measure lesson participation *at the individual student level*. The second additional purpose of the design experiment will be to develop and refine three group and individual student performance assessments that will be used in the formal experiments to assess student learning.

Year 1: Sample Participants

Three local school districts have agreed to participate in the project (see letters of support). In these districts there are 53 elementary schools with two to four kindergarten classrooms per school. There are approximately 25 students per class. All teacher and student participants in the project will be selected from these three districts.

Teacher participants. The major focus in Year 1 is on curriculum development. Primary participants will be 4 general education kindergarten teachers recruited based on their expertise in kindergarten curriculum and instruction. We anticipate selecting all 4 of these teachers from schoolwide Title 1 schools in Springfield Public Schools, a school district we have worked with extensively in the past on elementary school interventions, including kindergarten interventions (e.g., Baker & Smith, 1999; Baker & Smith, 2001). We will work with district *Director of Programs, Dr. Hollenbeck*, as well as individual building principals in selecting four kindergarten teachers. These teachers will be recruited to work as *teacher-researchers* for the duration of the project. Their primary responsibilities will be to serve on the *intervention development team* and to pilot curriculum materials. They will participate most extensively in Year 1. During Years 2 and 3, these teacher-researchers will continue to work on the project to refine and pilot test materials and strategies.

Student participants. All kindergarten students in the teacher-researchers’ 4 classrooms will be participants in the design experiments of Year 1. Teacher-researchers will pilot test

intervention materials with their students. Project staff will collect implementation data during pilot testing and administer group and individual assessments with selected students in these classrooms to determine the efficacy of the intervention lessons. The ultimate goal of the ongoing group and individual assessments is the development of the three *ongoing curriculum assessments* (three group and three individual) that will be administered to 8 target students per class during the two formal experiments in Years 2 and 3 to determine the degree to which students in the intervention group are learning important knowledge and skills compared to students in the comparison group. In terms of mathematics knowledge and skills, a broad range of kindergarten students will be represented in the pilot assessments during Year 1.

Year 1: Measurement Development

A primary goal of Year 1 will be the development of (a) three interim student performance assessments and two observation protocols for (b) measuring fidelity of implementation and (c) student participation during instructional lessons.

Performance assessments. In conjunction with the intervention development, we will develop and field test interim assessments to be administered at three points during Year 2 and 3 formal experiments. At each point, a measure of student participation in a small group problem-solving activity will be administered as well as an individually administered measure of a similar problem-solving activity. These measures will be based on curriculum objectives and tied to classroom instructional routines that will be increasingly familiar to students in the experimental group. However, the performance measures will also have an objective measurable outcome corresponding to broad mathematics standards in kindergarten, so their administration with students in the comparison group will be appropriate. We will also assess a number of process variables that will be a consistent part of the performance assessments. On the group measures, we will observe and audiotape the group's activities as they work through the application problem. We will ascertain the contributions of each member, code the nature of the student-student interactions, and observe the number of different solutions the group comes up with to solve the problem. On the individually-administered measures, we will use an interview format to determine the thinking students engage in to work through the specific application problem, similar to Geary's (1991) system for determining student strategy use.

Observation instruments. Two observation instruments will be developed in Year 1 to measure implementation fidelity and specific instructional practices during Years 2 and 3 of the study. Year 1 will focus on the development and refinement of the observation systems.

Implementation fidelity. The fidelity observation instrument will target specific components of the intervention that should be a daily part of the intervention lesson. The instrument will focus on the delivery of critical program components. One purpose of the fidelity measures will be to ensure that the intervention is being implemented as intended. A second purpose will be to document differences between intervention and comparison classrooms. Consequently, the fidelity instrument will be used in both intervention and comparison classrooms. Some of the items on the measure may be unique to intervention classrooms, such as structured peer interactions to discuss mathematics topics and problems. For these types of items we would expect intervention classrooms to include these components regularly as intended during instruction, and comparison classrooms to rarely, if ever, include them. The fidelity measure will be constructed to reflect these differences. Other items will include important intervention objectives, but will not be unique to the intervention group, and thus will occur with some regularity in the comparison classrooms as well. For example, the fidelity measure will include one or more items related to instruction in key mathematics vocabulary.

Student participation and engagement. A unique and special feature of this study will be the development of an observation system linked to the intervention, that measures levels of engagement and lesson participation *at the individual student level*. In both intervention and comparison classrooms, 8 target students will be observed regularly during the course of the year to determine, at the individual student level, the influence of the instructional intervention on student mathematics achievement. Observation data will be collected on such variables as overall engagement rates during mathematics lessons (e.g., engaged or not engaged at specific points of time), specific student participation patterns and responses to teacher instruction (e.g., hand raises, answers provided, manipulatives correctly sorted or aligned), and mathematical interactions with other students during structured small group and whole class instruction (e.g., solutions offered, questions asked or answered, use of mathematics vocabulary or other relevant utterances).

Classroom observations will emphasize the *opportunities* these students have to use and reason with mathematical concepts, language, and specific vocabulary, and most importantly how these students respond to these opportunities. Part of the emphasis on opportunities to respond will be to investigate the development of specific testable hypotheses for the Year 3 study, focusing on specific attempts to increase learning opportunities for students at-risk for mathematics difficulties.

Year 2: Formal Experiment I

The flexibility that makes *design experiments* useful for developing and refining complex interventions in the context of real classroom settings limits their ability to answer questions regarding instructional effectiveness. Therefore, Years 2 and 3 involve formal experiments to determine the impact of the curriculum. Our goal is to systematically determine the impact of the instructional intervention on the range of students in general education classrooms, paying special attention to impact on students at risk for mathematics difficulties and ELLs.

We will randomly assign a sufficient number of kindergarten teachers to experimental and comparison conditions to substantially reduce the influence of teacher effects in explaining student outcomes (teacher effects is still a potential issue even when students are randomly assigned). We will also assess students on a battery of mathematics measures prior to the study to account for potential pretest differences that may explain outcomes. We do not anticipate there will be systematic differences between students in experimental and comparison classrooms, but if there are we will use appropriate covariant data analysis procedures to account for pretest differences on student learning outcomes. In addition to randomly assigning teachers to condition, we will also match experimental and comparison classrooms on demographic and student variables, and for specific target students who will be assessed on the interim assessments on an ongoing basis, we will match students in experimental and comparison classrooms as part of our procedure for randomly selecting at-risk and average-achieving students for more detailed learning and classroom participation analyses.

In the Year 2 study, 20 kindergarten classrooms will randomly assigned to experimental and comparison conditions. Teachers in the experimental condition will implement the innovative kindergarten curriculum and teachers in the comparison condition will implement their standard mathematics curriculum. In both conditions, mathematics instruction will occur for approximately 20 minutes per day, 5 days per week for the entire school year. A series of mathematics assessments will be administered to determine the overall impact of the innovative kindergarten curriculum. One of the project goals for the Year 2 study is to identify specific instructional procedures, strategies, and activities that maximize engagement and learning of

students most at-risk for mathematics failure. Detailed classroom observations, audio-taped lessons, and mathematics performance assessments (group and individual) will contribute to a rich database for addressing the impact of the curriculum on student learning and identifying precise areas of curriculum refinement that will be investigated experimentally in Year 3.

Year 2: Sample Participants

Teacher participants. In the spring of Year 1, 20 teachers will be recruited from Title I schools with the largest English Language Learner (ELL) populations from the three participating school districts. These teachers will participate in the project for two years. Recruitment efforts will focus on the importance of developing effective mathematics programs in kindergarten, the project's potential to significantly improve the mathematics achievement of all kindergarten students, and the strong professional development (PD) that will be provided to participating teachers. Teachers will also receive a modest stipend each year for their efforts.

Participating teachers must agree to five project requirements: (a) participation for two years; (b) random assignment to experimental or comparison group; (c) four days of PD targeting implementation prior to the beginning of the school year; (d) allowing project staff to conduct classroom observations and assessments; and (e) working with project staff on implementation fidelity during the course of the study, which may include additional PD.

At the end of Year 1, teachers will be randomly assigned to experimental or comparison groups. Teachers assigned to the *intervention mathematics group* will implement the curriculum for two years, with a new cohort of kindergarten students each year. Teachers assigned to the *comparison mathematics group* will implement their standard curriculum for two years, also with a new cohort of kindergarten students each year. After two years, if the curriculum proves effective, we will provide PD to teachers in the comparison group at no charge. This is intended to serve as incentive for teachers assigned at the outset of the study to the comparison group.

Student participants. In Year 2, all students in the 20 classrooms will participate. All students in the experimental and comparison classrooms will be administered standardized mathematics assessments at pretest and posttest (one of the standardized assessments will also be administered at mid-year). In addition, a sample of 8 students in each classroom will be administered performance assessments at three points during the intervention to determine ongoing student learning and progress. These 8 students will be randomly selected from stratified samples of kindergarten students in both intervention and comparison classrooms.

Pretest data will be used to stratify students in each classroom into two groups: (a) a group of students at risk for mathematics learning difficulties, approximately the lowest one third of students in the class; and (b) a group of average-achieving students, including all of the other students in the class. Group status will be based on a combination of pretest data and teacher professional judgment.

The 10 experimental and 10 comparison classrooms will be matched on pretest data, SES, and other salient factors. Then, for each matched pair of classrooms, at-risk students in the intervention classrooms will be matched with at-risk students in the comparison classrooms. The same matching procedure will be used with the average-achieving students. Matched pairs of students will be randomly selected to participate in the subsample of target students so that there will be 4 target students per class in the at-risk group and 4 target students per class in the average-achieving class. These 8 students per classroom will participate in the performance assessments and will be the target of observations during mathematics instruction.

Year 2: Measures

For the formal experimental study in Year 2, three types of measures will be used: (a) student measures of mathematics learning and performance; (b) classroom observation measures of implementation and student participation during instruction; and (c) a teacher interview and standardized survey that addresses implementation of the experimental intervention. The administration schedule for these measures is presented in the following **Table 1** in **Appendix A**.

Student Measures. Three types of student measures will be administered to assess intervention impact. At pretest and posttest a published standardized measure of mathematics achievement will be administered to all students in intervention and comparison classrooms. At three points during the school year, a series of standardized progress monitoring measures will be administered to 8 target students per classroom. At three other points during the year, the group and individual performance measures will be administered to the same subsample of 8 target student in each classroom to determine the degree to which students in intervention and comparison classrooms are learning key kindergarten objectives targeted in the intervention.

Stanford Achievement Test-Tenth Edition [SAT-10] (Harcourt Brace Educational Measurement, 2003). The SAT-10 is a group administered, standardized, published test of academic achievement. The mathematics section of the test will be administered to all students in intervention and comparison classrooms at pretest and posttest. The SAT-10 will also be administered to students at the one-year follow-up, that is, at the end of first grade. The SAT-10 is aligned with objectives of mathematics curricula that stress development of number sense and a conceptual understanding of arithmetic concepts. The kindergarten measure covers content related to vocabulary (i.e. more, less, most), counting, dividing a whole into parts, sequencing, and single digit addition and subtraction. The psychometric properties of the measure are strong, with well-reported validity and reliability data.

Number Knowledge Test (Okamoto & Case, 1996). The Number Knowledge Test (Okamoto & Case, 1996) has been used to chart children's developmental profiles of numerical competency (Case, Okamoto, Henderson, McKeough, & Bleiker, 1996; Okamoto & Case, 1996) and to study the effect of math instruction on kindergarteners from low SES families (Griffin, 1998). Administered individually, this measure allows the tester to understand the depth of understanding (Griffin, 1998, p. 1) that a student has developed related to a particular concept. We have used this measure extensively with hundreds of kindergarten children (Chard et al., in press). When administered in kindergarten, it has been a strong predictor of subsequent mathematics performance at the end of grade 1, accounting for 68% of the variance on a standardized mathematics test. The measure has been shown to have excellent sample distribution properties even when administered very early in kindergarten and is an excellent indicator of children's growth over the course of the kindergarten year.

Early Numeracy-Curriculum-Based Measurement (EN-CBM) (Clarke & Shinn, in press, Chard et al., in press) EN-CBM are a set of measures based on principles of curriculum-based measurement that has been validated extensively in reading, primarily oral reading fluency (Shinn, 1992). EN-CBM measures were developed from the research base examining the progression of children's informal mathematical knowledge. Each fluency-based measure requires the student demonstrate a skill that provides a foundation for later mathematics. The EN-CBM measures have been validated for use with first grade students. Based on the strong support for these measures with first grade students we have conducted extensive field-testing of these measures with kindergarten students. Our preliminary analysis indicates they are reliable and valid with kindergarten students. They are strong predictors of future mathematics

performance, sensitive to small changes in student learning, and can be administered frequently as a formative measure of student learning. Each measure is detailed below.

Number Identification Measure (NI). The NI measure requires students to orally identify numbers between 0 and 10 when presented with a set of printed number symbols. Students are given a sheet of randomly selected numbers formatted in an 8 by 7 grid. The number correctly identified in 1 minute is reported. With first-grade students, the NI measure has reliabilities ranging from .76 to .99 and concurrent and predictive validities ranging from .60 to .72 with other published standardized measures.

Quantity Discrimination Measure (QD). The QD measure requires students to name which of two visually presented numbers is larger. Student performance is reported as the number of correctly identified larger numbers in 1 minute. With first-grade students, QD has reliabilities ranging from .85 to .99 and concurrent and predictive validities ranging from .70 to .80.

Missing Number Measure (MN). The MN measure requires students to name the missing number from a string of numbers (0-10). Students are given strings of three numbers with the first, middle, or last number of the string missing. The number correctly identified in 1 minute is reported. With first-grade students, MN has reliabilities ranging from .78 to .98 and concurrent and predictive validities ranging from .67 to .78.

Performance assessments. The development of the performance assessments were described in Year 1 above. All 8 target students in the intervention and comparison classrooms will be administered a group and individual performance assessment three times during the year. Measures will be closely aligned to the problem-solving application activities in the intervention.

Classroom observations. Two classroom observation measures will be used to assess intervention fidelity and student participation during instruction.

Intervention fidelity. The development of the fidelity measure was described under Year 1. Measures of fidelity will occur monthly for each teacher. These measures will occur during the entire 20-minute mathematics lesson. The fidelity implementation checks serve two purposes. The first is to ensure that intervention teachers are implementing the intervention as intended. If fidelity is low, or if teachers have questions about implementation, the monthly fidelity checks will give project staff the opportunity to provide clarification or more PD, to make sure that implementation objectives are met. The second purpose of the fidelity checks is to document differences between instruction in intervention and comparison classrooms.

Student participation and engagement. The development of the student observation system was described under Year 1. Each of the 8 target students per classroom will receive four, 20-minute observations during the course of the year. These will be spaced at approximately equal intervals throughout the year. During Year 1, we will determine whether observing each student during an entire lesson, or using momentary time-sampling procedures to observe multiple students per lesson provides a more accurate gauge of student engagement and participation.

Teacher Measures. Each intervention teacher will be interviewed and complete a standardized questionnaire focusing on their thoughts and feelings about the intervention. These measures will be the primary data sources used in 10 individual case studies of intervention teachers. The purpose of the case studies will be to describe the evolution of implementation of the intervention over time. We hypothesize that intervention teachers will initially have concerns about the intervention and struggle with certain aspects of implementation (Hall & Hord, 2001). Over time teachers' skill in using the intervention will grow, as will their enthusiasm for the intervention. By the end of Year 3, when teachers have implemented for two full years, we predict they will be strong supporters of the intervention as well as strong implementers. This

timeframe for “full” implementation effectiveness is supported by research evidence (Gersten, Baker, & Lloyd, 2000).

Levels of Use Interviews (Hall & Hord, 2001; Loucks, Newlove & Hall, 1975). The Levels of Use interview system (Loucks, Newlove & Hall, 1975) will be used with all teachers at the end of Years 1, 2, and 3. Interview content is quantifiable according to the extensiveness that a particular innovation has been implemented, and the degree to which teachers understand key principles underlying the approach. The semi-structured format also provides a rich source of data for qualitative analyses (Baker, Gersten, Dimino, & Griffith, in press). This system has been widely used over the past twenty years and demonstrates high levels of validity with direct observational measures (e.g., Gersten, Carnine, Zoref & Cronin, 1986). Levels of Use interviews will be conducted in the spring of Years 1, 2, and 3.

Stages of Concern Questionnaire (Hall & Loucks, 1978) will be used in conjunction with the Levels of Use interview. This 35-item measure is designed to identify concerns teachers experience during implementation of a teaching innovation. On a Likert scale, teachers indicate their concerns about aspects of an innovation or approach. Research has shown teachers’ concerns about using new interventions change over time from concerns about managing the logistics and material of the intervention to concerns about being able to document the impact of the intervention on student learning outcomes (Baker, et al., in press; Hall & Hord, 2001). Stages of Concern is the most widely used survey in intervention research and has been used by one of the Principal Investigators (Baker et al., in press). Teachers in the intervention group will fill out the Stages of Concern in the spring before beginning the intervention (Year 1) and in the spring of the first and second intervention years (Years 2 and 3).

Year 3: Formal Experiment II

Part of our data collection strategy for Year 2 will be used to guide the development of specific research hypotheses we will test in Year 3. A potential study we would conduct in Year 3 involves a hypothesis with related components that address (a) teacher expertise and (b) the instructional needs of the lowest performing students. The first part of the hypothesis is that because teachers’ expertise in implementing complex and challenging curricula improves over time (Gersten, Chard, & Baker, 2000), we predict that teachers implementation of the mathematics intervention will continue to improve in Year 3. We would compare teachers’ second year of implementation (i.e., Year 3) to their first year of implementation (i.e., Year 2). A related comparison would involve student outcomes in Year 3 where we predict that students in intervention classrooms would do better on mathematics measures than comparison students.

In terms of student outcomes, we have an additional specific hypothesis we would test in Year 3. We hypothesize that one way teacher expertise is most clearly manifested is through better instruction for those students most at risk of mathematics failure, including those students who are ELLs. More than other students, at-risk students benefit from teachers who are able to gauge on an almost moment-by-moment basis what difficulties struggling students are having learning a particular concept or applying a particular strategy, and are able to make both subtle and substantial instructional adjustments. We will test this hypothesis by determining the extent that experienced teachers adjust their instruction to meet the learning needs of students in the classroom and by the degree of engagement and active learning of at-risk students in the classrooms of teachers who have a second year of experience with the curriculum. At-risk students in intervention classrooms should have more and improved instructional opportunities than the previous at-risk cohort.

These differences across years would be manifested on observations targeting student engagement and participation. A second way these differences would be manifested would be through more granular analysis of student learning. In Year 2 we predict that both at-risk and average-achieving students will do better in intervention than comparison classrooms but that there will still be a considerable discrepancy between the performance of at-risk and average-achieving students within intervention classrooms. In Year 3, our prediction is that improved expertise of intervention teachers will result in a statistically significant decrease in the gap between at-risk and average-achieving students within intervention classrooms.

Year 3: Sample Participants

Teacher participants. The same teachers who participated in the formal experiment in Year 2 will continue to participate in Year 3.

Student participants. As in Year 2, Year 3 student participants will be yoked to the participation of their teacher, and students in experimental classrooms will be matched with students in comparison classrooms. All students will be administered the battery of mathematics assessments to determine the overall impact of the intervention curriculum on student learning. In each classroom, 8 students will also be selected for the ongoing performance assessments and as targets for student observations. This is the same configuration of student participants, measures, and observations used in Year 2. A second group of students will also participate in Year 3. Kindergarten students who participated in the Year 1 study will be followed into first grade and assessed the end of their first grade year to determine the long-term impact of the kindergarten intervention on student mathematics learning.

Year 3: Measures

The measurement protocol in Year 2 will be utilized in Year 3. In addition, students from Year 2 will be assessed in the spring to determine the continued impact of the intervention in first grade. Students will be assessed on the SAT-10 and the EN-CBM.

Data Analysis for Student Mathematics Measures

For student assessments involving mathematics learning and performance, our analytic procedures will focus on differences between students in the intervention and comparison groups on identifying students for whom the intervention is most successful. At the end of Year 3, we will also conduct secondary analyses investigating whether teacher improvements in implementation of the intervention in Year 3 over Year 2 result in better student outcomes. We will follow analysis procedures for determining intervention impact on students using the same procedures as Stoolmiller et al., (2000). Muthén and Curren (1997) described the underlying conceptual considerations of this approach and possible contrasts.

When the intervention is delivered to an entire target population, it is frequently the case that individuals at different pre-intervention levels on the outcome variable benefit differently from the intervention (Cronbach & Snow, 1977). Thus, a major part of our analysis will be to determine if there are differential effects based on student status at entry into kindergarten. This will help us understand whether the intervention is more effective for at-risk students or average-achieving students.

Differential intervention effectiveness is a change process that disrupts the natural stability of the intervention group outcome and, in simple pre-post designs, lowers the slope of the post on pre regression (assuming the regressions are essentially linear, which we will test before proceeding). The natural stability of the outcome is represented by the posttest on pretest regression in the comparison group. Differences in slopes among the groups signal differential effectiveness. These differences will be tested using the standard approach for testing

homogeneity of regression in ANCOVA where the covariate is the pretest (Cohen & Cohen, 1983; Stoolmiller, Eddy & Reid, 2000). If we do not find strong evidence of differential effectiveness, we will fit simpler models using repeated measures analysis of variance (ANOVA). In this case, we predict the group by time interaction will be significant, which we will then analyze according to a specific set of contrasts. Overall, we expect students in the intervention classrooms to be equivalent to students in the comparison classrooms on all measures before intervention, but to be significantly higher after intervention. If we find evidence of differential effectiveness, we will determine where in the pre-score distribution (at-risk group or average-achieving group) the intervention was significant. The mean difference will be computed by plugging the pre-intervention score in the fitted equation for the intervention group and then subtracting the predicted intervention mean from the predicted comparison mean (Stoolmiller et al., 2000).

Student observations. On the student observation measure we will conduct data reduction procedures prior to formal analysis to identify a manageable structure. We will identify major factors and compute separate construct scores from the items comprising each major dimension. We will conduct separate analyses on the individual construct scores and collapse across dimensions only if the pattern of results on intervention effects is similar across dimensions. Of the primary observation variables identified in Year 1, we expect the intervention to have its strongest impact on specific variable categories. Data reduction will be based on these apriori predictions. For example, we expect one of the strongest differences between students in intervention and comparison classrooms will be opportunities to engage in discourse and reasoning, and for students in intervention classrooms to have higher participation “scores” in than students in the comparison classrooms. We will reduce the data in other ways only if these types of predictions do not fit the data or if intercorrelations among items warrant it. We will employ the types of ANCOVA procedures described above to examine group differences on participation constructs and differential impact based on student at-risk status. We will also use multiple regression techniques to determine the influence different student participation variables have on measures of student mathematics performance.

Fidelity of implementation. Although the sample size for the fidelity of implementation measure will be relatively small (10 teachers in the intervention group and 10 in the comparison group), we will still be able to investigate differences using inferential techniques. The reason is that the fidelity measure will be designed to identify specific features of the study unique to the intervention group. In other words, differences between intervention and comparison classrooms should be large and statistically significant, even given the relatively small sample size.

Power calculations. The power of this design to detect treatment impact on student achievement will be robust. We expect differences between intervention and comparison groups to be pronounced; student measures are reliable and sensitive to instruction, and the student sample is large. *We expect treatment impact to be at least moderate in magnitude (above .50 SD units)*, but we will be able to detect even very small differences between groups. The power of the design to detect treatment differences between intervention and comparison groups has been calculated with a sample of measures using a “main effects” model (Keppel, 1982). We adjusted sample size to reflect intervention comparison differences without attrition as well as differences calculated with very high attrition rates (i.e., 50% over the year). On the SAT-10, the power to detect treatment effects (regardless of attrition rates) will be at or near the maximum value (above .99), even when treatment effects are relatively small (i.e., .10 SD units). Calculations were based on a sample of 250 students administered the SAT-10 in the spring of kindergarten.

In terms of mathematics performance and measures of participation for the subsample of 8 students per class, we will have sufficient power to detect differences. We have no estimates for score values we can use for power calculations because these measures will be developed in first year of the study. However, a couple of factors are relevant in terms of power. First, the sample size for the target students will be large ($n = 160$) and will be able to detect even small differences. Second, the performance measures and the student participation measures will be designed to capture unique facets of the intervention. Thus differences between intervention and comparison groups should be more pronounced than on the standardized measures. That is, differences should be moderate to large (Cohen, 1988) and capable of being detected even with considerable attrition. For example, in terms of intervention effectiveness for at-risk students, we would have a sample of 80 students with no attrition. At this level our design would detect small differences between groups. However, if attrition was 50%, our power would be about .77 to detect a small difference at alpha level of .05.

Data Analysis for the Design Experiment and Teacher Case Studies

For the design experiment, we will use qualitative data analysis methods (Baker, Gersten, Dimino, & Griffiths, in press;) paying particular attention to constructing data analysis matrices according to procedures described by Miles and Huberman (1994) to understand intervention impact on student learning. We will study student learning on the performance assessments and on the EN-CBM (described in Year 2 Measures section). Student data will be used to inform modifications of the intervention to ensure increasingly higher levels of student learning. We will also use the data collected in the development of the classroom observation systems to inform our ongoing refinements of the intervention.

Case studies will be conducted with the 10 teachers who will implement the intervention in Years 2 and 3. Qualitative analyses will focus on multiple sources of data. For example, observations of mathematics instruction and student measures of performance will provide direct and indirect measures of teacher change. We will use constant comparative methods to analyze changes in implementation among teachers and will use our field notes to attempt to explain these observed phenomena. Teachers' responses to the Levels of Use interview will be used to search for themes or common ideas (Baker et al., in press; Miles & Huberman, 1994; Vaughn, Schumm, & Sinagub, 1996). We will apply a systematic procedure for the analysis of interview data that includes categorizing findings according to thematic units and then sorting and categorizing data to verify or contradict these themes. We will generate data display matrices using important factors thought to underlie key implementation targets, such as teacher understanding of the curriculum, modeling and feedback during instruction, and opportunities for at-risk students to participate during instructional lessons. We will contrast these patterns in different ways, such as among teachers who provide extensive opportunities versus teachers who provide substantially fewer opportunities.

3.0 Qualifications of Key Personnel

Dr. David Chard, Co-Principal Investigator. Dr. Chard is Associate Professor at the University of Oregon where he serves as Director of Graduate Studies for Special Education. His research and teaching interests are in the instruction of early literacy and mathematics skills for all students including students with disabilities. He has been a PI on state and federal research and training grants totaling more than \$10 million. Currently, Dr. Chard is the principal investigator on two federal research projects on mathematics and reading comprehension instruction in the primary grades. He also serves as a research associate to two federally-funded centers focused on school-wide models of reading and behavioral prevention and intervention

and is an associate of the National Reading First Technical Assistance Center. He is the author of core curricular programs in elementary reading and mathematics, and in middle school mathematics. He has taught elementary and secondary school in Michigan, California, and in the U.S. Peace Corps in southern Africa.

Dr. Scott Baker, Co-Principal Investigator. Dr. Baker is currently a research associate at the University of Oregon. He specializes in early literacy measurement including mathematics, academic achievement, and English-language learners. Baker is Co-Principal Investigator on an IES grant on Reading Comprehension, and is Director of Evaluation for the Oregon Reading First Center. Baker's scholarly contributions include conceptual, qualitative, and quantitative publications on a range of topics related to students at-risk for school difficulties and students who are English-language learners. His publications have appeared in journals such as *School Psychology Review*, *Exceptional Children*, *Reading Research Quarterly*, *Elementary School Journal*, and *Review of Educational Research*. Dr. Baker has conducted a number of meta-analyses on effective instruction for at-risk students, having most recently completed a meta-analysis on effective instruction for students experiencing difficulties in mathematics.

Dr. Benjamin Clarke, Project Coordinator. Dr. Clarke conducts research in the area of reading comprehension and early mathematics assessment. Formerly, Dr. Clarke was a school psychologist for the Bend-Lapine School District. His research and teaching interests are in the area of elementary mathematics assessment and instruction. His doctoral dissertation studied the development of an early numeracy curriculum-based measurement system. AIMSweb has developed his dissertation work for use as an Internet based schoolwide math evaluation and progress monitoring system. Dr. Clarke also serves as an associate of the National Reading First Technical Assistance Center. Dr. Clarke has published articles on curriculum-based measurement and early math assessment.

Dr. Ruth Kaminski, Research Associate. Dr. Kaminski brings considerable expertise related to prevention and early intervention and ten years' experience collaborating on projects with Head Start. Since 1994 Dr. Kaminski has directed a program of research to examine effectiveness of classroom and parenting interventions for preschoolers who are at-risk for later social/academic difficulties.

Dr. Barbara Gunn, Consultant. Dr. Gunn studies early childhood literacy development and effective approaches for developing beginning reading skills among Spanish and English-speaking students. She is the co-investigator on an early childhood research project funded by NICHD. Dr. Gunn is an experienced general education teacher, and has taught first, third, fourth, and fifth grades. She has also supervised student teachers and taught courses in the special education program at the University of Oregon. She has authored curricular programs, book chapters and journal articles on reading instruction and development.

Kathleen Jungjohann, M.S., Intervention Development/Research Assistant. Kathleen Jungjohann coordinates the Special Educator Licensure Program at the University of Oregon and has over fifteen years experience training preservice teachers. She specializes in effective instructional design to meet the needs of a diverse range of learners, including students from diverse cultural, linguistic, and socioeconomic backgrounds. Currently, Ms. Jungjohann consults in reading, language arts, and math curriculum with elementary schools with a majority of students from culturally, linguistically, and economically diverse backgrounds in Hawaii and Oregon.

Lisa Howard, M.S., Intervention Development/Research Assistant. Ms. Howard has taught Title 1, special education, and general education with students in grades 1-12. She has worked on

numerous federal research projects in both reading and math—serving as a Research Assistant and Project Coordinator. Currently she is the Coordinator for a project designed to improve comprehension and vocabulary in first grade using read aloud books. Ms. Howard co-authored the primary reading program *Read Well and Write Well Spelling*.

Janet Otterstedt, M.S., Research Assistant. Ms. Otterstedt has a master’s degree in school psychology and currently works as a research assistant. She has training and experience working with young children and their parents. Her responsibilities as a Project Coordinator have included serving as a liaison with principals and teachers, training data collectors, scheduling and over-seeing data collection activities including managing and analyzing data.

Rachell Katz, M.S., Research Assistant. Ms. Katz is a doctoral candidate in the school psychology program at the University of Oregon. Her work with Drs. Baker and Chard has focused on the development of early math skills for kindergartners and first graders. This has included organizing and participating in data collection as well as conducting observations in the classroom during math instruction. Ms. Katz is a licensed school psychologist and has worked closely with teachers to develop effective instruction for learners from diverse backgrounds.

4.0 Adequacy of Resources

The University of Oregon is a research university and the only Oregon member of the Association of American Universities. The various colleges and departments at the University offer programs for over 18,000 undergraduate and graduate students per year. The College of Education is a major contributor to the University’s instructional and research programs. The College of Education faculty was ranked number 1 in research productivity per member according to US News and World Report. The College’s research and outreach mission is coordinated through four centers and institutes. The Institute for the Development of Education Achievement, directed by Dr. Ed Kame’enui, manages the fiscal and personnel matters for six prominent research groups, including the Center for Teaching and Learning. IDEA provides accounting, travel, grants management, and technology support which will facilitate the administration of the current project. IDEA currently manages over research grants and contracts totaling more than \$9 million dollars. All staff members are equipped with a desktop computer. The computers are a mix of Macintoshes running Mac OS X, and PCs running Windows XP or Windows 98. Most machines are located on campus and connected to the University of Oregon’s high-speed internal and external network. All machines have access to an IDEA file server. The standard office applications used are Word, Excel, and PowerPoint. The standard database is FileMaker Pro, and the standard e-mail client is Eudora. For data analysis, IDEA own and licenses for SPSS and S-Plus, and University-wide site licenses are available for SAS. In addition, the University has extensive computer mainframe resources for data analysis, including SPSS, SAS, S-Plus, and Minitab. The main University library holds over 2 million volumes, including subscription to more than 20,000 professional journals. The Instructional Media Center provides support for video development and editing.

Specific information about participating schools can be found in **Appendix A**.

IntelliTools, Inc. will develop the technology component of the intervention as described in Appendix B. IntelliTools is a leader in software and hardware development in education. IntelliTools has been researching math solutions for students since 1992 through awards from NICHD and NSF including instructional tools like *IntelliMathics* and *IntelliKeys*. Their emphasis has been and continues to be technology solutions for diverse learners.

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- Griffin, S. A., Case, R., & Siegler, R. S. (1994). Rightstart: Providing the central conceptual prerequisites for first formal learning of arithmetic to students at risk for school failure. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp. 24-49). Cambridge, MA: MIT Press.
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- Kame'enui, E. J., Dixon, D. W., & Carnine, D. (1987). Issues in the design of vocabulary instruction. In M. G. McKeown & M. E. Curtis (Eds.), *The nature of vocabulary acquisition* (pp. 129-145). Hillsdale, NJ: Lawrence Erlbaum.
- Kennedy, M. M. (1991). Implications for teaching. In E. A. Ramp & C. S. Pederson (Eds.), *Follow through: Program and policy issues* (pp. 57-71). Washington, D.C.: Office of Education Research and Improvement, U.S. Department of Education.
- Kennedy, M. M. (1997). The connection between research and practice. *Educational Researcher, 26*(7), 4-12.
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- Kline, F. M., Deshler, D. D., & Schumaker, J. B. (1992). Implementing learning strategy instruction in class settings: A research perspective. In M. Pressley & K. R. Harris & J. T. Guthrie (Eds.), *Promoting academic competence and literacy in school* (pp. 361-406). San Diego: Academic Press.
- Klingner, J. K., Vaughn, S., & Schumm, J. S. (1998). Collaborative strategic reading during social studies in heterogeneous fourth-grade classrooms. *Elementary School Journal, 99*(1), 3-22.
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- Ma, L. (1999). Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States. Mahwah, NJ: Lawrence Erlbaum Associates.
- Malouf, D. B., & Schiller, E. P. (1995). Practice and research in special education. *Exceptional Children, 61*, 414-424.
- Mathematics Learning Study Committee (2001). *Adding it up: Helping children learn*. Washington, DC: National Academy Press.
- McLaughlin, M. J., & Verstegen, D. A. (1998). Increasing regulatory flexibility of special education programs: Problems and promising strategies. *Exceptional Children, 64*(3), 371-384.
- Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.
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- Muthén, B. O., & Curran, P. J. (1997). General longitudinal modeling of individual differences in experimental designs: A latent variable framework for analysis and power estimation. *Psychological Methods, 2*(4), 371-402.

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- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. Washington, DC: National Academy Press.
- Okamoto, Y., & Case, R. (1996). Exploring the microstructure of children's central conceptual structures in the domain of number. In R. Case & Y. Okamoto (Eds.), *The role of central conceptual structures in the development of children's thought: Monographs of the Society for Research in Child Development*, (Vol. 1-2, pp. 27-58).
- Phillips, D., & Crowell, N. A. (1994). *Cultural diversity and early education: Report of a workshop*. Washington, DC: National Academy press.
- Pressley, M., & McCormick, C. B. (1995). *Advanced educational psychology for educators, researchers, and policymakers*. NY: Harper-Collins.
- Roehler, L. R., & Cantlon, D. J. (1997). Scaffolding: A powerful tool in social constructivist classrooms. In K. Hogan & M. Pressley (Eds.), *Scaffolding student learning: Instructional approaches and issues*. Cambridge, MA: Brookline.
- Shinn, M. R., Good, R. H., Knutson, N., Tilly, W. D., & Collins, V. (1992). Curriculum-based measurement of oral reading fluency: A confirmatory analysis of its relation to reading. *School Psychology Review*, 21, 459-479.
- Snow, C. S., Burns, S. M., & Griffin, P. (1998). *Preventing reading difficulties in young children*. Washington, D.C.: National Academy Press.
- Stahl, S. A., & Shiel, T. G. (1999). *Teaching meaning vocabulary: Productive approaches for poor readers. Read all about it! Readings to inform the profession*. Sacramento: California State Board of Education, pp. 291-321.
- Stoolmiller, M., Eddy, J. M., & Reid, J. B. (2000). Detecting and describing preventative intervention effects in a universal school-based randomized trial targeting delinquent and violent behavior. *Journal of Consulting and Clinical Psychology*, 68, 296-306.
- Woodward, J. & Montague, M. (2002) Meeting the challenge of mathematics reform for students with LD. *Journal of Special Education*, Summer, 1-22
- Woodward, J. Monroe, K., & Baxter, J. (2001). Enhancing student achievement on performance assessments in mathematics. *Learning Disability Quarterly*. 24 (1), 33.

DAVID J. CHARD
(Brief Vita, Winter 2003)

EDUCATION

Ph.D., Special Education, University of Oregon, Eugene, 1995

B.S., Mathematics/Chemistry Education, Central Michigan University, Mt. Pleasant, 1985

PROFESSIONAL EXPERIENCE

Associate Professor; Assistant Professor Director of Graduate Studies	Special Education Area University of Oregon Eugene, OR	Fall, 2003 - present Fall, 2000 – Fall 2003
Assistant Professor	Department of Special Education The University of Texas at Austin Austin, TX	Fall, 1997 – Fall 2000
Assistant Director	Texas Center for Reading and Language Arts The University of Texas at Austin Austin, TX	Fall, 1997 – Fall 2000
Assistant Professor	Department of Special Education School of Education Boston University, Boston, MA	Fall, 1995 - Fall, 1997

RECENTLY FUNDED GRANTS

The Story Read Aloud Project: The Development of an Innovative Instructional Approach to Promote Comprehension and Vocabulary in First Grade Classrooms. U.S. Department of Education, Office of Educational Research and Improvement (CFDA 84.305G), \$1,019,249, Principal Investigator.

Center for Improving Reading Competence Using Intensive Treatments Schoolwide (Project CIRCUITS). U.S. Department of Education, Office of Special Education Programs (OSEP) (CFDA 84.324X), Centers for Implementing K - 3 Behavior and Reading Intervention Models, \$900,000, Research Associate.

Texas Reading Leaders. Office of Statewide Reading Initiatives, Texas Education Agency, \$300,000, 1999-2000, Project Director.

Developing Number Sense Instruction Accessible to Kindergartners Experiencing Developmental Delays. (CFDA No. 84-324D). U.S. Department of Education, Office of Special Education Programs, \$540,000, 2000-2002, Co-Principal Investigator.

Project BRIDGE: An examination of a model for linking research to practice for students with high incidence disabilities in reading (CFDA No. 84.324D). U.S. Department of Education, Office of Special Education Programs, \$799,956, January 1999-December 2002, Co-Principal Investigator.

SELECTED PUBLICATIONS

Chard, D. J., Clarke, B., Baker, S., Otterstedt, J., Braun, D., & Katz, R. (in press). Using measures of number sense to screen for difficulties in mathematics: Preliminary findings. Assessment Issues in Special Education.

Chard, D. J., Vaughn, S., & Tyler, B. (2002). A synthesis of research on effective interventions for building reading fluency with elementary students with learning disabilities. Journal of Learning Disabilities, 35, 386-406.

Bos, C., Mather, N., Dickson, S., Podhajski, B., & Chard, D. (2001). What preservice and inservice educators believe and know about early reading instruction. Annals of Dyslexia, 51.

Smith, S. B., Simmons, D. C., Gleason, M. M., Kame'enui, E. J., Baker, S. K., Sprick, M., Gunn, B., Thomas, C. L., Chard, D. J., Plasencia-Peinado, J., Peinado, R. (2001). An analysis of phonological awareness instruction in four kindergarten basal reading programs. Reading and Writing Quarterly, 17, .

Jitendra, A.K., Chard, D., Hoppes, M.K., Renouf, K., & Gardill, M.C. (2001). An evaluation of main idea strategy instruction in four commercial reading programs: Implications for students with learning problems. Reading and Writing Quarterly, 17, 53-73.

Chard, D. J., Vaughn, S., Tyler, B., & Sloan, K. (2000). Building a school-wide model for reading improvement. Australasian Journal of Special Education, 24, 32-46.

Vaughn, S., Chard, D. J., Bryant, D. P., Coleman, M., Tyler, B. J., Thompson, S., & Kouzekanani, K. (2000). Fluency and comprehension interventions for third-grade students. Remedial and Special Education, 21, 325-335.

Vaughn, S., Gersten, R. , & Chard, D.J. (2000). The underlying message in LD intervention research: Findings from research syntheses. Exceptional Children, 67, 99-114.

Edwards, L., & Chard, D. J. (2000). Curriculum reform in a residential treatment program: Establishing high academic expectations for students with emotional and behavioral disorders. Behavior Disorders, 25, 259-263

Gersten, R., Chard, D. J., & Baker, S. (2000). Factors enhancing sustained use of research-based instructional practices. Journal of Learning Disabilities, 33, 445-457.

Chard, D. J., & Kameenui, E. J. (2000). Struggling first grade readers: The frequency and progress of their reading. The Journal of Special Education, 34, 28-38.

Gersten, R., & Chard, D. J. (1999). Number Sense: Rethinking Math Instruction for Students with Learning Disabilities. The Journal of Special Education, 33, 18-28.

SELECTED PRESENTATIONS

Chard, D. J. (April, 2003). Effective instruction and assessment in mathematics. Strand organized at the International Conference for the Council for Exceptional Children, Seattle, WA.

Chard, D. J. & Jungjohann, K. (October, 2002). Mathematics instruction designed to teach all learners. Division for Learning Disabilities, San Antonio, TX.

Chard, D. J. (October, 2002). Research on reading fluency development. Invited presentation at the California State University Conference on Reading, Los Angeles, CA.

Chard, D. J., & Vaughn, S. (April, 2002). Instruction in beginning reading for students with disabilities. Strand organized for the International Conference for the Council for Exceptional Children, New York, NY.

Jungjohann, K., & Chard, D. J. (April, 2002) Mathematics instruction designed to work. Poster session presented at the International Conference for the Council for Exceptional Children, New York, NY.

Gersten, R., & Chard, D. J. (April, 2002). Preliminary findings from a meta-analysis on mathematics instruction for students with learning disabilities. Paper presented at the International Conference for the Council for Exceptional Children, New York, NY.

Chard, D.J. (April, 2002). Research on effective mathematics instruction for students with disabilities. Showcase presentation organized for the Division for Research for the Council for Exceptional Children, New York, NY.

Bos, C., Mather, N., Dickson, S., Chard, D., & Podhajski, B. (June, 2001). Perceptions and knowledge of preservice and inservice educators about early reading instruction. Annual Meeting of the Society for the Scientific Study of Reading, Boulder, CO.

RECENT COLLABORATORS

Scott Baker
Candace Bos
Douglas Carnine
Edward Kameenui
Russell Gersten
Deborah Simmons
Sharon Vaughn

Scott K. Baker

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ACADEMIC BACKGROUND

Ph.D.	University of Oregon	School Psychology	1993
M.S.	Western Washington University	Psychology	1984
B.A.	Long Beach State University	Psychology	1981

PROFESSIONAL EXPERIENCE

Director, Pacific Institutes for Research; Eugene, Oregon	2003 - present
Director of Evaluation, Oregon Reading First Center; Eugene, Oregon	2003 - present
Director, Eugene Research Institute; Eugene, Oregon	2002
Senior Researcher, Eugene Research Institute; Eugene, Oregon	2002 - 2003
Vice president, Eugene Research Institute; Eugene, Oregon	1998 - 2003
Research Associate, Eugene Research Institute/University of Oregon	1995 - 2002
Postdoctoral Fellow / Research Associate, National Center to Improve the Tools of Educators at University of Oregon's College of Education	1992 - 1995

MEMBERSHIP IN ACADEMIC, PROFESSIONAL, SCHOLARLY SOCIETIES

National Association of School Psychologists, Council for Exceptional Children, American Psychological Association, American Educational Research Association, International Reading Association, Division for Research, (Publications Chair), Council for Exceptional Children

REVIEWING RESPONSIBILITIES

Journals: Exceptional Children, Journal of Direct Instruction, Learning Disabilities Research & Practice, Journal of Teacher Education

Grants/Contracts: Institute for Education Sciences: Reading Comprehension (2003); Office of English Language Acquisition, Language Enhancement, and Academic Achievement for LEP Students (OELA) (2003); Oregon Department of Education: Oregon Reading First (2003); National Institutes of Health: English Literacy in Spanish Speaking Children (2000); Oregon Department of Education: Reading Excellence Act (1999); Office of Special Education: Beginning Reading Model Demonstration (1998)

FEDERALLY FUNDED GRANTS

Principal investigator (or co-principal investigator) for the following:

State of Oregon Reading First Grant. Principal writer with Edward J. Kame'enui & Deborah Simmons (Reading First, Title I, Part B, U. S. Department of Education; September 1, 2002 – present; \$50,000,000)

- The story read aloud project: The development of an innovative instructional approach to promote comprehension and vocabulary in first grade classrooms* (U.S. Department of Education, 2002-2005, \$1,019,249).
- Investigating the effects of a preschool curriculum.* (National Institute of Child Health and Human Services, Departments of Health and Human Services, and Public Health Services, 2002-2003, \$159,125).
- Developing number sense instruction accessible to kindergartners experiencing developmental delays.* (U.S. Department of Education, 2000-2002, \$539,784).
- Conceptual approaches to teaching history to students with learning disabilities in integrated settings.* (US Department of Education, 1999-2002, \$549,910).
- A center to study sustainability (CSS) of research-based interventions for students with learning disabilities.* (US Department of Education, 1998-2002, \$999,720).
- Achieving curriculum inclusion and integrating technology with instruction through backward mapping and collaborative action research.* (U.S. Department of Education, 1996-1999, \$899,820)
- Parameters of effective instruction for language-minority students with disabilities and those at risk for school failure: Research synthesis and dissemination.* (U.S. Department of Education, 1995-1998, \$239,826)
- Project Vocabulary: Understanding early growth and remediation effects for students with disabilities or at risk of reading failure.* (US Department of Education, Grant No. H023C50121, 1995-1998, \$525,155.00).
- Project BRIDGE: Bridging research and instruction through dynamic and grounded exchange.* (US Department of Education, Special Education Programs Special Projects Competition Grant No. H023G50021, 1995-1999, \$559,984).
- Exploring the utility of oral reading fluency with limited English proficiency students.* (US Department of Education, Grant No. H023B00017, 1991-1992, \$9,767).
- Longitudinal evaluation of later effects of bilingual education.* (READ Institute, 1996-1997, \$7,000)

SELECTED PUBLICATIONS

Guest Editor: Special Issue of *Journal of Learning Disabilities*: “Translating Empirical Research to classroom Practice” (March/April 2003) (co-edited with Russell Gersten).

Journal Articles

- Gersten, R., Baker, S., Smith-Johnson, J., Flojo, J., & Hagan-Burke, S. (in press). A tale of two decades: Trends in support for federally funded experimental research in special education. *Exceptional Children*.
- Baker, S., Gersten, R., Dimino, J.A., & Griffiths, R. (in press). The sustained use of research based instructional practice: A case study of peer-assisted learning strategies in mathematics. *Remedial and Special Education*.
- Gersten, R. & Baker, S. (2003). The contemporary research base in learning disabilities on teaching writing, promoting higher order thinking, and enhancing self-concept: Introduction to the special issue. *Journal of Learning Disabilities*, 36(2), 98-99.

- Baker, S., Gersten, R., & Graham, S. (2003). Teaching expressive writing to students with learning disabilities: Research-based applications and examples. *Journal of Learning Disabilities, 36*(2), 109-123.
- Baker, S., Gersten, R., & Lee, D. (2002). A synthesis of empirical research on teaching mathematics to low-achieving students. *Elementary School Journal, 103*(1), 51-73.
- Baker, S., Gersten, R., & Scanlon, D. (2002). Procedural facilitators and cognitive strategies: Tools for unraveling the mysteries of comprehension and the writing process, and for providing meaningful access to the general curriculum. *Learning Disabilities Research and Practice, 17*(1), 65-77.
- Gersten, R., Fuchs, L., Williams, J., & Baker, S. (2001). Teaching reading comprehension strategies to students with learning disabilities: A review of research. *Review of Educational Research, 71*, 279-320.
- Baker, S., Gersten, R., & Keating, T. (2000). When less may be more: A two-year longitudinal evaluation of a volunteer tutoring program with minimal training. *Reading Research Quarterly, 35*, 494-519.
- Gersten, R., & Baker, S. (2000). What we know about effective instructional practices for English-language learners: A multi-vocal research synthesis. *Exceptional Children, 66*, 454-470.
- Gersten, R., Baker, S., & Lloyd, J.W. (2000). Designing high quality research in special education: Group experimental design. *Journal of Special Education, 34*(1), 2-18.
- Gersten, R., Chard, D., & Baker, S. (2000) Factors that enhance sustained use of research-based instructional practices: A historical perspective on relevant research. *Journal of Learning Disabilities, 33*, 445-457.
- Baker, S., & Smith, S. (1999). Starting off on the right foot: The influence of four principles of professional development in improving literacy instruction in two kindergarten programs. *Learning Disabilities Research & Practice, 14*, 239-253.
- Gersten, R., & Baker, S. (1998). Real world use of scientific concepts: Integrating situated cognition with explicit instruction. *Exceptional Children, 65*, 23-35.
- Gersten, R., Baker, S., Marks, S. U. (1998). Reflections on "A view from across the Grand Canyon" (by Richardson and Anders) and the Compatibility of Qualitative and Quantitative Research. *Learning Disabilities Quarterly, 21*, 102-104.
- Shinn, M. R., Powell-Smith, K. A., Good, R. H., & Baker, S. (1997). The effects of reintegration into general education reading instruction for students with mild disabilities. *Exceptional Children, 64*, 59-78.
- Baker, S. & Good, R. (1995). Curriculum-based measurement of English reading with bilingual Hispanic students: A validation study with second-grade students. *School Psychology Review, 24*, 561-578.
- Baker, S., Kameenui, E. J., Simmons, D. C., & Stahl, S. (1994). Beginning reading: educational tools for diverse learners. *School Psychology Review, 23*, 372-391.

Book Chapters

Authored or co-authored 17 book chapters

Benjamin Samuel Clarke Ph.D.

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Education

University of Oregon
Ph.D., School Psychology, June 2002
University of Oregon
M.A., Special Education, June 2001
Wabash College
B.A. Summa Cum Laude, Psychology, May, 1997

Professional Associations

Licensed School Psychologist, State of Oregon
Council of Exceptional Children (CEC)

Work Experience

Fall 03- Present Associate Western Regional Reading First Technical Assistance Center. Duties include providing technical assistance and professional assistance to state departments of education regarding multiple components of federally funded Reading First legislation.

Fall03-Present Research Associate Pacific Institutes for Research. Duties include support to Oregon public schools in the structure and evaluation of school reading and assessment programs as part of Oregon Reading First initiative. Design effective programs and evaluation tools as part of Federal research grant investigating the development of reading comprehension in first grade students. Development of early math assessment system based on the kindergarten and first grade students beginning number sense.

Fall 01-Spring 03 School Psychologist Bend-Lapine School District. Duties included work on individual student evaluations to determine need for services in academic, behavioral, and social emotional domains. Implemented the use of Curriculum Based Measurement – Reading (CBM-R), CBM-Mathematics, and Dynamic Indicators of Basic Early Literacy Skills (DIBELS) assessment system to aid district in the evaluation of district, school, classroom, and individual student programs. Member of both Reading and Math Curriculum Teams as assessment specialist.

Grant Experience

Fall 98-Spring 00 Training Leadership Personnel in Curriculum-Based Measurement, Problem-Solving Assessment, and a Problem-Solving Model, Office of Special Education Programs, U.S. Department of Education. Duties included various research projects involving CBM and working at the local, statewide, and national level on implementing and utilizing CBM. Coordinated ongoing professional development through presentations, coaching, and consultation for Redmond School District, Redmond, OR, North Shore Education District, Glenbrook, IL, and Kenai Peninsula School District, Kenai, AK. Supervisor Dr. Mark Shinn

Fall 97-Spring 98 Preparing School Psychologists to Support Young Children with Attention Deficit Disorder and Related Problems in Early Intervention and Preschool Settings, Office of Special Education Programs, U.S. Department of Education. Duties included clinical casework, designing and implementing a med trial, and assisting in research for scholarly papers. Supervisor Dr. Deanne Crone

Publications

Clarke, B. & Shinn, M.R. (in press). A Preliminary Investigation into the Identification and Development of Early Mathematics Curriculum-Based Measurement. *School Psychology Review*

Shinn, M.R., Shinn, M.M., Hamilton, C.R. & Clarke, B. (2002). Using curriculum-based measurement in general education classrooms to promote reading success. In M.R. Shinn, H.M. Walker, & G. Stoner (Eds.), *Interventions for academic and behavioral problems II: Preventive and remedial approaches* (pp. 113-142). Bethesda, MD. NASP Publications.

Materials

Clarke, B. & Shinn, M.R. (in press). Test of Early Numeracy (TEN). Administration and scoring of AIMSweb early numeracy measures for use with AIMSweb. Eden Prairie, MN: Edformation Inc.

National Presentations

Pacific Coast Research Conference: Developing a general outcome measure for early numeracy skills. Winter 03 LaJolla CA.

Council for Exceptional Children: The identification, development, and investigation of early mathematics curriculum-based measurement. Spring 02 New York NY.

National Association of School Psychologists: A schoolwide approach to improving reading outcomes for all students. Spring 01 Washington DC.

Teaching Experience

Winter 03 Instructor Lewis and Clark College SPED 633 Curriculum and Instruction (Masters in Special Education Program, Central Oregon Cohort).

Winter 01 Graduate Teaching Fellow University of Oregon SPSY 626 Educational Assessment.

Fall 00 Graduate Teaching Fellow University of Oregon ED 212; Foundations of Learning and Intervention. Position was also held in Fall 98, Winter 99, Fall 99, Winter 00.

Research Experience

Fall 03-present Research Associate. The Story Read Aloud Project. Investigation of the effects of a reading comprehension curriculum implemented in 1st grade classrooms.

Fall 02 – present Co-investigator. Investigation into longitudinal trajectories of mathematics growth and the long-term predictive validity of Early Mathematics Curriculum-Based Measurement. South Lane School District; Cottage Grove, OR.

Fall 02 – present Co-Investigator. Investigation of the validity of Early Mathematics Curriculum Based Measurement with kindergarten and first grade students. Bethel School District; Eugene, OR.

Fall 00- Spring 01 Dissertation Primary Investigator. The Role of Simple Measures of Number Sense in First Grader's Mathematics Performance. Developed and analyzed the utility of four experimental measures of 1st grade students mathematics performance for potential use in early identification and formative evaluation. South Lane School District; Cottage Grove, OR.

RUTH A. KAMINSKI, Ph.D.

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rkamin@oregon.uoregon.edu

Education

- 1992 University of Oregon
Ph.D., School Psychology
- 1982-84 University of Oregon
M.S., Early Childhood Special Education
- 1971-75 Pennsylvania State University
B.S., Speech Pathology and Audiology

Membership in
Professional
Organizations

National Association of School Psychologists
Oregon School Psychology Association
American Psychological Association
Council for Exceptional Children
 Division of Early Childhood
National Association for the Education of Young Children
Oregon Association for the Education of Young Children

SELECTED PUBLICATIONS 2000-2003

Kaminski, R.A., & Stormshak, E.A. (in press). Project STAR: Early intervention with preschool children and families for the prevention of substance abuse. In J. Szapocznik, P. Tolan, & S.Sambrano (Eds.) *Preventing substance abuse*. American Psychological Association.

Kaminski, R.A., Stormshak, E.A., Good, R.H., & Goodman, M. (2002) Outcomes from Project STAR: Preventing later substance abuse in preschool children. *Psychology of Addictive Behaviors*, 16(14), 11-26.

Stormshak, E.A., & Kaminski, R.A., Goodman, M.R. (2002). Enhancing the parenting skills of Head Start families during the transition to kindergarten. *Prevention Science*, 3(3), 223-234.

Priest, Jeff S; McConnell, Scott R; Walker, Dale; Carta, Judith J; Kaminski, Ruth A; McEvoy, Mary A; Good, Roland H.; Greenwood, Charles R; Shinn, Mark R. (2001). General growth outcomes for young children: Developing a foundation for continuous progress measurement. *Journal of Early Intervention*. 24(3), 163-180.

Stewart, L., & Kaminski, R. (2002). Best practices in developing local norms. In A. Thomas & J. Grimes (Eds.) *Best practices in school psychology IV*. National Association of School Psychology.

Good, R., Gruba, J., & Kaminski, R.A. (2002). Best practices in early literacy assessment. . In A. Thomas & J. Grimes (Eds.) *Best practices in school psychology IV*. National Association of School Psychology.

Good, R.H., Kaminski, R.A., Simmons, D., & Kame'enui, E. (2001). Using Dynamic Indicators of Basic Early Literacy Skills (DIBELS) in an outcomes-driven model: Steps to reading outcomes. Oregon School Study Council.

SELECTED PRESENTATIONS AT NATIONAL CONFERENCES

Kaminski, R., Good, R., & Smith, S. (April, 2003). *Steps to Reading Success: Using DIBELS in an outcomes-driven model*. Council for Exceptional Children Annual Convention. Seattle, WA

Leitschuh, C., Greenwood, C., McEvoy, M., McConnell, S., & Kaminski, R. (October, 2001). *Update on ECRI-MGD*. Division for Early Childhood International Conference. Boston, MA.

Stormshak, B., Kaminski, R., Reid, J., Webster-Stratton, C., Fisher, P., & McConnell, S. (April 2001). *Effective interventions with at-risk preschool children*. Society for Research in Child Development. Minneapolis, MN.

McConnell, S., Greenwood, C., Kaminski, R., Shin, J., & McEvoy, M. (February 2001). *A report on research and development of individual growth and development indicators for young children*. Pacific Coast Research Conference. La Jolla, CA.

Kaminski, R., McConnell, S., & Carta, J (February, 2001). Measuring Growth and Development of Young Children. *NECTAS-OSEP National Meeting*. Washington, D.C.

Kaminski, R., McConnell, S., & Greenwood, C. (April, 2000). *Dynamic Early Childhood Assessment within a General Outcomes Measurement Model*. Conference on Research Innovations in Early Intervention. San Diego, CA.

McEvoy, M., Kaminski, R., & Priest, J. (April, 2000). *Early Childhood Research Institute on Measuring Growth and Development: A Decision-Making Process*. Council for Exceptional Children, Vancouver, B.C.

Good, R., & Kaminski, R. (March, 2000). *Using DIBELS in an Outcomes Driven Model*. Oregon Department of Education Reading Summit. Portland, OR.

Ruth Kaminski

Page 3

Good, R. & Kaminski, R. (March, 2000). *Tracking Early Literacy Skills through First Grade: Dynamic Indicators of Basic Early Literacy Skills*. Oregon Department of Education Reading Summit. Portland, OR.

Kaminski, R. (February, 2000). *Assessment for the Prevention of Reading Failure: Current Research on Dynamic Indicators of Basic Early Literacy Skills*. Invited Presentation to the Phyllis Mirkin Colloquium Series, Minneapolis, MN.

SELECTED RESEARCH GRANTS FUNDED

Principal Investigator or Co-Principal Investigator on more than \$5 million of externally supported research and personnel preparation grants since 1996.

VITA

Barbara K. Gunn

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barbarag@ori.org

ACADEMIC BACKGROUND

- Bachelor of Arts:** California State University, Sacramento,
California, Social Science, 1968-1971
- Non-degree
Graduate Work:** California State University, Sacramento,
California, Counseling, 1971-1972
- Teacher Certification:** University of Washington, Seattle,
Washington, Elementary and Secondary
Certification, 1984-1986
- Doctor of Philosophy:** University of Oregon, Eugene, Oregon
Special Education, 1992-1996

PROFESSIONAL EXPERIENCE

- August 2001 - Present **Associate Research Scientist**, Oregon Research Institute
Center for Community Interventions on Childrearing
- September, 1996- August, 2001 **Research Associate**, Oregon Research Institute
Center for Community Interventions on Childrearing
- September, 1997-1999 **Research Associate**, University of Oregon, Eugene, Oregon
National Center to Improve the Tools of Educators
- July, 1995- September, 1996 **Research Assistant II**, Oregon Research Institute, Eugene, OR
Center for Community Interventions on Childrearing
- September, 1994- August, 1995 **Instructor**, University of Oregon,
College of Education, Eugene, Oregon
- September, 1994- June, 1995 **Field Experience Coordinator**, University of Oregon,
College of Education, Eugene, Oregon
- September, 1992 - August, 1995 **Research Assistant**, University of Oregon, Eugene, Oregon,
National Center to Improve the Tools of Educators
- September, 1986- June, 1992 **Elementary School Teacher:**
Fifth Grade - Pleasant Hill Elementary
Pleasant Hill, Oregon
Fourth Grade - Pleasant Hill Elementary
Pleasant Hill, Oregon
Third Grade - Cottonwood Elementary
Bremerton, Washington
First Grade - Seabeck Elementary
Seabeck, Washington

LICENSING/CERTIFICATION

State of Oregon, Basic Teaching Credential, K-12
State of Washington, Continuing Teaching Credential, K-12

PROFESSIONAL ACTIVITIES

Review Panel Member, National Council on Teacher Quality, 2001.
Reviewer, Society for the Scientific Study of Reading, 2000.
Review Panel Member, Maryland School Performance Assessment Program, 2000.
Admission Committee for Special Education Master's Degree Program, University of Oregon, 1994 -1995.
Admission Committee for Handicapped Learner Endorsement Program, University of Oregon, 1994 -1995.
Search Committee for Faculty Position in Department of Special Education, University of Oregon, Spring 1995.
Practicum Supervisor, University of Oregon, College of Education, 1994-1995.
Consortium Member, Higher Education, Department of Education, University of Oregon, 1992-1994.
Graduate Student Council Representative, College of Education, University of Oregon, 1992-1994.
Secretary, Council for Exceptional Children, College of Education University of Oregon, 1993-1994.

GRANTS

2002 -2004 Co-Investigator (Principal Investigator: Ed Feil)
“Early Start for School Success” NIH/NICHHD
1998 - 1999 Co-Investigator (Principal Investigator: Ed Kameenui)
“Open Court Implementation Study”
Funded by the Packard Humanities Institute; Institute for the Development of Educational Achievement (IDEA) College of Education, University of Oregon
1995 - 2000 Research Associate (Principal Investigator: Anthony Biglan)
“A Comprehensive Program to Reduce the Risk of Drug Abuse” NIH/NIDA Grant #1

PUBLICATIONS

Sprick, M., Jones, S. V., Dunn, R., & Gunn, B. (2003). Read Well Kindergarten: Critical Foundations in Beginning Reading. Colorado: Sopris West.
Gunn, B. (2002). Supplemental reading instruction to develop second language literacy. In E. Durán (Ed.) *Systematic Instruction in Reading for Spanish Speaking Students*. Illinois: Charles. C. Thomas.
Gunn, B. (2002). *Teacher Education for Teaching Reading in the California State University System*. Prepared for the National Council on Teacher Quality, Washington, D.C.
Barrera, M., Jr., Biglan, A., Taylor, T.K., Gunn, B.K., Smolkowski, K., Black, C., Ary, D.V., & Fowler, R.C. (2002). Early elementary school intervention to reduce conduct problems: A randomized trial with Hispanic and non-Hispanic children. *Prevention Science*, 3, 83-94.

- Gunn, B., Biglan, A., Smolkowski, K. & Black, C. (2002). Supplemental instruction in decoding skills for Hispanic and non-Hispanic students in early elementary school: A follow-up. *Journal of Special Education*.
- Smith, S. B., Simmons, D. C., Gleason, M., Kame'enui, E. J., Baker, S. Sprick, M., Gunn, B., Thomas, C., Chard, D., Plasencia-Peinado, J., & Peinado, R. (2001). An analysis of phonological awareness instruction in four kindergarten basal reading programs. *Reading and Writing Quarterly*, 17, 25-51.
- Gunn, B. K. Emergent Literacy, Research Bases. (2001) In CORE, Inc (Ed.), *Reading Research Anthology*. Arena Press, CA.
- Gunn, B. K., Biglan, A., Smolkowski, K., & Ary, D. V. (2000). The efficacy of supplemental instruction in decoding skills for Hispanic and non-Hispanic students in early elementary school. *Journal of Special Education*, 34(2), 90.
- Gunn, B. K. (2000). *Review of the Maryland Statewide Assessment of Reading*. Submitted to the Abell Foundation, Baltimore, MD.
- Kameenui, E. J., & Gunn, B. (1999). *Open Court Implementation Study*. Submitted to the Packard Humanities Institute, San Francisco, CA.
- Metzler, C. W., Taylor, T.K., Gunn, B., Fowler, R.C., Biglan, T., & Ary, D. (1998). A comprehensive approach to the prevention of behavior problems: Integrating effective practices to strengthen behavior management programs in schools. *Effective School Practices*, 17 (2), 8-24.
- Gunn, B. K., Simmons, D. C., & Kameenui, E. J. (1998). Emergent Literacy: Research bases. In: *What Reading Research Tells us About Children with Diverse Learning Needs: Bases and Basics*. Mahwah NJ: Lawrence Erlbaum Associates, p. 19-50.
- Gunn, B. K., Simmons, D. C., & Kameenui, E. J. (1998). Emergent Literacy: Instructional and curricular basics and implications. *What Reading Research Tells us About Children with Diverse Learning Needs: Bases and Basics* Mahwah NJ: Lawrence Erlbaum Associates, p. 51-59.
- Biglan, T., Metzler, C. W., Fowler, R. C., Gunn, B., Taylor, T. K., Rusby, J., & Irvine, B. (1997). Improving childrearing in America's communities. In P. A. Lamal (Ed.), *Cultural contingencies: Behavioral Analytic Perspectives on Cultural Practices* (pp. 185-213). Westport, CT: Praeger.
- Gunn, B., & Kameenui, E. K., (1996). An investigation of three approaches to teaching phonological awareness to first-grade students and the effects on word recognition. Unpublished doctoral dissertation, University of Oregon, Eugene.
- Kameenui, E. J., Simmons, D. C., Baker, S., Chard, D., Dickson, S., Gunn, B., Lin, S. J., & Sprick, M. (1995). Effective strategies for teaching beginning reading. In E. J. Kameenui & D. W. Carnine (Eds.), *Effective Teaching Strategies That Accommodate Diverse Learners* (pp. 45-70). Alexandria, VA: ASCD.
- Simmons, D. C., Gunn, B., Smith, S. B., & Kameenui, E. J. (1994). Phonological awareness: Applications of instructional design. *Learning Disabilities Forum*, 19, 7-10.

UNDER REVIEW

- Gunn, B., Feil, E., Seeley, J., Severson, H., & Walker, H., Promoting school success: Developing social skills and early literacy in Head Start classrooms
- Gunn, B., Smolkowski, K. Biglan, A., Black, C., & Blair, J. Fostering the Development of Reading Skill of Hispanic and Non-Hispanic Students Through Supplemental Instruction
- Gunn, B., Smolkowski, K., Black, C. & Biglan, A. The Measurement of Home Literacy.

Kathleen Jungjohann
Special Education College of Education
University of Oregon

EDUCATION

- | | |
|-----------|---|
| 1990-1992 | Post-Masters and Administrative Coursework
University of Oregon, Eugene, Oregon |
| 1980 | M.A., University of Oregon, Special Education
University of Oregon, Eugene, Oregon |
| 1973-1975 | Graduate Coursework, Elementary Education, Deaf Education,
and Special Education, San Diego State University |
| 1972 | B.A. in Speech and Hearing and Sociology
University of California, Santa Barbara, California |

LICENSURE

- | | |
|-----------|---|
| 2003-2008 | Oregon Standard Elementary License, Standard Handicapped Learner,
Basic Hearing Impaired |
|-----------|---|

PROFESSIONAL EXPERIENCE

- | | |
|-------------------------------|--|
| 2001-present | Educational Consultant and Trainer |
| 1993-present
Program, UO | Coordinator, Early Childhood/Elementary Special Educator Licensure
Program, UO |
| 1988-present
Education, UO | Senior Instructor and Field Supervisor, Special Education Area, College of
Education, UO |
| 1986-1988 | Liaison Supervisor for the Field Experience Office, Division of Teacher
Education, University of Oregon, Eugene, Oregon |
| 1983-1986 | EMR Specialist, Briggs Middle School, Springfield, Oregon |
| 1976-1983 | TMR Specialist, Guy Lee Elementary, Lane ESD TMR Program |
| 1974-1976 | Deaf-Blind Teacher, Sweitzer School, San Diego, California |

UNIVERSITY TEACHING EXPERIENCE

Special Education Reading Instruction - methods and procedures for teaching beginning reading, phonic and structural analysis, vocabulary and comprehension strategies, and content area instruction for all students with special focus on students with learning problems.

Special Education Math Instruction - methods and strategies for teaching math skills and problem solving with special focus on low performing students.

Reading and Writing in the Content Area - systematic process approach to writing instruction and strategies for reading, writing, and study skills in content area curriculum.

Professional Practices - seminar linked to practicum with focus on effective teaching strategies, management and motivational strategies, modifying and adapting curriculum, evaluation, and progress monitoring.

Collaborative Educational Planning – focuses on models of consultation and collaboration, establishing IEPs which are legally correct and educationally useful and which reflect the unique needs of the individual with disabilities, knowledge of research and legal requirements in the field of special education, and knowledge of effective interventions for meeting students’ needs.

Introduction to Exceptionalities - overview of issues and trends in the area of special education and community issues for individuals with disabilities.

Psychology of Exceptional Children - focus on specific disabilities as defined by IDEA, instructional methods, and service delivery systems in special education.

PROFESSIONAL SERVICE

Coordinator of Early Childhood / Elementary Special Educator Licensure Program
Chair of Special Education Elementary Admissions Committee
Department Masters Committee
College Coordinators Council
Career Conference Committee
Oregon Higher Education Consortium of Education Training Programs
Faculty Advisor of University of Oregon Student CEC Chapter

RECENT WORKSHOPS / PRESENTATIONS / TRAININGS

READING MASTERY, LANGUAGE FOR LEARNING, EXPRESSIVE WRITING, AND CORRECTIVE READING TRAINING, Hilo, Hawaii, August 2003.

INSTITUTE ON BECOMING AN EFFECTIVE DI TRAINER, ADI Conference, Eugene, OR, July 2003.

PROVIDING MEANINGFUL ACCESS TO GENERAL EDUCATION: ALIGNING IEPs TO STATE CURRICULUM STANDARDS, CEC Annual Convention Preconference Workshop, Seattle, April 2003.

READING MASTERY TRAINING, Tualatin, OR, March 2003

COACHES TRAINING LEVEL I, National Implementation of Direct Instruction, Honolulu, February 2003.

EFFECTIVE SUPERVISION PRACTICES, Georgia State University at Valdosta, December 2002.

TEACHING WITH INTENSITY: EFFECTIVE INSTRUCTIONAL PRACTICES, Valdosta, GA, December 2002 and January 2003.

PROVIDING MEANINGFUL ACCESS TO GENERAL EDUCATION: ALIGNING IEPs TO STATE CURRICULUM STANDARDS, CEC Annual Convention, NY, April 2002.

DESIGNING EFFECTIVE MATHEMATICS INSTRUCTION, CEC Annual Convention, NY, April 2002.

DON'T STOP NOW: REWARDING DECODING INSTRUCTION FOR OLDER READERS, Oregon Conference, February, 2002 and 2003.

MATHEMATICS INSTRUCTION DESIGNED TO WORK, Bridging the Gap between Research & Practice, DLD Conference, San Antonio Texas, October 2001.

STRATEGIES TO SUPPORT LOW ACHIEVING READERS IN CONTENT AREA INSTRUCTION, Pleasant Hill, OR October 2001.

LITERACY FOR INTERMEDIATE STUDENTS, Westridge Middle School, Oakridge, OR, 8/29/01, 9/28/01, 10/11/01.

REWARDS (Reading Excellence: Word Attack and Rate Developments Strategies) TRAINING, Oakridge, October 2001; Springfield, September 2001; Redmond, September 2000.

READING MASTERY I & II TRAINING for Bethel and Springfield district teachers and staff, August, 2001.

READING INSERVICE follow up for middle school teachers, Redmond, OR, January and March 2001.

IDEA '97: ALIGNING IEPS TO THE GENERAL EDUCATION CURRICULUM AND STATE STANDARDS, CEC Annual Convention, Vancouver, BC, April 2000.

COMPREHENSION STRATEGY INSTRUCTION FOR ESTABLISHED READERS and INSTRUCTIONAL GUIDELINES and STRATEGIES FOR BEGINNING READERS, Redmond School District, March 2000.

COLLABORATIVE SUCCESS: HELPING FIRST GRADE KIDS CATCH UP IN READING, Oregon Conference, February 2000.

STRATEGIES FOR INCREASING READING FLUENCY and TEACHING BIG IDEAS IN BEGINNING READING, Redmond School District, January 2000.

PROFESSIONAL AFFILIATIONS

Council for Exceptional Children (Teacher Education Division / Division of Learning Disabilities / Division on Mental Retardation and Developmental Disabilities Association for Direct Instruction The ARC

VITA

Lisa M. Howard

PERSONAL INFORMATION

Present Position: Project Coordinator

Business Address: Pacific Institutes of Research
1600 Millrace Drive, Ste. 111
Eugene, OR 97403
(541) 393-0181

Home Address: (b)(6)

ACADEMIC BACKGROUND

Master of Science: Special Education, 2001
University of Oregon
Eugene, OR 97403

Bachelor of Arts: History (with Honors), 1983
University of Montana
Missoula, MT 59801

Education (with High Honors), 1983
University of Montana
Missoula, MT 59801

PROFESSIONAL EXPERIENCE

2003 - Present Project Coordinator
Eugene Research Institute/Pacific Institutes for Research
Eugene, OR 97403

1993 - 2002: Researcher/Editor/Author
Teaching Strategies, Inc.
Eugene, OR 97405

1989 - 1992 Research Assistant
Eugene Research Institute
Eugene, OR 97402

1987 - 1989: Teacher (Special Education/Chapter 1/General Education)
Missoula School District
Missoula, MT 59801

1984 - 1987: Teacher (Chapter 1/Special Education)
Alberton School District
Alberton, MT 59801

PUBLICATIONS

Sprick, M., Howard, L., & Fidanque, A. (1998). Read Well: Critical Foundations in Primary Reading. Longmont, CO: Sopris West.

Sprick, M. & Howard, L. (2000). Write Well Spelling. Longmont, CO: Sopris West.

Sprick, R.S., Garrison, M., & Howard, L. M. (1998). CHAMPs: A Proactive and Positive Approach to Classroom Management. Longmont, CO: Sopris West.

Sprick, R.S., Garrison, M., & Howard, L. M. (2000). Para Pro: Supporting the Instructional Process. Longmont, CO: Sopris West.

Sprick, R.S. & Howard, L. M. (1996). Substitutes: Planning for Productivity and Consistency. Longmont, CO: Sopris West.

Sprick, R.S. & Howard, L. M. (1995). The Teacher's Encyclopedia of Behavior Management: 100 Problems/500 Plans. Longmont, CO: Sopris West.

Sprick, R.S., Howard, L., Wise, B.J., Marcum, K., & Haykin, M. (1998). The Administrator's Desk Reference of Behavior Management (Vols. 1-3). Longmont, CO: Sopris West.

VITA

Janet R. H. Otterstedt

PERSONAL INFORMATION

Present Position: Research Assistant

Business Address: Pacific Institutes for Research
1600 Millrace Drive, Suite 111
Eugene, OR 97403
(541) 349-9886

Home Address: (b)(6)

ACADEMIC BACKGROUND

Master of Science: University of Oregon
Eugene, Oregon
School Psychology, 1990-93

Bachelor of Science: University of Oregon
Eugene, Oregon
Psychology and Biology, Chemistry minor
Magna Cum Laude, 1984-1987, 1988-1990

PROFESSIONAL EXPERIENCE

2003 – Secretary, Board of Directors
Pacific Institutes for Research, Eugene, Oregon

2003 – Research Assistant
present Pacific Institutes for Research, Eugene, Oregon

2003 Reviewer
Curriculum Review Panel, Oregon Reading First

1997 – Research Assistant
2003 Eugene Research Institute, Eugene, Oregon

1994 – Home Visitor
1997 Head Start of Lane County, Springfield, Oregon

1993 – School Psychologist

1994 Portland School District, Portland, Oregon

1992 – School Psychologist Intern
1993 Pleasant Hill School District, Pleasant Hill, Oregon

1992 – Practicum Supervisor
1993 First Year Early Childhood School Psychology Students
University of Oregon, Eugene, Oregon

1992 – Training Grant Assistant Coordinator
1993 Early Childhood School Psychology Training Grant
University of Oregon, Eugene, Oregon

1990 – Grant Participant
1992 Early Childhood School Psychologist Training Grant
University of Oregon, Eugene, Oregon

RESEARCH EXPERIENCE

Assessment and data coordinator, *The Story Read Aloud Project: The Development of an Innovative Instructional Approach to Promote Comprehension and Vocabulary in First Grade Classrooms*, U.S. Department of Education Research Grant, 2002-2005.

Assessment and data coordinator, *Developing Number Sense Instruction Accessible to Kindergartners Experiencing Developmental Delays*. U.S. Department of Education Research Grant, 2000-2003.

Assistant data analyst, research syntheses on expressive writing instruction and math instruction, 1999-2002.

Data coordinator, investigation of effective instruction for English-language learners in California, 1999-2001.

Assessment and data coordinator, evaluation of the Start Making A Reader Today (SMART) program, 1998-1999.

Coordinator of a master's project examining curriculum based assessment tools of pre-reading skills, Winter and Spring, 1992.

Member of a research team examining the effects of medication on pre-school children diagnosed as having Attention Deficit Hyperactivity Disorder. Developed a picture naming task, assisted in parent training sessions, assessed preschoolers using a cookie delay task and a picture naming task. Winter and Spring, 1992.

Research assistant, Infant Monitoring Project. Recruited subjects and assessed four year old children using the McCarthy Scales of Children's Abilities. This project is examined the

utility and validity of utilizing parent questionnaires as a way of monitoring the skills of young children who are considered "at risk". Summer and Fall, 1991.

Research Assistant for Russell Fernald, Ph.D., Institute of Neuroscience, University of Oregon, Eugene, Oregon, 1990.

Research Assistant for Donald Tucker, Ph.D., Cognitive Laboratory, University of Oregon, Eugene, Oregon, 1988-1989.

JOURNAL ARTICLES

Chard, D.J., Clarke, B., Baker, S., Otterstedt, J., Braun, D., & Katz, R. (2004) *Using Measures of Number Sense to Screen for Difficulties in Mathematics: Preliminary Findings*. Paper submitted for publication.

TECHNICAL REPORTS

Gersten, R., Baker, S., & Otterstedt, J. (1999). *Further analysis: A meta-analysis of the effectiveness of bilingual education, by J. P. Greene (1989)*. (Tech. Rep. No. 99-01). Eugene, OR: Eugene Research Institute.

PRESENTATIONS

Otterstedt, J. R. H., & Good, R. H., III. (1993, April). Comparison of onset fluency and rhyming fluency tasks as measures of prereading skills. Paper presented at the National Association of School Psychologists Convention, Washington, D.C.

Stoner, G, Carey, S., Otterstedt, J., & Ball, P. (1993, April). Interventions with preschool children diagnosed with attention deficit hyperactivity disorder: A preliminary model for evaluating the differential and combined effects of methylphenidate and behavior management. Paper presented at the National Association of School Psychologists Convention, Washington, D.C.

Feil, E., Kaminski, R. A., & Otterstedt, J. R. H. (1992, June). Assessment for program planning. Training module presented at the University of Oregon summer institute entitled "Quality Early Intervention: Beyond the Test Kit," Eugene, OR.

HONORS AND AWARDS

Phi Beta Kappa, 1989

Presidential Scholarship, University of Oregon, 1984-1986 and 1988

Rachell A. Katz

(b)(6)

EDUCATION

The University of Oregon, Eugene, Oregon September 1999 to Present
Doctoral Candidate in School Psychology
Expected Degree June 2004
Masters Degree in Special Education June 2002
Licensed School Psychologist November 2003
Oregon Teacher Standards and Practices Commission

Dartmouth College, Hanover, New Hampshire September 1993 to June 1997
Bachelor of Arts in Psychology
Minor Concentration in Education

HONORS AND AWARDS

Graduate Teaching Fellowship, University of Oregon, 2001-2003
Cum Laude at Dartmouth College, 1996-1997
Women in Science Internship, Dartmouth College 1994
Awarded Scholarship: Long Island Hispanic Association, 1993

PROFESSIONAL AFFILIATIONS

American Psychological Association, Student member February 1999 to Present
National Association of School Psychologists, Student member September 1999 to Present

EMPLOYMENT EXPERIENCE

Pacific Institutes for Research, Research Assistant. September 2003 to present. Research assistant on Oregon Reading First. This position includes assisting with the Institutes on Beginning Reading as well as conducting DIBELS trainings around the state. Supporting regional coordinators with coverage of schools in the Portland area in addition to participating on the evaluation team and developing an instructional fidelity measure. Currently using the Consumer's Guide to review supplemental and intervention reading programs.

Principal Investigator: Scott Baker, Ph. D.

Oregon Social Learning Center, Family Interventionist/ Research Assistant. January 2001 to present. Family interventionist on a federally funded grant working with low-income families. The project is investigating the effects of intervening with the siblings of children who are currently experiencing severe anti-social and behavioral difficulties.

Principal Investigator: Lew Bank, Ph. D.

Western Region Technical Assistance Center, Consultant. November 2003 to present. Currently serving as a consultant for Reading First schools in the western region. This includes reviewing state plans and providing assistance for schools currently in the implementation phase of Reading First. In addition to serving as a DIBELS trainer, duties include responding to new

issues that arise for schools working to integrate Scientifically Based Reading Research into their instructional practices.

Deputy Director: Kathy Howe, Ph. D.

Eugene Research Institute, Research Assistant. March 2000 to September 2003. Research assistant on federally funded grant projects on a variety of topics including: Reading First, Instruction for English Language Learners, Evaluating a Civil Rights Curriculum, and Early Math Instruction. Responsibilities included preparing presentations, reviewing manuscripts for referred journals, writing and editing manuscripts, and organizing and participating in data collection.

Principal Investigators: Scott Baker, Ph. D. & Russell Gersten, Ph. D.

University of Oregon, Graduate Teaching Fellow.

January 2003- June 2003. Assisted in teaching an undergraduate class on the Applications of Theories of Learning and Intervention.

September 2002- December 2002. Assisted in teaching a graduate level course on reading instruction in the department of Special Education.

September 2001 to June 2002. Assisted in teaching year-long assessment sequence to first year graduate students. Domains include behavioral, educational, and intellectual assessment.

The Hill Preschool, Teacher. July 1997- August 1999. Designed the curriculum and conducted daily activities in a school setting. Responsibilities included providing instruction in early literacy skills and shaping pro-social interactions between children ages 3-5. Completed developmental evaluations of each child to be used for school placement. Participated in parent conferences to discuss developmental progress.

TRAINING AND PRACTICA EXPERIENCE

Oregon Social Learning Center Basic Intervention Model, December 2000- June 2001, Eugene, OR. Invited to participate in a year-long Parent Management Training program involving multi-national and multi-cultural participants. The OSLC interventions teach parents effective family management strategies to treat and prevent the development of antisocial behaviors and conduct disorders in children.

School Psychology Practicum, September 2000- June 2001, Springfield School District, OR. Year-long placement with a school psychologist including work at the elementary, middle, and secondary levels. The work completed included collection of relevant assessment data and the linking of assessment data to the design of intervention plans within the problem-solving model.

First Steps to Success, December 2000- March 2001, Eugene School District 4J, OR. Implemented an intervention for a kindergarten student exhibiting behavioral difficulties at school. Intervention required observations, role-playing, providing performance feedback, and consulting with the teacher. Also included weekly meetings with the parent to provide information on effective parenting techniques and ways to increase the student's likelihood of success at school.

Handicapped Learner Practicum, Summer 2000, Meadowview Elementary School, Bethel School District, OR. Involved the instruction of students receiving year round school services in both reading and mathematics. Instruction was provided using Reading Mastery and Connecting Math Concepts.

Reading instruction was informed by assessment utilizing CBM reading measures. Math instruction was informed by utilizing CBM math measures.

RESEARCH EXPERIENCE

Research Assistant, Dynamic Indicators of Basic Early Literacy Skills (DIBELS), Fall 2000-present. Train teachers and administrators to use DIBELS to improve reading skills in students. Assisting in the creation of a website that is accessible to teachers, administrators and parent to support all children becoming readers.

Principal Investigator: Roland Good, Ph. D.

Research Assistant, Early Childhood Research Institute, September 1999 to June 2001. Research assistant on a federally funded grant at the University of Oregon, College of Education, School Psychology Program, Eugene, Oregon. Responsibilities include assisting in the research and development of a language measure. Developed the instructions and protocols to be used for the language measure. Trained data collectors and supervised data collection in the schools. Assisted in the research and development of an Activity –Based Assessment, aimed at providing information useful for intervention with children at the pre-school level. Conducted a parent education, birth to three group.

Principal Investigators: Ruth Kaminski, Ph.D. and Sylvia Smith, Ph.D.

PRESENTATIONS

Mercier, J. L., Katz, R. A., Hill, D., & VanLoo, D. (2003, April). Charting a course to reading: Let DIBELS (Dynamic Indicators of Basic Early Literacy Skills) Web Be Your Guide. Paper presented at the meeting of the National Association of School Psychologists, Toronto, Canada.

Baker, S., Chard, D., & Katz, R. A. (2003, April). Assessing the Math Achievement of Students in Kindergarten and First Grade: Some Preliminary Findings From Two Sites. Paper presented at the meeting of the Council for Exceptional Children, Seattle, WA.

Katz, R. A. (2002, November). Early Literacy: Effective Assessments. Invited presentation at the University of Oregon, Psychology Department.

Good, R., Hill, D., Katz, R. A., Mercier, J. L., VanLoo, D. B., & Warrington, R. (2001) Charting a course to reading: Let DIBELS Web be your guide. The Oregon Conference, Eugene, OR.

Good, R., Hill, D., Katz, R. A., & VanLoo, D. B. (2000). Institute on Beginning Reading sponsored by the Oregon Department of Education, Bend, OR.

Katz, R. A. & Hill, D. K. (2000). Get Ready to Read: A home-based intervention. Poster presented at the conference of the Oregon Division of Early Childhood, Eugene, OR.

Form 524 Section C - Other Budget Information

Year One

PERSONNEL

<u>PRIN. INV.</u>	<u>FTE</u>	<u>BASE</u>	<u>AMOUNT</u>
Chard	0.20	76,062	15,212
Baker	0.15	96,000	14,400

RESEARCH STAFF

Clarke	0.40	52,500	21,000
Jungjohann	0.40	62,465	24,986
Howard	0.40	52,500	21,000
Kaminski	0.10	78,000	7,800
Otterstedt	0.45	44,500	20,025
Katz	0.45	40,425	18,191

ADMIN

McManus	0.10	45,000	4,500
O'Keefe	0.05	46,600	2,330

SUBTOTAL

\$149,445

FRINGE BENEFITS

Fringe = 41% if Base > \$50K	42,803
Fringe = 51% if Base <\$50K	22,974

SUBTOTAL

\$65,777

TRAVEL

Local travel - staff & consultants	2,400
Local travel - data collectors	0
Required meeting with IES	1,600
Professional conferences	0

SUBTOTAL

\$4,000

SUPPLIES

Curriculum materials	2,600
Assessment materials	0
Minor equipment	4,320
General operating supplies	1,500
Software	1,000

SUBTOTAL

\$9,420

CONTRACTUAL

Consultant - B. Gunn	18,304	
Data collectors	0	
IntelliTools	75,000	
SUBTOTAL		\$93,304

OTHER

Telephone	1,000	
Photocopies: individualized assess. meas.	0	
Other photocopies	3,000	
Postage	500	
Teacher participation fees	14,400	
Teacher-researcher stipends	10,000	
SUBTOTAL		<u>\$28,900</u>

Total direct costs **\$350,846**

Less exempt costs (IntelliTools contract over \$25,000) **\$50,000**

Modified direct costs **\$300,846**

Indirect costs (49% of modified direct costs) **\$147,414**

Total Project Costs - Year One **\$498,260**

Form 524 Section C - Other Budget Information

Year Two

PERSONNEL

<u>PRIN. INV.</u>	<u>FTE</u>	<u>BASE</u>	<u>AMOUNT</u>
Chard	0.20	79,865	15,973
Baker	0.15	100,800	15,120

RESEARCH STAFF

Clarke	0.50	55,125	27,563
Jungjohann	0.40	65,588	26,235
Howard	0.40	55,125	22,050
Otterstedt	0.55	46,725	25,699
Katz	0.55	42,446	23,345

ADMIN

McManus	0.10	47,250	4,725
O'Keefe	0.05	48,930	2,447

SUBTOTAL

\$163,156

FRINGE BENEFITS

Fringe = 41% if Base > \$50K	43,846
Fringe = 51% if Base <\$50K	28,670

SUBTOTAL

\$72,516

TRAVEL

Local travel - staff & consultants	4,320
Local travel - data collectors	750
Required meetings with IES	1,600
Professional conferences	2,700

SUBTOTAL

\$9,370

SUPPLIES

Curriculum materials	6,500
Assessment materials	6,800
Minor equipment	2,600
General operating supplies	1,500
Software	1,000

SUBTOTAL

\$18,400

CONTRACTUAL

Consultant - B. Gunn	18,304	
Data collectors	15,000	
IntelliTools	10,000	
SUBTOTAL		\$43,304

OTHER

Telephone	1,000	
Photocopies: individualized assess. meas.	500	
Other photocopies	3,000	
Postage	500	
Teacher participation fees	1,600	
Teacher-researcher stipends	4,000	
Professional development	6,000	
Teacher stipends	12,000	
SUBTOTAL		<u>\$28,600</u>

Total direct costs **\$335,346**

Less exempt costs (IntelliTools contract) **\$10,000**

Modified direct costs **\$325,346**

Indirect costs (49% of modified direct costs) **\$159,420**

Total Project Costs - Year Two **\$494,766**

Form 524 Section C - Other Budget Information

Year Three

PERSONNEL

<u>PRIN. INV.</u>	<u>FTE</u>	<u>BASE</u>	<u>AMOUNT</u>
Chard	0.20	83,858	16,772
Baker	0.15	105,840	15,876

RESEARCH STAFF

Clarke	0.50	57,880	28,940
Jungjohann	0.40	68,868	27,547
Howard	0.40	57,880	23,152
Otterstedt	0.45	49,060	22,077
Katz	0.45	44,570	20,057

ADMIN

McManus	0.10	49,613	4,961
O'Keefe	0.05	51,377	2,569

SUBTOTAL **\$161,950**

FRINGE BENEFITS

Fringe = 41% if Base > \$50K	47,091
Fringe = 51% if Base <\$50K	24,018

SUBTOTAL **\$71,109**

TRAVEL

Local travel - staff & consultants	4,320
Local travel - data collectors	750
Required meetings with IES	1,600
Professional conferences	2,700

SUBTOTAL **\$9,370**

SUPPLIES

Curriculum materials	6,500
Assessment materials	10,000
General operating supplies	1,500
Software	1,000

SUBTOTAL **\$19,000**

CONTRACTUAL

Consultant - B. Gunn	18,304	
Data collectors	15,000	
IntelliTools	10,000	
SUBTOTAL		\$43,304

OTHER

Telephone	1,000	
Photocopies: individualized assess. meas.	750	
Other photocopies	3,000	
Postage	500	
Teacher participation fees	1,600	
Teacher-researcher stipends	4,000	
Professional development	6,000	
Teacher stipends	12,000	
SUBTOTAL		<u>\$28,850</u>

Total direct costs **\$333,583**

Less exempt costs (IntelliTools contract) **\$10,000**

Modified direct costs **\$323,583**

Indirect costs (49% of modified direct costs) **\$158,556**

Total Project Costs - Year Three **\$492,139**

University of Oregon
Early Learning in Mathematics: A Prevention Approach
Budget Justification

This budget narrative is for the Center for Research in Teaching and Learning in the College of Education at the University of Oregon which will serve as the research and academic unit for the proposed research conducted for the project *Early Learning in Mathematics: A Prevention Approach*. The grand total request of support for the project in year 1 is \$498,260, including budget requests for the University of Oregon and a subcontract to IntelliTools Corporation. Of the total for Year 1, the direct cost request for the University of Oregon is \$350,846, including the IntelliTools subcontract of \$75,000, and the indirect cost is \$147,414, calculated at a rate of 49% of modified direct costs. The budget justification for all three years of University of Oregon project costs follows.

Personnel

Dr. David Chard, Co-Principal Investigator. Dr. Chard will be .20 FTE for the entire three years of the project. Along with Dr. Baker, he will share responsibility for overall grant management. Dr. Chard will be one of four senior staff members of the intervention design team. Dr. Chard will also supervise professional development and assist in the development of the observation system and observation data collection.

Dr. Scott Baker, Co-Principal Investigator. Dr. Baker will participate at .15 FTE each of the project's three years. In addition to overall grant management, Dr. Baker will play a key role in both the quantitative and qualitative data collection and analysis components of the project. He will also assist Dr. Chard with the development of the observation systems, and Dr. Clarke in the development and validation of the performance assessments.

Dr. Benjamin Clarke, Project Coordinator. Dr. Clarke will be .40 FTE in Year 1 and his FTE will increase to .50 FTE in Years 2 and 3. In addition to playing the key role in managing the day-to-day operations of the project, Dr. Clarke will assume the major responsibility for data collection and management associated with the student assessment portions of the project. His small increase in FTE in Years 2 and 3 reflect his increased responsibilities associated with the formal experimental studies.

Dr. Ruth Kaminski, Research Associate. Dr. Kaminski will participate during the first year of the project, at .10 FTE. Her role will be to conduct ongoing reviews of curriculum materials and planned instructional approaches, emphasizing in particular effective and appropriate strategies for kindergarten students and kindergarten students with learning difficulties.

Kathleen Jungjohann, M.S., Intervention Development Research Assistant. Ms. Jungjohann will participate at .40 FTE throughout each of the three years of the project. Her major responsibility in Year 1 will be the development of the mathematics intervention curriculum. In Years 2 and 3, Ms. Jungjohann will work on curriculum refinement, professional development, classroom observations, and student assessments.

Lisa Howard, M.S., Intervention Development/Research Assistant. Ms. Howard will be .40 FTE during each of the project's three years. Her major responsibility in Year 1 will be the development of the mathematics intervention curriculum. In Years 2 and 3, Ms. Howard will work on curriculum refinement, professional development, classroom observations, and student assessments.

Janet Otterstedt, M.S., Research Assistant. Ms. Otterstedt will participate at .45 FTE in Year 1, .55 in Year 2, and .45 in Year 3. Her primary responsibilities will be to assist Clarke in quantitative aspects of the project. Ms. Otterstedt will also have primary responsibility for data management. Her slight increase in FTE in Year 2 of the project reflects the small increase in project responsibilities associated with conducting the first formal study, and with data collection requirements associated with developing and validating hypotheses for the Year 3 study.

Rachell Katz, M.S., Research Assistant. Ms. Katz will participate at .45 FTE in Year 1, .55 in Year 2, and .45 in Year 3. Ms. Katz's primary responsibility will be to assist Drs. Baker and Chard with the classroom observations. She will also work on the individual teacher case studies. Her slight increase in FTE in Year 2 reflects the small increase in project responsibilities associated with conducting the first formal study, and with data collection activities associated with developing testable hypotheses for the Year 3 study.

Sofia McManus, Business Manager. Ms. McManus will be .10 FTE during all three years of the project to assist Drs. Chard and Baker with all administrative and fiscal project management functions, including preparation of budget status and regulatory progress reports.

Diane O'Keefe, Senior Business Manager. Ms. O'Keefe will be .05 FTE during all three years of the project to provide overall administrative management and fiscal oversight support to Drs. Chard and Baker.

All base salaries are adjusted by 5% each year for cost of living/merit increase adjustments.

Fringe Benefits

Fringe benefits: Funds are budgeted for all applicable state and federal employee payroll taxes and insurance fees and employee benefit programs in accordance with the current cost structure for University of Oregon employees. Fringe benefit costs are calculated at 41% of salary expense for employees whose base salary is over \$50,000 per year and at 51% for employees whose base salary is under \$50,000 per year.

Travel

Local travel: Funds are budgeted for local mileage reimbursement to staff employees and consultants during Years 1, 2 and 3 and to data collector contract employees during Years 2 and 3 to provide for travel to project schools for training, group observations, student assessments, and project reviews. Total project mileage is estimated at 6,400 miles for Year 1 and 13,520 miles in each of Years 2 and 3. The University of Oregon reimburses mileage at a rate of 37.5 cents/mile.

Required meeting with IES: Funds are budgeted at \$1600 for a staff member to attend a required two-day meeting each year with Institute of Education Sciences staff and other grantees in Washington, DC. Funds budgeted include \$850 for airfare, \$480 for three nights lodging, \$140 for meals and \$130 for ground transportation and incidental expenses.

Professional conferences: Funds have been budgeted totaling \$2,700 in each of Years 2 and 3 to provide for two staff members to attend professional conferences for four days each, per year. Estimated costs per person per conference are \$750 for airfare and conference fees, \$360 for lodging, \$140 for meals, and \$100 for ground transportation and incidentals.

Supplies

Curriculum materials: Funds have been budgeted at \$2,600 for Year 1 and \$6,500 each in Years 2 and 3 for curriculum materials based on estimated costs of \$650 per class for classroom supplies, display materials, practice sets and manipulatives.

Assessment materials: Funds have been budgeted at \$6,800 in Year 2 and \$10,000 in Year 3 to cover purchase costs and materials of standardized tests and other assessment tools for pretest, interim progress and posttest assessments of students' performance.

Minor equipment: Funds are requested in Year 1 to purchase one laminating machine (\$1,000) for preparation of classroom materials, one PowerBook computer (\$2600) for project and curriculum design and development and four tape recorders and related equipment (\$720) for recording teachers' classroom instructions as well as interviews with students and teachers. Funds are requested in Year 2 for the purchase of a second PowerBook computer (\$2600) for data collection and analysis. No equipment purchases are planned for Year 3.

General operating supplies: General supply costs have been estimated at \$1,500 in each of the three years of the project to provide for day-to-day supplies such as computer paper, envelopes, file folders, labels, recording materials, writing materials and other general office supplies.

Software: Funds of \$1,000 per year are budgeted for purchase of software to assist in curriculum development and data collection and analysis of student and classroom results.

Contractual

Dr. Barbara Gunn, Consultant. Funds have been budgeted under a Personal Services Contract for Dr. Gunn who will provide consultation services for 52 days during each year of the project. Her expertise is required to support the development of the intervention curriculum. Dr. Gunn will also play a key role in curriculum refinement for at-risk students and in the development of classroom observation systems and in conducting classroom observations. Calculated at a daily rate of \$352, the consultant cost budgeted in each of the three years is \$18,304.

Data collectors: Funds have been budgeted at \$15,000 in each of Years 2 and 3 to hire data collectors at \$20 per hour to provide 750 hours per year assistance and support to staff personnel for data collection, testing of children, and data transcription and analysis. Extensive pretest, interim progress and posttest assessments will be administered to 160 students in Years 2 and 3 with the assistance of these data collectors.

IntelliTools: Funds have been budgeted for a subcontract to IntelliTools totaling \$75,000 in Year 1 and \$10,000 in each of Years 2 and 3. In Year 1, IntelliTools will design an “automaticity builder” technology component to accompany the kindergarten mathematics intervention. In Years 2 and 3, IntelliTools will maintain and refine the software capabilities developed in Year 1 and provide consultation in using the software to address broader aspects of the mathematics curriculum. Budget details of the IntelliTools contract for all three years are included at the end of this narrative.

Other

Telephone: Telephone costs have been budgeted at \$1,000 per year to cover line costs and long distance and cell phone expenses to facilitate communication between project staff, participating professionals, project sites, classroom personnel and IES staff.

Photocopies of individualized assessment measures: Funds of \$500 in Year 2 and \$750 in Year 3 have been budgeted for copying individualized assessment measurement materials at 5 cents per page for 500 students in Year 2 and 750 students in Year 3.

Other photocopies: Photocopying expense has been estimated at \$3,000 per year to provide 60,000 pages at five cents per page to cover costs of reproducing curriculum development and instructional materials, observations forms, test development and analysis materials, data collection and analysis materials, and project and regulatory reports.

Postage: Funds of \$500 per year have been budgeted to cover postage fees for mailings to participating schools and school districts, teachers, project professionals and IES staffs.

Teacher participation fees: Funds have been budgeted for teacher participation fees to compensate school districts for the cost of replacing four teacher-researchers on a periodic basis throughout the school year. Costs of \$14,400 have been estimated in Year 1 to permit four teacher-researchers to meet with project staff one day each of 36 weeks at a cost of \$100 per week. In each of Years 2 and 3, teacher participation fees have been estimated at \$1,600 per year to provide for four meetings during the year with each of the four teacher-researchers.

Teacher-researcher stipends: To ensure and support participation of four teacher-researchers, funds are budgeted for stipends to compensate them for the extensive work involved in training and development, field-testing, progress reports and evaluation throughout 36 weeks of Year 1. Stipends are budgeted at \$2,500 per teacher for their weekly involvement in Year 1 for a total of \$10,000. Stipends for teacher-researchers are budgeted at \$1,000 per teacher in each of Years 2 and 3, totaling \$4,000 per year, covering four meetings in each year.

Professional development: Funds have been budgeted totaling \$6,000 in each of Years 2 and 3 to compensate ten teachers \$150 per day for attending four days of staff training and development sessions prior to and during the school year.

Teacher stipends: To support the participation of teachers in Years 2 and 3, funds have been budgeted for a stipend of \$600 per teacher per year for 20 teachers (covering 10 experimental and 10 comparison classrooms), totaling \$12,000 in each of the two years.

Direct Costs

Direct costs are budgeted at \$350,846 for Year 1, \$335,346 for Year 2 and \$333,583 for Year 3.

Exempt Costs

The IntelliTools contract is budgeted for a total of \$95,000 in direct costs over the three years of the project. In calculating the budget for indirect costs, \$70,000 in direct costs have been excluded, equal to the amount of the Intellitools contract in excess of \$25,000.

Indirect Costs

Indirect costs, budgeted at a rate of 49% of modified direct costs, are \$147,414 for Year 1, \$159,420 for Year 2 and \$158,556 for Year 3.

The University of Oregon's on-campus rate of 49% has been applied to all modified direct costs in each of the project years in accordance with the University of Oregon's indirect cost agreement negotiated with the US Department of Health and Human Services. Under the terms of this agreement, the on-campus rate is applied to all qualifying direct project costs when off-campus costs comprise less than 50% of project expenses.

Total Costs

Total project costs have been budgeted as \$498,260 for Year 1, \$494,766 for Year 2 and \$492,139 for Year 3.

IntelliTools Subcontract - Budget Details

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>
Personnel	\$ 45,735	\$ 8,130	\$ 8,130
Fringe Benefits	<u>\$ 10,519</u>	<u>\$ 1,870</u>	<u>\$ 1,870</u>
Total Salaries and Fringes	\$ 56,254	\$ 10,000	\$ 10,000
Facilities & Administrative Costs and Fees	<u>\$ 18,746</u>	<u>-</u>	<u>-</u>
Total Budget	<u><u>\$ 75,000</u></u>	<u><u>\$ 10,000</u></u>	<u><u>\$ 10,000</u></u>

Appendix A

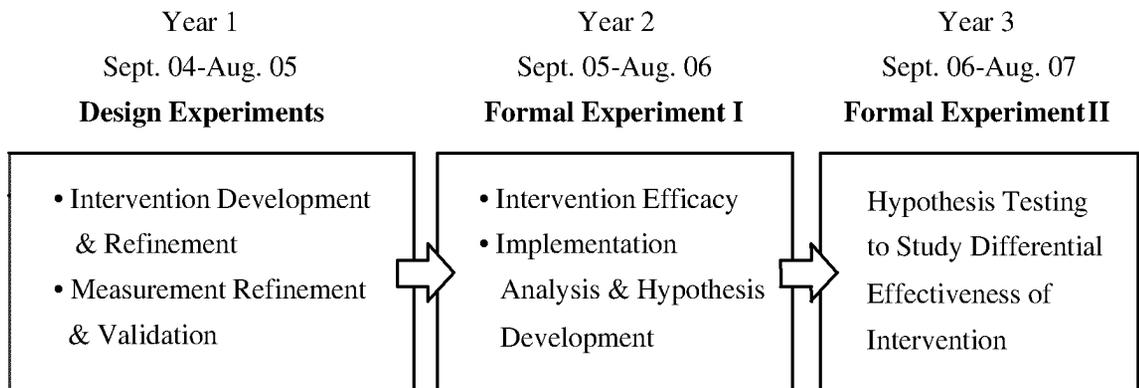


Figure 1 Overview of Project Goals

Table 1. Administration Schedule of Measures for Year 2 Study

Measures	Year 1	Year 2								
	Spring	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Student										
• SAT-10		•								•
• NKT		•								•
• EM-CBM		•				•			•	
• Performance				•			•		•	
Observation										
• Fidelity		•	•	•	•	•	•	•	•	•
• Participation			•		•		•		•	
Teacher										
• LoU Interview	•									•
• Stages of Concern	•									•

Note. SAT = Stanford Achievement Test – Tenth Edition; NKT = Number Knowledge Test (Okamoto & Case, 1996); EM-CBM = Early Numeracy Curriculum-Based Measurement (Clarke & Shinn, in press; Chard, Clarke, Baker, Otterstedt, Braun, & Katz, in press); LoU Interview = Levels of Use Interview (Loucks, Newlove & Hall, 1975; Baker, Gersten, Dimino, & Griffith, in press).

Table 2. District Demographics

	Springfield	Eugene	Bethel
Elementary Schools	16	30	7
Title Schools	10	16	6
# Kindergarten Teachers	36 half day classrooms (18.0 FTE)	26.1 FTE	16.0 FTE
# ELL	501 out of 11,118	457 of 18,476	168 of 5,311
Students in Poverty	1943 (17.4%)	1958 (10.6%)	1,025 (19.3%)

January 5, 2004

David Chard
5261 University of Oregon
Eugene, OR 97403

Dear Dr. Chard,

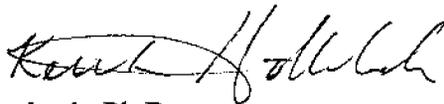
This letter is to express my district's strong support for your proposed grant to develop and test kindergarten mathematics instructional materials and assessments. As you know, Springfield School District has had a firm commitment on improving mathematics achievement across the grades for some time. Our efforts, while successful, do not always reach the most struggling students.

As a district, I am convinced we can make a significant improvement in students' mathematical skills and knowledge in the early grades. I also believe that with well-designed instructional materials and assessments, kindergarten is an excellent time to lay the foundation for more sophisticated mathematical thinking for all our students.

Given your teams' history of work with our district and the focus and intent of your proposed project, I think teachers and administrators in the district will be very enthusiastic and willing to participate.

Best of luck with the proposal. I look forward to working with you and your research team.

Sincerely,



Keith Hollenbeck, Ph.D.
Director of Special Programs
Springfield Public Schools



School District 4J
Eugene Public Schools
200 North Monroe Street
Eugene, OR 97402-4295

January 5, 2004

David Chard
5261 University of Oregon
Eugene, OR 97403

Dear Dr. Chard,

This letter is to express my district's strong support for your proposed grant to develop and test kindergarten mathematics instructional materials and assessments. As you know, Eugene School District 4J has had a firm commitment on improving mathematics achievement across the grades for some time. Our efforts, while successful, do not always reach the most struggling students.

As a district, I am convinced we can make a significant improvement in students' mathematical skills and knowledge in the early grades. I also believe that with well-designed instructional materials and assessments, kindergarten is an excellent time to lay the foundation for more sophisticated mathematical thinking for all our students.

Given the focus and intent of your proposed project, I think teachers and administrators in the district will be enthusiastic and willing to participate.

Best of luck with the proposal. I look forward to working with you and your research team.

Sincerely,

Dennis Urso
Research and Evaluation Specialist
Eugene School District 4J

Bethel School District #52

4640 Barger Drive • Eugene, OR 97402 • Phone (541) 689-3280 • Fax (541) 689-0719 • www.bethel.k12.or.us



"The mission of the Bethel School District is to offer a secure place where students gain knowledge, grow in wisdom, develop confidence, and value learning for life."

January 2, 2004

David Chard
5261 University of Oregon
Eugene, OR 97403

Dear Dr. Chard,

This letter is to express my district's strong support for your proposed grant to develop and test kindergarten mathematics instructional materials and assessments. As you know, Bethel School District has had a firm commitment on improving mathematics achievement across the grades for some time. Our efforts, while successful, do not always reach the most struggling students.

As a district, I am convinced we can make a significant improvement in students' mathematical skills and knowledge in the early grades. I also believe that with well-designed instructional materials and assessments, kindergarten is an excellent time to lay the foundation for more sophisticated mathematical thinking for all our students.

The work your team has done in our district on validating early mathematics assessments and systems for monitoring progress will make it easy for us to generate enthusiasm among our teachers and administrators for your project.

Best of luck with the proposal. I look forward to working with you and your team research team.

Sincerely,

Drew Braun, Ph.D.
Curriculum Director
Bethel Public Schools

Steve Hull
Superintendent

Tim Keeley
Asst. Superintendent

Carl Cole
Special Services Director

Drew Braun
Curriculum Director

Filan Mooney
Business Services Director

Craig Hawkins

Maryann Herron

** TOTAL PAGE.01 **



1720 CORPORATE CIRCLE

Petaluma, CA 94954

707-773-2000

FAX: 707-773-2001

EMAIL: into@intellitools.com

www.intellitools.com

Dr. David Chard
5261 University of Oregon
Eugene, OR 97403

RE: IntelliTools Subcontract with the University of Oregon

Dear Dr. Chard,

Please find enclosed IntelliTools' portion of an application for support of a project entitled "Developing an Automaticity Builder for Kindergarten Mathematics." This portion is part of a proposal you are submitting to the U. S. Department of Education's research program on Mathematics and Science Education (CFDA No. 84.305). Ed Koenig, Chief Financial Officer, submits IntelliTools' portion of the application. IntelliTools, Inc. seeks funds in the amount of \$95,000 for the proposed project period of September 1, 2004 through August 31, 2007.

IntelliTools will be pleased to collaborate with the University of Oregon on this project. If an award is made, a subcontract agreement will be entered into between IntelliTools, Inc. and the University of Oregon. The subcontract document can be sent to IntelliTools, Inc., 1720 Corporate Circle, Petaluma, CA 94954-6924, Attn: Ed Koenig.

Questions regarding the IntelliTools application should be directed to Arjan Khalsa (ext. 2030) or Ed Koenig (ext. 2038). Your consideration of this application is greatly appreciated.

Sincerely,

A handwritten signature in black ink, appearing to read "Ed Koenig". The signature is written in a cursive, flowing style.

Ed Koenig
Chief Financial Officer

Appendix B: K Math Intervention

Scope and Sequence

The content of the K Math Intervention is organized around four major strands. These strands provide the foundation for establishing a solid sense of numbers and their relationships as well as experience with math concepts that young children encounter and find meaningful in their everyday lives. These strands are:

Numbers and operations (counting, number identification, addition, subtraction);

Geometry (shapes, patterns, symmetry);

Measurement (time, money, linear, capacity, etc.), and

Math vocabulary (basic concepts and domain specific words).

Content across the year is further broken down by quarters and displayed in the table below.

Strand	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Numbers and Operations	Identifies & writes numbers to 10 Rote counts to 20 Counts from a number other than 1 Rational counts to 10 1:1 correspondence Makes equal number sets Makes sets to equal number Identifies number equal to set	Identifies & writes numbers to 20 Counts backward from 20, counts by 10s, ordinal counts to tenth Counts 2 groups of objects to 10 Adds and subtracts groups of objects to 10	Identifies & writes numbers to 100 Counts backward from 20, by 5s to 100. Rational counts up to 20 Writes number sentences Adds and subtracts by drawing lines and with a number line	Counts by 2s. Odd / even One half Place value Min strategy Number families Mental addition & subtraction Conceptual multiplication & division
Geometry	Recognizes & names triangle, circle, square Sorts by 3 attributes (shape, color, size) Recognizes & extends simple patterns Related domain vocabulary	Recognizes & names rectangle, hexagon Uses rules for sorting Recognizes & extends complex patterns Related domain vocabulary	Describes & draws shapes Identifies patterns in multiple contexts Defines rules for patterns Related domain vocabulary	Recognizes symmetry Recognizes 3 dimensional shapes Relates 2 and 3 dimensional shapes Related domain vocabulary
Measurement (conceptual understanding, identifies, names, counts, compares, measures)	Calendar concepts (days, months, years) Names days of week Names year Related domain vocabulary	Length (standard and non-standard) Hours, minutes Pennies, dimes Related domain vocabulary	Weight* Capacity* Nickels, quarters Related domain vocabulary *standard and non-standard	Temperature Dollars Names months of the year Related domain vocabulary
Vocabulary	Same, different, more, less, equal, fewer, more, most, before, after, first, next, last, triangle, circle, square	Second, third, etc., between, in front of, in back of, middle, left, right, rectangle, hexagon	Add / plus Subtract / minus / take away Total / how many	Ones/tens/hundreds Odd / even Part/whole/half Opposite

Building Math Competency Across the Year

Specific concepts and skills are identified and sequenced across four quarters of nine weeks each. The first quarter focuses largely on numbers to 10; introduces basic shapes; important math vocabulary (same, different, more, less, before, after, equal); rational counting and constructing sets of more, less and equal; calendar concepts and skills; and problem solving activities of classifying and comparing.

The second quarter extends the understanding and fluency with numbers to 20; introduces additional math vocabulary; shapes and patterns; simple conceptual addition and subtraction; linear measurement and time; and additional problem solving activities.

Numbers to 100 are the focus in the third quarter, with corresponding work on money and temperature; patterns and sequences; addition and subtraction strategies; and more application in problem solving activities.

The fourth quarter consolidates number and place value proficiency to 100; focuses on mental math, estimation, number families, and conceptual multiplication and division; and applies problem solving across multiple strands. Each quarter ends with a checkpoint to assess and evaluate student progress and readiness for the next quarter's content. Across each quarter, systematic review of previously introduced concepts is emphasized.

Although some students may enter kindergarten knowing numbers well past ten and being able to count out objects, the first quarter provides a comprehensive conceptual understanding of each single digit number using multiple representations and its position on the number line and in the counting sequence, extending understanding for more sophisticated learners and building a critical foundation for naïve learners. Fine motor skills required to write numbers is a challenging skill for all kindergarteners and is practiced daily, further reinforcing the concept of numbers.

Weekly Units

Each quarter is divided into nine weekly units. Each weekly unit has specified objectives that all students are expected to master by the end of four days, although some students may exceed the unit objectives. Daily 20 minute lessons include counting and numeration skills, geometry, math vocabulary, and measurement and provide students with ample practice and review to master the weekly objectives. The fifth day of the unit culminates in a problem solving event in which students will work in small groups to apply the skills and strategies to contextually meaningful problems. Additionally, the fifth day provides the teacher with an opportunity for assessment of students' skill and strategy use as well as a review of unit content.

Weekly Folder and Daily Lessons

Daily lessons utilize manipulatives (attribute and pattern blocks, dice, counters, coins, clocks, etc.) as well as representational models (numbers, number lines, symbols, drawings, etc.). Instruction includes explicit teacher modeling, guided practice, and small group or paired partner activities. Additional pencil and paper activities allow each student to practice independently and provides the teacher with important information on individual student proficiency.

Daily math lessons are anchored to the Weekly Unit Folder (11" x 17" paper folded in half and formatted as a separate lesson on each of four sides) providing a predictable instructional routine while new skills and concepts are introduced, and other skills are practiced and reviewed to develop fluency. The math lesson begins with a "Math Workout" with students practicing counting, number, and vocabulary skills from previous lessons. New concepts are introduced on

the first day of the unit with concrete, visual, and representational supports and practiced across the week with less teacher support and increasing integration and discrimination of the skill(s). The weekly folder allows the teacher and the students to refer to and/or review introductory information when needed and assures that the weekly objectives are well practiced and mastered. Folders also allow the teacher to collect and analyze student mastery of unit objectives and make individual and group decisions about reviewing, reteaching, acceleration, extra practice, etc.

Building Conceptual Understanding to Abstract Reasoning

Concepts are always introduced with manipulatives and representational models. Instruction is scaffolded over time as students use increasingly more abstract representations. As children develop more abstract reasoning, conceptual understanding increases. The following example illustrates this progression for basic addition.

Students are provided many opportunities to count out and add groups with three dimensional models (blocks, pennies) to determine a total. As students develop concepts of single digit numbers and their representations, they begin to substitute two dimensional representations (lines or dots) to determine the total of two numbers. Other representational strategies are introduced including addition on the number line, initially paired with models and counting sequences to further reinforce conceptual understanding. Because the number line has been used regularly throughout the curriculum, students play “cover up” games to visualize the numbers that comes next on the line, providing the beginnings of mental addition (plus 1, plus 2, etc.). The min strategy, adding by counting up from the bigger number, integrates many skills and concepts previously introduced and is the bridge to understanding number families. As students work with number families, fact memorization can be anchored to relationships between numbers rather than isolated unconnected bits of knowledge. When students recall what $4 + 3$ equals, their answer reflects deep understanding of addition and the relation between 4, 3, and 7.

Math Related Vocabulary

Critical math vocabulary related to basic concepts (same, next, before, more, etc.) is systematically introduced in the first two quarters in the context of math applications and then utilized throughout the curriculum to increase depth of understanding of both the vocabulary words and other math concepts. For example, the vocabulary word “same” is introduced in Unit 1 through examples of finding shapes that are the “same.” Later on, students count out the “same” number of objects, and find the number that is the “same” for a given number of objects. When the more difficult vocabulary word “equal” is introduced, it is related to “same,” a concept that is by then, well established. Vocabulary words continue to be utilized throughout the third and fourth quarters in increasingly sophisticated ways and to introduce more difficult skills and concepts (ten ones is the “same” as one ten, or ten ones “equal” one ten).

Domain specific vocabulary is introduced and explicitly taught in the context of strand instruction throughout the year. Names of shapes and measurement units such as inch, minutes, and degrees, are introduced and used in geometry and measurement respectively.

Procedural Fluency and Automaticity

Building fluency is a key feature of the K Math Intervention. The daily “Math Workout” provides systematic and massed practiced of newly acquired skills as well as cumulative and regular review of all mastered skills. The workout is designed to be a fast paced, interactive,

engaging, and highly successful activity. Some workout goals are specified for each unit, others can be selected by the teacher to ensure continued student practice and mastery.

Because daily lessons draw on multiple strands, students are able to engage in a variety of familiar activities during the week and will be less apt to “forget” what they learned in previous units. As they encounter familiar activities across a variety of contexts, they build fluency and confidence in applying these skills to unfamiliar contexts. The instruction is also carefully designed to integrate previously mastered concepts and skills providing for maintenance and generalization.

In addition, automaticity builder software aligned to lesson objectives provides regular opportunities for students to build fluency with math vocabulary, number and shape identification, counting sequences, and math facts. This technology based component will be developed in collaboration with IntelliTools, Inc., a leader in educational software and assistive technology devices. The software will comprise three components: a number concept builder designed to reinforce concepts taught in the daily K Math lessons by representing on the computer various models of numbers and number operations (e.g., number lines with movable objects to represent increases in number); an automaticity component designed to assess students’ baseline automaticity levels in recognizing numbers and solutions to number operations as well as to provide students with engaging problems with which to improve automaticity of skills presented during teacher-directed instruction. These skills are often implicated as one of the chief reasons students fail to solve more complex problems.

Building Competence in Problem Solving

Although problem solving is an important part of the curriculum, it does not comprise a separate strand of specific skills, but rather a weekly activity incorporating a variety of strands to develop mathematical reasoning and strategic competence.

Problem solving activities integrate concepts, skills, and strategies in new and applied ways. At the end of each weekly unit, students are presented with a problem solving activity requiring strategic application of recently mastered math skills. Problems are presented in meaningful contexts with opportunities to utilize multiple models and representations. Students work in peer groups, with or without teacher guidance to engage in math related discourse and determine possible strategies and solutions. Groups are structured to insure that at-risk students least likely to engage in math related discourse do so. Each group member contributes and discusses their ideas, strategies, and potential solutions.

Problem solving scenarios may be as simple as identifying examples of triangles, circles, and squares in the classroom and noting the differences and similarities across each shape, finding all the “fours” in the classroom, or predicting and confirming the probability of any group member selecting a single red counter from a bag with 4 other black counters. Other problem solving activities apply measurement concepts and organizing data such as determining how many students in the group are taller than 4 feet and how many are shorter than 4 feet or whether the tallest students also have the biggest (longest) feet. Problem solving scenarios introduced later in the curriculum require students to integrate multiple strands to successfully complete the activity. For example, an advanced problem solving scenario would require mathematical reasoning, modeling, counting larger numbers, grouping, and conceptual understanding of

multiplication as students determine the least number of dice rolls needed to win a board game of 32 spaces.

Sample Unit 5 Lesson

UNIT 5 (SAMPLE)

Overview

Unit 5 extends the rote counting sequence to 10; introduces numeral 6 as the “star number of the week” and explores the cardinal meaning of 6, the 6 position on the number line, various representations of 6 (numeral, quantity, tally, dot configuration, number of fingers, location on calendar and clock, printed word) and teaches the strokes sequence to trace, copy, and write the numeral 6. The vocabulary word “equal” is introduced through the activities of counting out objects to 5 and then constructing sets of equal number objects (reinforcing the concept of one-to-one correspondence). Throughout the week, students transition from using manipulatives to increasingly abstract representations by drawing an equal number of lines for a given number.

Unit 1-4 skills are practiced and reviewed during the Math Workout at the beginning of the lesson (rote count to 9, naming numbers 1-5, identifying shapes that are the same or different) and in the daily folder (writing numerals 1-5, naming numbers 1-5 recognizing triangles, circles, and squares).

Unit 5 Objectives

Rote counts 1-10
Names numeral 6
Writes numeral 6
Constructs equal number groups 1-5
Vocabulary: equal(s)
Identifies and compares triangles, circles, and square in the environment

Review Objectives

Rote counts 1-9
Names numerals 1-5
Writes numerals 1-5
Counts objects and identifies amounts 1-5
Identifies groups that are more and less
Vocabulary: same, different, more, less
Recognizes triangle, circle, square

At a Glance

Day 1	Day 2	Day 3	Day 4	Day 5
Math workout Rote count 1-10 Introduce 6 Review 1-5 Write numeral 6 (review 2 & 5) Count out objects to 5 Identify equal groups (up to 5) Recognize words triangle, circle, square. Sort by shape (tri, circle, sq)	Math workout Rote count 1-10 Review 1-6 Write numeral 6 (review 4 & 5) Count and construct equal number groups 1-5 Sort by shape (tri, circle, sq)	Math workout Rote count 1-10 Review 1-6 Write numeral 6 (review 5 & 3) Count items & circle equal # for groups 1-5 Identify groups that are more, less, and equal Sort shapes by color	Math workout Rote count 1-10 Review 1-6 Write numeral 6 (review 5, 4) Count items & circle equal # for groups 1-5 Sort shapes by size	Assess: Rote count 1-10; I.d. numerals 1-6; Writing 1-6 Constructing equal number groups for # 1-5 Reteach or review Problem Solving Activity – finding and comparing shapes in the classroom



See Unit 5 Weekly Folder, Math Practice 1 and Teacher’s Guide on the pages that follow.

Unit 5 Weekly Folder
Math Practice 1

Name _____

1. Math Workout: Counting 1-9; Number cards 1- 5; Days of week.

2. Introduce Star Number of the week 6:

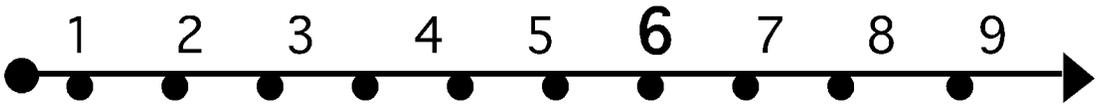
6

Six, six, show me six. 

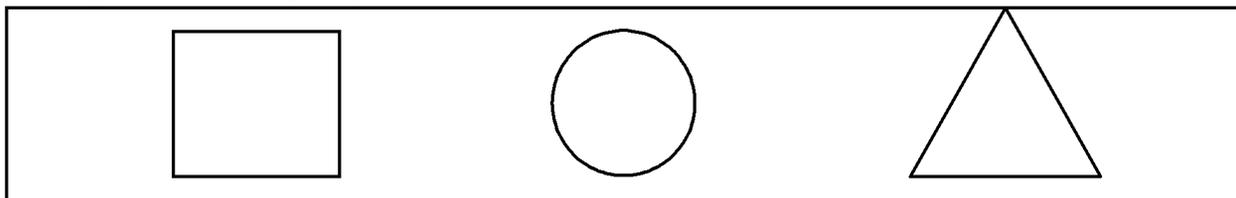
Six, six, count the sticks.

1, 2, 3, 4, 5, 6. 

How many? Six!



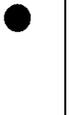
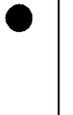
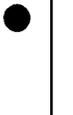
3. Recognize and sort by shape.

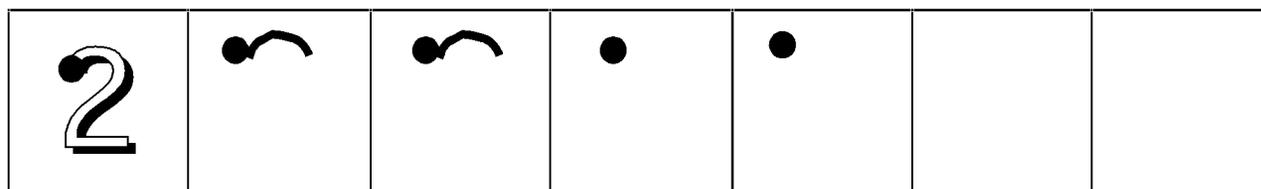


4. Count out objects to 5 and make equal number of groups

5. Count by ones to 10

6. Number Writing

6						
5						



UNIT 5 LESSON 1 TEACHER'S GUIDE (SAMPLE)

(Use with Math Practice 1)

1. Math Workout

Call on different children to select a “workout stick.” Announce the activity selected and help the student lead the activity. Today’s activities must include counting by ones to nine, reading number cards 1 – 5, counting to a number lower than 9, and saying the days of the week in order. Quickly practice each activity as a whole class, then call on small groups (boys, girls, kids wearing tennis shoes, kids on the right side of the room, etc.). Praise correct responses. Provide model and lead if students make errors until they can respond correctly.

After each workout, use math vocabulary to give directions on which daily container to place the workout stick for future lessons.

Continue until all the workouts have been completed.

2. Introduce Star Number of the Week: 6

Pass out Math Folders. Announce the Star Number for the Week is 6. Have the student find the six, touch it and say the number.

Ask the students to identify other things in the box that show six. Confirm and demonstrate how each represents 6. (“Yes, there are six dots, count them with me, 1, 2, 3, 4, 5, 6. Yes, there are six fingers, show me six fingers,” (lead counting the fingers on some of the students hands). “Yes, this is the number six on the number line. Touch the six on your number line. Let’s count to six on the number line.”)

Read the story about six. Have students follow along and do what the story says:

Six, six, show me six. (Have students put out six fingers as depicted).

Six, six, count the sticks. (Have students touch as you count.)

1, 2, 3, 4, 5, 6.

How many? Six!

Read the story again and have the students repeat each line after you and do the actions. Have the students touch the first word (six). Ask them to find and touch the next word “six”. Have the students circle the first word “six” with their pencil. Check. Have them find the other “sixes” and circle them. Challenge the students to count and tell how many sixes there are in the story (6).

3. Recognize and sort by shape

Place a pile of shapes close by students. Ask them to pick out a square, circle, and triangle. Have them place the shapes in the same order as shown in the picture in their folder.

Name each shape and have students hold up the correct shape, then name the shape. Check and repeat until students are firm.

Have students touch and name each shape. In pairs, have students ask a partner the name of each shape.

4. Count out objects to 5 and make equal number groups

Have the students take their circle and count out more circles until they have 5.

Have students check their count by comparing the number of objects with their partner to see if they have the “same” number of circles.

Tell students that when they have the “same” number of circles they have an “equal” number of circles.

Direct students to count out the “same”, or “equal” number of squares. Students may count out squares to 5 or use 1:1 correspondence with circles.

Observe students and ask students (who used different strategies) how they made an equal number of squares.

Have students now make “an equal number of triangles.” Again, ask different students how they made an equal number of squares. Ask how they could check that they have an equal number of triangles, circles, and squares.

5. Rote Count 1 – 10

Tell the student they are now going to count to ten. Remind them this will be easy because they already know how to count to 9. Have them listen as you count 1 – 10 emphasizing **9, 10**. Tell them to count with you to nine and then you’ll say 10. Ask what number comes after 9? (10). Have students count to 10 with you, then by themselves, then ask for small groups and individuals to count to 10.

6. Number Writing

Have students touch the star number of the week: 6. Tell them they will practice writing number 6. Using their finger, have them start on the dot and trace a six while you provide cues for the stroke sequence (curve down and all the way around for 6). Have students do this several times with their fingers, then with their pencil while you lead the words for the stroke.

Have students touch the number below 6 and tell you what number that is (5). Have students start on the dot and trace 5 with their finger as you provide the cues for the stroke sequence. With pencils, do the next several with the students, but have them do the last two on their own. Walk around and praise student performance.

Ask student what the last number is (2). Have them trace the 2 with their finger while you cue the stroke sequence. Have them write the rest of the 2s by themselves.

Have the students look over their row of 2s and circle the very best 2. Praise students.

Unit 5, Days 2-4

Similar but extended activities are practiced in a similar format through days 2-4 accompanied by three additional Math Practice pages. Refer back to the “At a Glance” chart on page 5 to note how students continue to practice new skills and extend skills across various contexts. This format allows diverse and at risk learners to gain fluency and competency with lesson objectives, ensuring their mastery by day 5.

Unit 5, Day 5

On day 5, the teacher assesses student mastery of the unit objectives and provides additional practice, review, or reteaching if needed. Also on day 5, students are presented with a group problem solving activity, integrating concepts and skills from the week and allowing students to apply reasoning skills and strategies, and talk about the problem, strategies, and potential solutions. The problem solving activity from Unit 5 is described below.

Day 5 Problem Solving Activity

In student groups of 3-4, assign each group to find examples of a shape in the classroom (triangle, circle, or square). Give an example for each shape (square on the calendar; clock for circle, etc.). Tell groups to identify at least 5 examples.

After groups have found at least 5 examples, ask them to compare the examples and discuss how they are the same, different. Ask students what ways they could compare their shapes (size, color, texture, locations, etc.). Tell students that each student will report to the class how one of the shapes compares.

Call on different groups to report their findings. Encourage use of math related attribute and comparative vocabulary.

Other Math Related Classroom Routines

Although the K Math Intervention is organized into daily 20 minute lessons, it is important that teachers also have in place daily routines that provide authentic and relevant mathematics experiences. These routines help establish and deepen students’ understanding of number sense and expose them to the many ways that math is useful in everyday life. As students progress through the curriculum, teachers should incorporate the concepts, skills, and strategies into these daily routines. Below are daily classroom routines that should accompany use of this curriculum. Examples for integrating the K Math content are also provided.

Calendar (year, month, week, day, seasons)

Most teachers have a “circle” or sharing time at the beginning of each day to incorporate calendar and a variety of math related routines. Calendar is an excellent opportunity to develop concepts of time (day, week, month, year, today, yesterday, tomorrow) as well as providing practice in number recognition, counting, and vocabulary (last week, next month, etc.). Blank calendars that allow information to be added and taken away are recommended. Letting students visually see each day identified and added to the calendar is a better way to understand the concept of “days” than static calendars. When students are learning days of the week, they can chant the days across the calendar, take down the names of the days and put them back up in the correct place. When teaching pattern recognition, a fall leaf theme in October or November can be used to establish a different color or shape pattern each week for students to identify and extend.

Noting holidays and special occasions and using temporal words to anticipate special dates help students develop a sense of time over longer periods. Using a visual representation to count the number of school days (growing number line, index cards with the next number placed in sequence on the wall) supports the concept of larger numbers as students celebrate the 100th day of school.

Attendance / lunch or popcorn count (counting, adding, subtracting)

Making attendance part of the morning routine provides many counting and mental math opportunities. Each student should have an individual name or picture card and “check in” upon arrival, putting their card in an area corresponding to being present. Activities can include counting how many students are present and how many are absent each day and verifying by counting individuals present. Incorporating lunch or popcorn counts where appropriate provides additional opportunities to use counting to accomplish important tasks. For advanced students, using mental math to determine number of students present based on how many students are absent provides challenging opportunities to use math skills.

Weather (collecting data, displaying, analysis, predictions, temperature)

Using pictures or a weather wheel showing different conditions (rain, sun, clouds, snow, etc.), have students make observations daily. Keep track of the weather each month using a variety of visual displays such as tallies on cards depicting weather conditions, building bar graphs with pictures of different conditions, etc. Use the data to count, compare, and make predictions. Later in the year when students are learning numbers to 100, post a thermometer outside and record daily temperature readings. Graph these daily during circle time and discuss and make predictions. Note correlations of weather and temperature.

Daily Schedule (clock, time telling, hours, minutes)

Using pictures of clock faces and written time, post a daily schedule. Make daily changes to the schedule during circle time and show students the time, activity, and where in the sequence the activity or change will take place. Refer to the schedule throughout the day to signal changes in activities. Link the time shown on the schedule to the wall clock. Use a kitchen timer to alert students to upcoming transitions. Telling students they have 2 more minutes of an activity and setting a timer not only provides a sense of how much time a minute or two is, but also demonstrates meaningful ways time is used in daily routines.



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Application Detail

APPLICATION R305K04081

Item 1. on ED 424 Organization Name and Address

Name	University of Oregon
Unit	Institute for the Development of Educational Achievement
Address	c/o Office of Research Services & Administration 5219 University of Oregon
City	Eugene
State	OR
Country	United States of America
Zip-Code	97403-5219



Item 2. on ED 424 Project Director Name and Information

First Name	David
Middle Initial	J
Last Name	Chard
Prefix	Dr.
Address	5261 University of Oregon
City	Eugene
State	OR



Country	United States of America
Zip-Code	97403
Phone	541-346-0065
Fax	541-346-0683
Email	dchard@uoregon.edu

Item 3. on ED 424 Authorized Representative Name and Information

Primary	Yes
First Name	Gary
Middle Initial	L
Last Name	Chaffins
Prefix	Mr.
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City	Eugene
State	OR
Country	United States of America
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Email	Diana_Evans@orsa.uoregon.edu

Primary	No
First Name	Karen
Middle Initial	C
Last Name	Findtner

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Prefix	
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City	Eugene
State	OR
Country	United States of America
Zip-Code	97403-5219
Phone	(541) 346-5131
Fax	(541) 346-5138
Email	Research_Services@orsa.uoregon.edu

Item 4. on ED 424 Application Details

4a. D-U-N-S Number	(b)(2)
4b. T-I-N Number	481278531
4c. CFDA Number	84.305K
4d. Novice	N/A
4e. Federal Debt Delinquency If Yes, Federal Debt Explanation	No N/A
4f. Type of Applicant If Other, Description:	Public College or University N/A
4g. Type of Submission	Non-construction Application
4h. Executive Order 12372	N/A
4i. Project Start Date Project End Date	9/1/2004 8/31/2007
4j. Human Subjects Research If yes, Exempt From Regulations?	Yes No
4k. Exemption Number(s)	N/A

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4l. Exempt Research Narrative	N/A
4m. Non-Exempt Research Narrative	1) Human Subject Involvement and Characteristics The project will be conducted in three school districts in western Oregon. In each site, children from kindergarten programs will receive either typical mathematics instruction (comparison condition) or the 20-minute per day of the treatment condition for approximately 32 weeks. All instruction will occur during the regularly scheduled kindergarten program day. Children participating in the study will include 5- and 6-year olds. Cohort I participants will include approximately 100 kindergarten students. Cohort II and Cohort III will participate in the large experimental study involving approximately 500 children in each cohort. Children will represent a diverse sample include children of diverse ethnic, racial, and linguistic backgrounds as well as students with disabilities or experiencing developmental delays. Children with disabilities are included as they are at significant risk for developing mathematics learning difficulties and are potentially strong benefactors of early mathematics intervention. Within Cohorts II and III, a subsample of 160 students will be selected randomly from stratifications based on pretest scores.

Children will receive intervention during their kindergarten year. All 500 students will be assessed, pre/post in kindergarten and grade 1, using a standardized assessment battery to assess the short- and long-term effects of early mathematics instructional intervention. In addition, the subsample (n=160) will be assessed at three points during the year for both Years 2 and 3 using performance measures related to problem solving activities and using curriculum-based measures of mathematics. Students in Cohort II will also be assessed on the standardized measure of mathematics in first grade.

Kindergarten teachers will receive professional development to implement the experimental treatment.

2) Sources of Materials

Materials to be used in the experimental condition will be developed in year 1 and will be designed to teach early mathematics skills including concepts and skills related to number, number operations, geometry, measurement, and mathematics vocabulary. In the comparison condition, kindergarten teachers will continue to use the curricula and materials currently implemented.

Materials obtained from kindergarten children include data from the following:

(a) Stanford Achievement Test-Tenth Edition (Harcourt Brace Educational Measurement, 2003), (b) Number Knowledge Test (Okamoto & Case, 1996), (c) Early Numeracy-Curriculum-Based Measurement (Clarke & Shinn, in press), (d) research developed performance assessments, and (e) classroom observations of student participation.

Materials obtained from kindergarten teachers include data from the following:

(a) Classroom observations of implementation fidelity (b) Levels of Use interviews (Loucks, Newlove, & Hall, 1975), and (d) Stages of Concern Questionnaire (Hall & Loucks, 1978)

Data will be obtained specifically for research purposes.

3) Recruitment and Informed Consent

Initial recruitment efforts have taken place. Three school districts have made tentative commitments to participate. Upon funding approval, project staff will work with the administrators of each district to conduct an informational meeting with kindergarten teachers. All children who are of age to enter kindergarten in the 2004/05 academic year are

eligible to participate. Exclusionary criteria include: (a) children with hearing or visual impairments that prevent them from profiting from classroom instruction, and (b) children with significant developmental disabilities of the magnitude that mathematics is not a current goal in the Individualized Education Plan.

Letters asking for parental consent will be given to parents of students who are identified for participation. The following information will be mailed or hand-delivered by school personnel to the parents of students: (a) information about the project and the school's support of the project, (b) information on how to contact the investigator, and (c) a consent form detailing the intervention, measurement, participation requirements, and level of risk.

In addition to gaining parental consent for the identified students from each classroom, assent from each child will be obtained prior to his or her participation in the project for children who are 7 years or older. This may be the case for some children as they enter first grade. A project member will discuss with the child what the project is and whether or not they would like to participate. After the discussion, each child will then be given a "child-friendly" handout with the information about the project that was just described to them by project

staff. A script/handout for verbal assent will be developed.

Teachers will be asked to complete a brief demographic questionnaire. We will request a waiver of documented consent for these activities because (a) each student's parent will give their consent for teachers to provide information about the student, (b) information requested on the questionnaire is non-sensitive in nature and involves no procedures for which written consent is normally required outside of the research context, and (c) activities involve no more than minimal risk to subjects. Teachers will be sent an informational letter describing the types of information that will be requested, informational meetings will be conducted, and teachers will be compensated for their time.

No waiver of consent has been authorized by the IRB.

4) Potential Risks

Federal regulations define "minimal risk" as follows: "The probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests."

a. Physical—identify, describe, and categorize as None, Minimal, More than Minimal or Unknown

None

b. Psychological—identify, describe and categorize as None, Minimal, More than Minimal or Unknown.

Minimal

Participation in the proposed research will result in no more than minimal psychological risks for parents of students. For instance, parents may feel anxiety after receiving a request for parental consent for their child's participation in an early mathematics instructional project.

Participation in the proposed research may also result in minimal psychological risks for students. Students may experience reservation when asked to participate in a different mathematics activity or when being observed by project staff.

Participation in the proposed research may also result in minimal psychological risks for teachers. Some teachers may feel uncomfortable when interviewed or observed by project staff.

c. Social/Economic—identify, describe, and categorize as None, Minimal, More than Minimal or Unknown

None

d. Legal—identify, describe, and categorize as None, Minimal, More than Minimal or Unknown

None

e. Loss of confidentiality—identify, describe, and categorize as None, Minimal, More than Minimal, or Unknown

Minimal

Participation in the proposed research will result in minimal risks of loss of confidentiality.

5. Protection Against Risk (Describe procedures to minimize identified "Minimal" and/or "More than Minimal" risks)

To minimize psychological risks for students, every effort will be made to put the students at ease during assessment and to keep the data collection as brief and unobtrusive as possible. Whenever possible, students will complete the assessment at times when they are working independently in the classroom. Students will not be asked to leave during the presentation of new content or during the presentation of new content or during valued classroom activities (e.g., games, gym class, etc.). Testing time

will be kept as brief as possible. If students show any sign of discomfort or distress at any time during testing, the activity will be immediately suspended or terminated for that session. All participants will have full knowledge of their right to withdraw from the study at any time.

To minimize psychological risks for the kindergarten teachers, a number of measures will be taken. Teachers will be consulted to determine a convenient time for them to provide requested interview or questionnaire information. Teachers who are required to spend time outside of normal work hours completing data will be compensated monetarily. Classroom disruptions due to testing will be kept to a minimum. Tests will be administered primarily when students are working independently. Teachers will be asked to provide a list of testing times that would be convenient for them. Additional teacher responsibilities for the study will be kept to a minimum so as to keep the stress level down (e.g., project staff will address all permission slips for teachers prior to disbursement, etc.). Finally, observations will be scheduled at the teachers' convenience.

To minimize the risk of loss of confidentiality, the following precautions will be taken. Initially, all participants will be assigned an

identification number (I.D.) that will be used in all project activities. A reference list that links participants to their respective I.D. will be maintained in a locked file in the principal investigator's office. Any identifying information will be removed from data collection measures and the measures will be maintained in a locked filing cabinet in the principal investigator's office throughout the duration of the study. Data will be entered and analyzed according to participant I.D. only. Upon completion of the study, all measures and identification reference lists will be destroyed. Only unidentifiable information will be displayed in the subsequent publications or disseminated products. Finally, all observers, data collectors, and other project staff will be instructed on the importance of maintaining confidentiality.

During observations and assessments of problem solving group activities, audiotaping may be used. Audiotapes will be transcribed and identifiable information removed. Audiotapes will be maintained in a locked filing cabinet in the principal investigator's office throughout the duration of the study. Upon completion of the study, all audiotapes will be destroyed.

6) Importance and Knowledge to Be Gained

The increased evidence supporting

early intervention is clear and compelling, yet few experimental studies exist comparing the efficacy of mathematical instructional programs used in kindergarten classrooms with a wide range of learners. The importance of the Early Learning in Mathematics Project and the proposed studies is to contribute to the evidentiary knowledge base from which schools, and particularly kindergarten classroom teachers, may make informed choices.

The project is designed to build upon research-based methods for teaching beginning early mathematics skills and to extend the knowledge base in intervention. The intent is to design economic, effective, enduring methods to ensure students have optimal opportunities for mathematics learning.

The knowledge to be gained from the Early Learning in Mathematics project involves: (a) defining intervention features and contexts that differentiate mathematics growth of kindergarten children, (b) evaluating over two years (kindergarten through first grade) the effects of individual student responses to kindergarten mathematics instruction, and (c) examining the sustainability of early mathematics effects through the primary grades. In addition the Early Learning in Mathematics project aims to examine learner and contextual

variables that mediate early mathematics growth including: (a) level of participation, (b) pretest status, (c) teacher-student interactions, (d) student-student interactions.

Through the proposed research, we anticipate the following outcomes:

- (a) an empirically validated mathematics instructional approach for developing kindergarten students' mathematical knowledge;
- (b) curriculum materials jointly developed with expert kindergarten teachers that promote improved understanding and proficiency with key mathematical concepts and principles;
- (c) a computer software program that promotes student automaticity and is linked to specific curriculum objectives;
- (d) a validated assessment framework for identifying students at-risk for difficulties in learning mathematics;
- (e) empirically identified student instructional variables that are linked to improved learning outcomes.

7) Collaborating Sites

The project will be conducted in Lane County, Oregon in the Bethel, Eugene 4-J, and Springfield Public School Districts. These districts were described in some detail in the proposal. These districts are demographically diverse and primarily

	represent urban and some suburban areas of low-to-middle income families. Research will be conducted in a minimum of 20 classrooms across the three districts. Upon approval of funding, formal approval to conduct research in the schools and to randomly assign classrooms to treatment and control conditions will be obtained. See letters of support in Appendix A.
4n. Human Subjects Assurance Number	FW A5914
4o. Application Title	Early Learning in Mathematics: A Prevention Approach

Item 5. on ED 424 Estimated Budget

a. Federal Funding	\$498,260.00
b. Applicant Funding	\$0.00
c. State Funding	\$0.00
d. Local Funding	\$0.00
e. Other Funding	\$0.00
f. Program Income Funding	\$0.00

Section A on ED 524 Federal Budget

Budget Categories	Project Year 1 (a)	Project Year 2 (b)	Project Year 3 (c)	Project Year 4 (d)	Project Year 5 (e)	Total (f)
1. Personnel	\$149,445.00	\$163,156.00	\$161,950.00	\$0.00	\$0.00	\$474,551.00
2. Fringe Benefits	\$65,777.00	\$72,516.00	\$71,109.00	\$0.00	\$0.00	\$209,402.00
3. Travel	\$4,000.00	\$9,370.00	\$9,370.00	\$0.00	\$0.00	\$22,740.00

4. Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
5. Supplies	\$9,420.00	\$18,400.00	\$19,000.00	\$0.00	\$0.00	\$46,820.00
6. Contractual	\$93,304.00	\$43,304.00	\$43,304.00	\$0.00	\$0.00	\$179,912.00
7. Construction	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
8. Other	\$28,900.00	\$28,600.00	\$28,850.00	\$0.00	\$0.00	\$86,350.00
9. Total Direct Costs	\$350,846.00	\$335,346.00	\$333,583.00	\$0.00	\$0.00	\$1,019,775.00
10. Indirect Costs	\$147,414.00	\$159,420.00	\$158,556.00	\$0.00	\$0.00	\$465,390.00
11. Training Stipends	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
12. Total Costs	\$498,260.00	\$494,766.00	\$492,139.00	\$0.00	\$0.00	\$1,485,165.00

Section B on ED 524 Non-Federal Budget

Budget Categories	Project Year 1 (a)	Project Year 2 (b)	Project Year 3 (c)	Project Year 4 (d)	Project Year 5 (e)	Total (f)
1. Personnel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
2. Fringe Benefits	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
3. Travel	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
4. Equipment	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
5. Supplies	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
6. Contractual	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
7. Construction	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
8. Other	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
9. Total Direct Costs	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
10. Indirect Costs	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
11. Training Stipends	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
12. Total Costs	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00

Abstract

Early Learning in Mathematics: A Prevention Approach

1. The RFA goal under which the applicant is applying: Goal 1
2. The potential contribution the proposed project will make to the solution of an education problem: The proposed studies will build on research that suggests the primary grades are an opportune time to take advantage of children's interests and rapidly developing knowledge of number, number operations, quantity, and shape. The major objective will be to develop and evaluate an instructional intervention that combines conceptual understanding, procedural fluency, problem solving, and mathematical vocabulary development to improve the mathematics achievement levels of learners experiencing difficulties in Kindergarten. The intervention will be augmented by an assessment system for monitoring student progress formatively to assure expected levels of achievement.
3. The population(s) from which the participants of the study(ies) will be sampled (age groups, race/ethnicity, SES): Participants will be kindergarten students (ages 5 - 6) and teachers from three urban school districts in western Oregon. All participating schools will be schoolwide Title I schools, where poverty rates will be significantly higher than state averages. Special recruitment efforts will be undertaken to increase the likelihood that schools with the highest percentages of Latino students and English-language learners will participate.
4. The proposed research method(s): In Year 1, a series of design experiments will lead to a year-long mathematics instructional intervention for use with groups of kindergarten students. We will also complete work already begun to develop an empirically validated assessment framework to screen students early in kindergarten who are likely to experience mathematical difficulties and to monitor students' progress over time. In Year 2, we propose to evaluate the mathematics intervention using rigorous experimental methods. Approximately 500 students from diverse urban classrooms will participate across a range of experimenter-developed and standardized measures of vocabulary, computation, and problem solving. A subsample of 160 students will be observed systematically over the course of the year to determine the influence of factors associated with student lesson participation on learning

outcomes. Based on findings from Year 2, we will formally test specific hypotheses in Year 3 related to potential mediating variables in the improvement of students' mathematical achievement, their use of mathematical vocabulary during instruction, and their complexity of interactions during problem solving.

5. The proposed intervention if one has been proposed: The proposed mathematics instruction will include the following:

- Weekly units targeting specific math vocabulary, numeration, geometry, and measurement concepts and skills;
- Daily lessons incorporating multiple strands of skill development and conceptual application that can be practiced daily;
- Mathematical concepts and skills introduced explicitly and reviewed systematically to build automaticity;
- A weekly problem solving activity drawing on related skills and concepts that challenge students to think strategically and to discuss their approach and possible solutions;
- Vocabulary instruction that is integrated across the strands for fluency, maintenance, and generalization;
- Frequent progress monitoring to assure high levels of achievement.

Collaborating Organizations

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Application Abstract

APPLICATION R305K04081

Project Director	Dr. David Chard
Applicant Organization	University of Oregon
Application Title	Early Learning in Mathematics: A Prevention Approach

Collaborating Organizations

This application has opted out of adding collaborating organizations.



Abstract

Early Learning in Mathematics: A Prevention Approach

1. The RFA goal under which the applicant is applying: Goal 1
2. The potential contribution the proposed project will make to the solution of an education problem: The proposed studies will build on research that suggests the primary grades are an opportune time to take advantage of children’s interests and rapidly developing knowledge of number, number operations, quantity, and shape. The major objective will be to develop and evaluate an instructional intervention that combines conceptual understanding, procedural fluency, problem solving, and mathematical vocabulary development to improve the mathematics achievement levels of learners experiencing difficulties in Kindergarten. The intervention will be augmented by an assessment system for monitoring student progress formatively to assure expected levels of achievement.
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