JUST THE FACTS

RESULTS FROM IERI SCALE-UP RESEARCH

IERI Projects Funded by
The National Science Foundation
The U.S. Department of Education
The National Institute of Child Health and Human Development

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The Data Research and Development Center (DRDC) is a research and technical center funded by the Interagency Education Research Initiative (IERI). As a research center, we work to understand the factors that are essential for scaling up promising educational models, programs, and strategies. As a technical center, we work to identify and address the methodological and other challenges that arise when conducting scale-up research.

We wish to thank William Heiser, Louis Hirsch, Demetria Proutsos, Michelle Llosa, and Imelda Demus for their invaluable assistance in preparing this brochure.

Special thanks go to Janice Earle, program director at NSF, for her assistance with this project and her unwavering support of the IERI community.

More information about IERI projects can be found at http://drdc.uchicago.edu/community/.

This material is based upon work supported by the National Science Foundation under Grant No. 0129365. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

The Interagency Education Research Initiative (IERI) is a collaborative effort jointly sponsored by the National Science Foundation (NSF), the U.S. Department of Education, and the National Institute of Child Health and Human Development (NICHD) in the National Institutes of Health. Since 1999 these three agencies have funded over 100 scientific research studies designed to develop and/or investigate the effectiveness of educational interventions in classrooms across the United States.

These IERI studies provide compelling evidence on how to improve teacher training and professional development; assessments and assessment-driven instruction; and student learning in science, mathematics, and reading. Several projects address more than one of these issues. Many develop and employ innovative educational technologies. All are focused on spreading “what works” to teachers and schools across the country.

A full list of IERI projects funded through July 2006 appears at the back. To learn more about these studies and their findings, please visit the IERI Community Zone online at http://drdc.uchicago.edu/community.

Scale-up research does more than provide rigorous evidence that an intervention produces the desired outcome. It attempts to determine the effectiveness of interventions beyond the initial “laboratory” or classroom settings. Scale-up research is designed to determine what works best, for whom, and under what conditions – evidence to inform decisions regarding which innovations can (and which cannot) be expected to be similarly effective in a wide range of school contexts and classroom settings.

The ultimate objective of IERI is to improve student learning outcomes and close achievement gaps by bringing effective educational interventions to more students, classrooms and educators in early childhood development programs and elementary, middle, and high schools across the U.S.
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"Improving education is a mission that must be supported by rigorous and sustained research and development. State and local policymakers, as well as school-level administrators and university faculty and administrators, need information on efforts at improvement that have led to increased and sustained student learning. In support of this mission, the Interagency Education Research Initiative (IERI) is designed to help educators integrate the insights of scientific research on educational improvement into the realities of varied educational contexts to produce sustainable improvements in learning for diverse student populations."

National Science Foundation
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IMPROVING THE QUALITY OF EVIDENCE
IERI projects use a variety of research designs to measure the effects of the interventions under study, including randomized controlled trials, quasi-experimental research, and observational studies. These methods are designed to produce robust evidence of interventions’ impacts – the type of evidence practitioners, parents, and policymakers require to be confident in the guidance research provides about the conditions under which specific theories and knowledge about teacher and learning, and particular teaching tools, materials, and instructional methods do – and do not – work to improve student learning.

The rigor of research methods is enhanced by the broad range of expertise brought to bear on the many types of questions that need to be answered in order to understand why something works well in some circumstances but not in others. IERI project teams often are highly interdisciplinary and include educational researchers, learning specialists, computer scientists, cognitive psychologists, neuroscientists, assessment experts, and engineers.

FILLING AN IMPORTANT GAP
The IERI program began in 1999 as a result of the President’s Committee of Advisors on Science and Technology (PCAST) Panel on Educational Technology’s recommendation that the federal government initiate a major program of experimental research in education focused on four benchmarks:
1. Scalability: Projects that “scale-up” either current laboratory-based research or small-scale lines of research to large-scale studies of educational interventions.
2. Methodology: Research that is sufficiently mature as to warrant well-controlled experimental and quasi-experimental designs.
3. Interdisciplinary: Studies that employ a broad-based approach to educational research that moves beyond traditional ways of conceptualizing learning, development, and pedagogy.
4. Technology: Designs that make technology an integral part of interventions for improving teaching and learning in the classroom.

Between 1999 and 2005, the IERI program funded 101 projects across the U.S. The average project lasted for nearly 3.5 years and received almost $2.3 million in funding. The IERI program has spent $223 million to date. The following map shows the 31 states that were home to IERI projects, the site of project interventions, or both.

Initially, IERI projects tended to focus on improving reading skills. The program emphasis gradually shifted to the scale-up of science, technology, engineering, or mathematics (STEM) learning interventions. The following graph gives a breakdown of topical focus for the 101 projects funded through July 2006 (note that some projects combined a ‘math and reading,’ ‘science and reading,’ or ‘math and science’ focus).
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The IERI program has been funding fewer and fewer projects since 2001, when 26 awards were made. However, a 2002 review of the program reasserted its importance to the nation’s future:

The Interagency Education Research Initiative (IERI) addresses an extremely important gap in US research funding: education research. Given the importance of education in the United States, and the high investment in education at the federal, state, local, and family levels, sound scientific information about effective educational practices for strong student outcomes is urgently needed. The disappointing state of current educational outcomes for young people intensifies the urgency even further. (NSF Committee of Visitors 2002)

The remainder of this brochure briefly describes selected IERI projects, highlighting findings from completed projects and questions being addressed by ongoing projects. Numbers at the end of each study description correspond to the numbered list of project titles at the back.

IMPROVING STUDENT ACHIEVEMENT IN SCIENCE

Recent test scores show that the U.S. may be falling behind other countries in educating the next generation of scientists and engineers (TIMSS 2003). The IERI program is helping to address this situation by funding 39 projects focused on science learning outcomes. Critical areas addressed by these projects include using computer models of natural processes to promote “authentic” learning; creating professional development activities that alter the way science is taught in the classroom; and motivating students so that schools produce more children interested in (and capable of) careers creating professional development activities.

Internet-based tools for developing reasoning skills across sciences have begun to scale up on their own.

Lessons Learned

• IERI researchers in Michigan studied the impacts of coordinated, technology-rich curriculum units designed to foster complex reasoning in science. The BioKIDS project uses technology and schoolyard-based learning methods to help middle-school students ask authentic science questions. Multiple curricular units using Internet resources and handheld computers were evaluated with matched cohorts of 2,000 Detroit Public School sixth graders, who participated in one of two treatment groups. Quasi-experimental results show that increased time on topics helps students develop complex reasoning skills and that systematic guidance improves students’ ability to ask and answer questions like a scientist (resulting in a 15 point gain on complex reasoning items in NAEP). Overall, the intervention led to a 10 point gain in state science test scores and reduced the gap between statewide and Detroit passing averages from 30 to 20 percent. [#9]

• One of the challenges schools face is how to make science accessible to all students, not just to those with strong abilities or interests in it. An early IERI project integrated a model for teaching science with an existing program of scientific curriculum enhancement driven by modern technology. 27 high school physics teachers and approximately 1,200 students in a variety of urban, suburban, and rural school districts in New Jersey participated in a study that evaluated student achievement in high school physics based on learning with/without “triarchic” instruction and with/without the use of computers. Results using a 2 x 2 experimental design show that adding triarchic or technology-enhanced instruction has little effect on student achievement overall, but that both students and teachers seem to prefer these instructional methods over the standard curriculum. [#6]

• IERI investigators are working with students from 37 highly diverse middle schools in Montgomery County, Maryland to explore the effectiveness and scale-up of three “highly rated” science curriculum units. Each unit focuses on a specific, challenging target idea and each has a different instructional profile. Results using a stratified sample of the schools indicate that one curriculum unit benefited all students, while another was not practically effective in this school system and will not scale up. The third unit shows potential for closing achievement gaps if implemented with fidelity. Analyses of video data show that each science unit varied in how students used scientific terms, engaged in object manipulation, and were affected by print materials. [#76]

• A Massachusetts-based team is investigating the extent to which high school students who acquire model-based reasoning skills in one science domain are able to transfer those skills when learning a different scientific discipline. The investigators offer students interactive learning activities in physics, biology, and chemistry and monitor their actions on the computer. The resulting log files provide a wealth of data bearing on students’ specific content knowledge and model-based reasoning skills. A diverse mix of urban, suburban, and rural schools from eleven different states was initially recruited to participate in the study and received ongoing support. Over 400 schools from 27 countries also have spontaneously downloaded the software. Logged data generated by these unsupported schools indicates that they achieved learning results similar to those in the original cohort, demonstrating the scalability of the project. [#58]

Questions Being Explored

• Rural, suburban, and urban middle schools in Wisconsin are participating in the CoMPASS project, which aims to integrate “hands-on” science learning with learning from “hands-off” scientific (digital) text. The project has two major goals: (1) to integrate conceptual learning from informational text with the experimental and hands-on activities in design-based classes and (2) to understand students’ changing representations as they use multiple electronic texts in their science explorations. This project is still collecting data and will use randomized controlled trials to examine students’ learning trajectories by taking into consideration the strategies that students use, students’ prior knowledge, and their group interactions. [#20]

• A Michigan team of researchers is working to provide rigorous evidence of the effectiveness of “inquiry” methods of science instruction. This project is developing, adapting, and revising science instructional practices according to the components of a model of inquiry instruction. These practices then will be tested against expert direct instruction using the random assignment of Chicago and Kalamazoo middle school students to treatment and control groups. Surveys and semi-structured qualitative interviews with students and teachers also will be used to augment experimental data. [#4]
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Internet-based tools for developing reasoning skills across sciences have begun to scale up on their own.

Innovative science courses affect learning depending on instructional profile, especially for students who are underserved.

New curriculum helps urban students think like scientists and score 10 points higher on state science tests.
• IERI investigators in Washington, D.C. are building a PC-based simulation game that can be used for teaching high school students and college freshmen about immunology and infection in an engaging manner with validated instructional content and effective educational elements. This game will be used to test the hypothesis that visualization and immersion in realistic depictions of human biology will be highly engaging to students and will hold their interest long enough for learning to occur. Key evaluation questions include: Does the system improve understanding in areas of immunology that are particularly difficult to master? Does the system increase student interest in science and their interest in a career in science? 

• Investigators based in Massachusetts are working in Wisconsin, Florida, and several other states to study the extent to which a multi-user virtual environment (MVE) is effective in enhancing student engagement and educational outcomes. Here the MUVE is the virtual “world” of River City where students work in teams to develop hypotheses regarding one of three strands of illness affecting the City’s population. In total, approximately 300 teachers and 30,000 students in 7th-9th grade classrooms with high proportions of ESL and free- and reduced-lunch students will participate in this project. Such MUVES may be a promising complement to more conventional kinds of instruction, particularly for low-performing students unmotivated by conventional pedagogy and skeptical about their ability to learn science. Random assignment and multi-level modeling will be used to measure effects on engagement and learning. 

IMPROVING STUDENT ACHIEVEMENT IN MATHEMATICS

Test scores show that the United States ranks 24th out of 29 countries in the math and problem-solving skills of its 15-year-old students (TIMSS 2003). IERI is helping to reverse this by supporting 35 projects that focus on math learning outcomes. These projects address a range of issues, including how to give preschoolers a head start and how multimedia technologies can be used to improve instruction, provide professional development, and create learning communities. Other projects are looking at ways of teaching higher math skills to more students and teaching students from poor urban or rural school districts.

LESSONS LEARNED
• An IERI research team has built a technological infrastructure to support ‘virtual math teams’ composed of small groups of students who meet online to discuss math topics in depth. The project included students from U.S., Europe, and Asia who usually meet in groups of 3 to 4 to discuss and problem solve for about an hour. Researchers analyzed the “chats” that take place among students using a method they developed from established methods of conversation analysis. The project has demonstrated the feasibility of hosting online forums for youth to discuss mathematics. A variety of mathematical topics and approaches to presenting the content also has been tested and led to the refinement of the online environment. 

• Researchers in Pittsburgh are engaging low-income, minority students in middle-school mathematics courses by using the Cognitive Tutor program. The first study contrasted immediate feedback from the Tutor during problem solving with feedback after a solution already was submitted. Results using randomly assigned pairs showed that girls performed better in the “delayed” condition, whereas boys benefited more from immediate feedback. The second study sought to stop “gaming” (rapid mouse clicking and systematic guessing) by introducing a gaming “detector” into the program. Students were randomly assigned into experimental and control conditions. Results showed that the gaming detector reduced gaming behavior by half and prevented frequent “gamers” falling farther behind their peers. The longitudinal study comparing the Cognitive Tutor and traditional math courses will begin in August 2006. 

• A pre-K mathematics curriculum called TRIAD (Technology-enhanced, Research-based, Instruction, Assessment, and professional Development) was tested in 25 randomly selected classrooms in New York and California. TRIAD includes all aspects of a normal curriculum but was developed based on current understandings of how children acquire mathematical skills and concepts. The project also created new instruments for assessing outcomes. Results show that TRIAD increased the quality and quantity of the mathematics environments and teaching in the experimental, compared to control, classes. Strong, consistent positive effects were noted on general classroom behaviors such as teaching more mathematics; showing knowledge of, enjoyment in, and enthusiasm for mathematics; and using effective management and instructional strategies. 

• A team of researchers in California is studying the impact of home and preschool classroom environment on children’s early mathematical development. This study examined 600 children in the U.S., China, and Japan, half of whom came from lower socioeconomic (SES) families. A cross-sequential design was employed with cohorts of 3-year-olds (Cohort 1) and 4-year-olds (Cohort 2) who were followed for two years. More extensive mathematical knowledge was found in Chinese and Japanese children than in American children and in higher SES children than in lower SES children. Educational resources and practices at home and preschool were associated with greater mathematical development.

QUESTIONS BEING EXPLORED
• A collaborative project is studying how students learn core algebra concepts and is creating professional development programs that help teachers understand and improve students’ algebraic reasoning. Several different qualitative and quantitative studies were conducted using middle school students and teachers in Wisconsin and Colorado. Preliminary results show that some, but not all, of the professional development programs improved teachers’ algebraic and pedagogical content knowledge. Students’ understanding of various algebraic concepts progressed through middle school, though many students still showed a weak grasp at the end of grade 8. The timing of concept acquisition also proved to be important for continued progress, as did the type of feedback given for wrong answers. 

• IERI researchers in Missouri are studying how the organization and presentation of mathematical content in secondary school textbooks impacts student achievement. Two different approaches to organizing mathematical content in mathematics courses are being tested: an integrated approach and a subject-specific approach. This four-year project began in 2005 and will study 30 classes using the integrated approach and 30 classes using the subject-specific approach within school districts that offer students a choice of either. The research team will use both project-developed and standardized achievement measures and several fidelity of implementation measures to gauge the success of each approach. Data analysis will employ hierarchical linear modeling.

Do advanced computer simulations make students more interested in science and improve learning outcomes?

Math course based on the latest research proves more engaging to teachers than current practices.

How can math textbooks and teaching practices be changed to improve student achievement?
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• The TRIAD research group is conducting a study to examine methods for implementing this pre-K mathematics curriculum on a large scale. A demographically diverse sample of more than 170 pre-K teachers and more than 2,000 children in urban and rural New York, Massachusetts, and Tennessee will be used to test the generalizability of TRIAD’s demonstrated benefits. Researchers will use a multi-site cluster experimental design where schools will be randomly assigned to one of three conditions: Experimental, Experimental-Follow Through, and Comparison. This project began in June 2006 and will continue for five years. [82]

• Another IERI project is trying to make complex mathematical concepts available to all students by using a mature technology-based innovation called SimCalc, which integrates curriculum, software, and teacher professional development. The five-year project began in September 2004 using 7th and 8th grade math classes in a random assignment experiment within an ethnically, economically, and geographically diverse area covering about a third of Texas. 140 teachers were randomly selected in the first year to receive professional development, and these teachers will be followed for two years and compared with a control group using a delayed treatment design. The first set of results is expected in Fall 2006. [97]

IMPROVING STUDENT ACHIEVEMENT IN READING

Literacy is the cornerstone of academic success, although the U.S. has only average reading test scores internationally (PISA 2003). The IERI program has funded 47 projects focused on improving literacy skills. Critical areas addressed by these projects include creating foundational skills for very young children; identifying and assisting children who are most at-risk of falling behind; providing resources to underserved communities, children with special needs, or non-native English speakers; and using reading instruction to improve math and science instruction as well. Many projects also use video or digital tools to help automate teacher training or classroom interventions.

LESSONS LEARNED

• IERI investigators in Maryland headed a project to increase reading skills and science knowledge using an innovative instructional technique called Concept-Oriented Reading Instruction (CORI). Working in 3rd, 4th, and 5th grade classrooms in the mid-Atlantic region, the research team found experimental effects demonstrating the benefits of CORI on reading comprehension, reading strategies, reading motivation, and ecological knowledge. A different quasi-experiment showed that linking interesting texts to classroom (inquiry) science activities increased the amount of growth in reading comprehension. [51]

• A Texas-based team developed and implemented a large-scale, interdisciplinary intervention designed to help prevent reading problems in young children. The project also included studies of how the brain mediates instruction and how the text characteristics of instructional materials influence outcomes. 308 first grade students from a Houston school district identified as “at risk” for reading difficulties were randomly assigned to one of three interventions, each compatible with the federal Reading First program. Results indicated that enhanced classroom instruction alone reduced the number of at-risk students from 20% of the school population to 3%. Adding small group supplemental instruction reduced these numbers to less than 1.5%. Brain imaging results showed that a specific neural network mediates word recognition skills. [27]

• Researchers in Tennessee developed lecture-based (SERT) and interactive computer-based (iSTART) training programs to help students understand difficult science texts. Over 5,300 middle and high school students in Kentucky, Virginia, Georgia, and Tennessee participated in this project, which demonstrated that the SERT and iSTART programs can significantly improve students’ understanding of challenging expository science texts. Especially encouraging was that these rather robust results were most strongly demonstrated for the students most in need—struggling readers. [65]

• Another project in Tennessee helped create and evaluated different models of software and video support for beginning readers in grades one and two. Computer-based reading units and animated instructional videos were tested and refined using 1,020 students attending elementary schools in a large Southeastern city. Employing experimental, comparison, and control groups, the researchers found that although the software helped children learn to read the words, the prime developmental window for this type of practice is likely earlier and shorter than the entire first grade of year. Children also were able to match a printed to a spoken word before they were able to read the word aloud themselves. [66]

• Pennsylvania researchers tested an intervention, the Individualized Reading Program (IRP), which takes linguistic and cultural backgrounds into account. The study was carried out in low-income public schools in Philadelphia, Atlanta, and California using four cohorts totaling 1,422 African-American, Euro-American, and Latino students with low reading scores. A program with equal emphasis on decoding skills was used for control. Experimental results showed equally large improvements on standardized test scores (WJ III) for both interventions. However, the IRP performed better for students with the weakest decoding skills and was particularly beneficial for Latino subjects who learned to read in Spanish first. [89]

• Investigators in Florida used project-developed curriculum units and teacher workshops to promote science and English literacy achievement among linguistically, ethnically, and economically diverse students in 15 elementary schools in Florida, California, and Arizona. Using both qualitative and quantitative methods, the research team found limited statistical effects on teaching practices but significant increases on all measures of science and literacy achievement in 3rd, 4th, and 5th grades across all three years. Though all students benefited from the intervention, low-achieving, low-income, and ESOL-exited students made the most impressive gains. [53]

• A Georgia-based project tested two different approaches to improving young children’s ability to read fluently. The study was designed to evaluate the relative effectiveness of wide-reading (incorporating text from three grade levels) versus repeated-reading interventions. 3,327 children from racially and economically diverse elementary schools in Georgia, New Jersey, and Kansas participated in the five-year study. The research team found that each intervention had its strengths but that the wide-reading approach generally was more successful in improving fluency. Evidence also suggests that fluent word and text reading operate together with reading autonomy to produce good comprehension in young readers and that, for simple passages, the development
• The TRIAD research group is conducting a study to examine methods for implementing this pre-K mathematics curriculum on a large scale. A demographically diverse sample of more than 170 pre-K teachers and more than 2,000 children in urban and rural New York, Massachusetts, and Tennessee will be used to test the generalizability of TRIAD’s demonstrated benefits. Researchers will use a multi-site cluster experimental design where schools will be randomly assigned to one of three conditions: Experimental, Experimental-Follow Through, and Comparison. This project began in June 2006 and will continue for five years. [#82]

• Another IERI project is trying to make complex mathematical concepts available to all students by using a mature technology-based innovation called SimCalc, which integrates curriculum, software, and teacher professional development. The five-year project began in September 2004 using 7th and 8th grade math classes in a random assignment experiment within an ethnically, economically, and geographically diverse area covering about a third of Texas. 140 teachers were randomly selected in the first year to receive professional development, and these teachers will be followed for two years and compared with a control group using a delayed treatment design. The first set of results is expected in Fall 2006. [#97]

IMPROVING STUDENT ACHIEVEMENT IN READING

Literacy is the cornerstone of academic success, although the U.S. has only average reading test scores internationally (PISA 2003). The IERI program has funded 47 projects focused on improving literacy skills. Critical areas addressed by these projects include creating foundational skills for very young children; identifying and assisting children who are most at-risk of falling behind; providing literacy skills. Critical areas addressed by these projects include creating foundational skills for very young children; identifying and assisting children who are most at-risk of falling behind; providing

LESSONS LEARNED

- IERI investigators in Maryland headed a project to increase reading skills and science knowledge using an innovative instructional technique called Concept-Oriented Reading Instruction (CORI). Working in 3rd, 4th, and 5th grade classrooms in the mid-Atlantic region, the research team found experimental effects demonstrating the benefits of CORI on reading comprehension, reading strategies, reading motivation, and ecological knowledge. A different quasi-experiment showed that linking interesting texts to classroom (inquiry) science activities increased the amount of growth in reading comprehension. [#51]

- A Texas-based team developed and implemented a large-scale, interdisciplinary intervention designed to help prevent reading problems in young children. The project also included studies of how the brain mediates instruction and how the text characteristics of instructional materials influence outcomes. 308 first grade students from a Houston school district identified as “at risk” for reading difficulties were randomly assigned to one of three interventions, each compatible with the federal Reading First program. Results indicated that enhanced classroom instruction alone reduced the number of at-risk students from 20% of the school population to 3%. Adding small group supplemental instruction reduced these numbers to less than 1.5%. Brain imaging results showed that a specific neural network mediates word recognition skills. [#27]

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IMPROVING TEACHER TRAINING AND PROFESSIONAL DEVELOPMENT

Several IERI projects are concerned with understanding how preservice teaching training and ongoing teacher professional development can be enhanced to assist the nation’s teachers in providing appropriate instruction for the students in their classrooms. In many instances this involves exploring how teacher professional development can be offered more efficiently and effectively through the use of online and other technological innovations.

LESSONS LEARNED

• IERI investigators in California questioned the conventional wisdom about what can and cannot be taught to young children, asking to what extent (and how) elementary school students can learn to think like a scientist. The research team developed and implemented two curriculum prototypes—one in botany and one in animal behavior—in two California school districts. Results showed that with instructional scaffolding even first graders could reach the point where pairs conceptualized and implemented a study of their own, often critically analyzing how they might change their study to improve it. This indicates that with more robust science instruction children are capable of much more powerful scientific reasoning than would have been assumed on the basis of the cognitive developmental literature. [96]

• Another team in California explored the idea that preservice elementary school teachers (PSTs) would be better prepared if they learned mathematics and studied children’s mathematical thinking simultaneously. The team developed two such programs along with two versions of traditional early field experiences and randomly assigned 159 PSTs to one of the four treatment groups or to the control group. Results indicated that those PSTs who learned about children’s mathematical thinking developed more sophisticated beliefs about mathematics, teaching, and learning and improved their mathematical content knowledge more than those who did not. [54]

• Missouri-based researchers designed a project-based learning (PBL) program and tools to help less experienced teachers use it. The setting for this study was an inner-city math and science magnet school which serves an ethnically, racially, and socio-economically diverse population of 510 students. Researchers used descriptive, observational, and quasi-experimental methods to analyze teaching activities, curricular content, and student assessments. Results then were used to revise templates, dialogue formats, and scoring guides for teachers to use in a PBL setting. [5]

• A project based in Texas is comparing the effectiveness of four similar professional development (PD) programs for teachers of at-risk pre-kindergarten children. All four PD programs included the same core components. Teachers in two PD programs were provided with either weekly mentoring or instructionally linked feedback on children's progress. Randomized experiments included 253 teachers and nearly 2,000 pre-K students from ethnically diverse Head Start programs, child care centers, and public school classrooms in four states. Preliminary results indicate that research-based practices can be scaled in typical child care and early childhood education settings via high quality, sustained professional development. The most comprehensive, integrated program yielded the most impressive changes in teaching practices and student learning. [73]
of reading prosody (intonation and vocal stress) is unrelated to reading comprehension skills. [#90]

- IERI researchers examined the impact of teaching practices on student learning (4th & 5th grade) in 20 elementary schools in a large, rapidly diversifying school district in the mid-Atlantic region. Using standardized observation protocols, the research team found that the quality of teachers’ requests was an important predictor of the quality of students’ responses in both reading and mathematics, irrespective of students’ academic and social backgrounds. If teachers ask students to reflect more thoughtfully, students do so. However, such cognitively demanding instruction is less common in schools where the press of high-stakes assessments is high. [#36]

- A Michigan team of researchers worked with 2nd and 3rd grade teachers to see if students would benefit from adding instruction in the linguistic features of science informational and procedural texts. The team assigned teachers to experimental and control classrooms in 16 randomly selected elementary schools in the Midwest. While the experimental findings revealed no effect of adding this explicit instruction of textual linguistic features on children’s growth in reading comprehension and writing composition, the investigators found that more authentic reading and writing of these two genres was associated with better reading comprehension and written composition. [#52]

- Children usually are taught to read and write using story books. A study using six large, low-income school districts in Michigan investigated whether first and second graders might benefit by including "informational" texts in the classroom. Using an experimental design and hierarchical analysis, researchers found that informational texts can have a positive impact on first graders, including those who enter school with relatively low literacy skills. Analyses involving the data from second grade are still being conducted. [#26]

**Questions Being Explored**

- A research team in Tennessee is examining factors that affect the implementation Peer-Assisted Learning Strategies (PALS), a research-based reading program which pairs higher performing readers with lower-performing readers. Trial data has been collected for 3,800 kindergartners attending 46 rural, urban, and suburban elementary schools in Texas, Minnesota, and Tennessee. Using a 3-level hierarchical model, researchers found that more teacher support for implementing PALS improved students’ phonological awareness skills across study sites. More intensive levels of teacher support also promoted stronger reading in connected text at one site. [#78]

- Investigators in Boston are exploring whether young children who are struggling readers can be helped after school. The goal was to design an effective after-school reading program that children with social, emotional, or behavioral problems found exciting and fun. The intervention was tested in 7 elementary schools in Boston and Phoenix using randomized controlled trials. Preliminary findings indicate that the intervention improved performance on a variety of measured reading skills such as word identification and phonological processing. [#93]

**Improving Teacher Training and Professional Development**

Several IERI projects are concerned with understanding how preservice teacher training and ongoing teacher professional development can be enhanced to assist the nation’s teachers in providing appropriate instruction for the students in their classrooms. In many instances this involves exploring how teacher professional development can be offered more efficiently and effectively through the use of online and other technological innovations.

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• An IERI research team developed and validated a teacher questionnaire, a teacher log, a classroom observation protocol, and student achievement and attitude measure in preparation for studies examining variations in the implementation and outcomes of middle-school inquiry-based science. Questionnaire data collected nationwide from 156 teachers and log data from a subset of 69 teachers were reliable, with strong validity evidence. Reliable observation data collected on 19 teachers showed the expected patterns and a strong correlation with mean student achievement. Achievement and attitude data collected from 428 students were reliable, content valid, and showed the expected relationships among latent variables. [#59]

QUESTIONS BEING EXPLORED

• Investigators in Washington, D.C. are studying the extent to which professional development can work in tandem with highly rated curriculum materials to help teachers change their instructional practices. The investigators developed a training program to learn and apply criteria for evaluating the likely effectiveness of goals-based instruction. 81 teachers representing 155 classrooms from nine demographically and geographically diverse school districts had their teaching practices recorded, analyzed, and commented on using a Web-based video analysis tool. Preliminary findings suggest that professional development based on teachers’ evaluation of their own videotapes can be a powerful catalyst for motivating change in teaching practice. [#45]

• IERI researchers are examining the implementation and impact standards-based accountability (SBA). Data were gathered from 92 school districts in California, Georgia and Pennsylvania by surveying teachers, principals, and superintendents and obtaining student achievement scores on state tests. Survey data are being analyzed using a variety of statistical techniques, including cross-tabulations, factor analysis, and hierarchical modeling. Preliminary descriptive findings indicate that school improvement plans focus more on the use of data for decision making, on the alignment of curriculum and instruction with state standards, and on low-performing students. Educators at all levels of the system also say that NCLB has led to an increased focus on student achievement but has reduced staff morale. [#80]

• Researchers in Kentucky are using technology to assist science teachers in poor, isolated school districts across Appalachia. The team developed a new hands-on, inquiry-based physics curriculum for middle school teacher professional development called “Newton’s Universe” that is taught entirely online. Using experimental and control groups, 60 middle school teachers and approximately 12,000 students will be evaluated both before and after teachers participate in four consecutive summer professional development courses for teaching concepts of temperature and heat (with and without technology) and forces and motion (with and without technology). [#7]

IMPROVING ASSESSMENTS AND ASSESSMENT-DRIVEN INSTRUCTION

Assessing student progress has always been critically important to educators and researchers alike. Each of the 50 states now must implement a program of standards and assessments to comply with the No Child Left Behind Act (NCLB) of 2001. IERI investigators are using computer technologies, cognitive psychology, and measurement theory to improve methods of assessing student achievement and to make assessment part of the learning process.

LESSONS LEARNED

• IERI researchers in California developed and tested two systems for designing, building, and utilizing assessments of complex learning across subject areas and grade levels. The Assessment Design and Delivery System (ADDS) is a web-based suite of tools derived from research and practice, while Diagnoser is a web-based program with pre-designed sets of questions that teachers can use as formative assessments. Experimental studies carried out in a variety of California school districts and in Vancouver, Washington found that the ADDS improved the assessment capabilities of those using it. Teachers focused more on important conceptual knowledge in a domain and on creating appropriate rubrics as part of the item development cycle. Teachers’ question prompts and scoring criteria also became more coherent and tended to focus more on critical ideas. [#38]

• One IERI study is examining how technology can help teachers collect and make better use of assessment data. In collaboration with Wireless Generation, the research team developed a handheld device for recording data on students’ reading abilities and then provided both human and web-based mentoring programs to support teachers as they interpret this data. A randomized study was conducted to determine the effect of the handheld device and the teacher support on students’ state reading test scores. The experiment took place in 255 Texas elementary schools (3 urban districts and 5 different rural regions) with approximately 2,115 teachers and 46,530 K-2 students. Preliminary analyses indicate that reading progress is affected more by previous ability and classroom performance than the type of assessment technique used. [#74]

QUESTIONS BEING EXPLORED

• Researchers in California are testing a practical, theory-based approach to the design of evidence-centered assessments of student learning called the Principled Assessment Designs for Inquiry (PADI). The PADI system provides online design, scoring, and calibration resources to support assessment in any content domain, based on any theory of learning, and serving any assessment purpose. This study tested PADI within two different curricular development projects using a total of 850 students in 4th, 5th and 6th grade classrooms across the country. Preliminary results have been used to establish system requirements and to build a digital library of working exemplars of design patterns, task templates, and task specifications. Evaluation results will be available in December 2006. [#37]
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**DEVELOPING AND IMPLEMENTING INNOVATIVE TECHNOLOGIES**

Technology has the potential to radically change how, how many, and which students are taught. The majority of IERI projects have incorporated technological components to create and scale up interventions, including use of the World Wide Web, automated tutors, virtual learning environments, and digital libraries. Projects also have used technology in innovative ways to collect and analyze evaluation data.

**LESSONS LEARNED**

- An IERI project in Maryland evaluated a technology-enhanced version of the Success for All reading program that incorporated embedded multimedia content and computer-assisted tutoring. Three studies were conducted, involving a total of 37 high-poverty Title I schools across the nation. The assignment of the technology was random and control groups were used to compare the regular and enhanced Success for All programs. Experimental results indicate significant benefit to use of embedded multimedia. The use of computer-assisted tutoring raised reading scores when implemented with fidelity, especially combined with use of the embedded multimedia. [#25]

- Investigators in Tennessee developed and tested the Language Environment Enrichment Program (TLEEP) to improve preschool children’s literacy learning. TLEEP used interactive television (ITV) and web-based instruction to deliver training to preschool teachers as well as online resources for parents to use at home. A total of 455 preschool children (including a control group) from North Carolina and New England participated in the study. HLM analyses revealed significant and sizable effects of TLEEP on receptive vocabulary and significant but smaller effects on phonological awareness and early literacy. [#94]

- The CTELL project in Georgia developed an online set of multimedia cases of best practice instruction in early reading (grades K-3). The researchers tested the effectiveness of CTELL in 20 different colleges of education across the country over a two year period using a complex set of data collection and analytic approaches, including randomized controlled trials. Results showed that CTELL case use significantly increased preservice teachers’ knowledge of effective principles of reading instruction, implying its potential to improve the nation’s teacher education programs. [#8]

- Researchers in Colorado created an animated, conversational “virtual teacher” named Marni that interacts with children to teach them to read and learn from text within a comprehensive, scientifically-based reading program called Foundations to Literacy. Marni was tested on about 1,500 students in 60 kindergarten and early elementary classrooms in five urban, suburban, and rural school districts in Colorado. Experimental results showed significant gains in single-word reading and letter-identification skills for the youngest readers. Students and teachers also reported liking Marni and found the programs useful and easy to use. [#35]

- Another Colorado team is determining whether two computer-aided tutors can help raise student reading achievement scores well above state and national norms. Foundations to Literacy (FtL) focuses on decoding skills using an animated “talking head,” while Summary Street targets reading comprehension by providing automated feedback on summarization skills. About 4,300 K-12 students from a variety of geographic, ethnic, and socioeconomic backgrounds participated in this experimental study. Preliminary findings indicate that both tutors improve literacy skills. Summary Street also significantly raised high stakes test scores when taken to scale, especially for medium-to-low performing students. [#71]

- IERI researchers have developed and are evaluating an automated Reading Tutor that listens to children read aloud and gives appropriate feedback. Project LISTEN has collected data from a socioeconomically and racially diverse sample of hundreds of children (mostly grades 1-5) who used the Reading Tutor for a semester or school year in dozens of classes at elementary schools in several urban and suburban districts, mostly in the Pittsburgh area. Findings from a variety of studies, including randomized controlled trials, show that successive versions of the Reading Tutor have produced higher gains on standard reading measures than current practices (and various alternatives) with as little as 20 minutes of use per day. Other results, including effects on ESL students, are expected by August 2007. [#44]

**QUESTIONS BEING EXPLORED**

- A California team is developing a formative assessment system that can automatically score and analyze children’s reading development from kindergarten through 2nd grade. This system will be capable of reliably testing both native and non-native English speakers so as to remove any bias. The research team collected data in 7 schools using 256 children ages 5-7, the majority of whom are native Spanish speakers. These recordings were used to develop an automated speech recognition (ASR) system that can account for variations in pronunciation (dialect). Field testing of the system will include 300 children in 5 schools and will compare automated assessment data with standardized reading achievement scores. [#39]

- Researchers in Michigan are helping teachers learn instructional practices known to enhance text comprehension among upper elementary school children. The team developed two sets of professional development materials using video-based cases of teaching and hypermedia tools. The materials were tested experimentally by assigning 60 teachers from Southeast Michigan Schools randomly to one of varied in terms of their “scalability.” Preliminary results indicate that both conditions improved pedagogy, with teachers showing increased sensitivity to context and a greater appreciation for the nuanced nature of the application of practices such as “scaffolding.” [#55]
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Can speech recognition technology be used to help native and non-native English speakers learn to read?

Computers can “tutor” children who are learning to read, helping even those who are struggling the most.
Bringing ‘What Works’ to More Students and Educators

Parents, teachers, schools, and communities all affect student achievement. This means interventions that work in one place with one set of students may not “scale up” to students who have different ethnic or cultural backgrounds, family or school resources, and district or state educational policies. The IERI program was designed specifically to take account of the learning context so that policymakers and educators would have evidence not only of “what works,” but also “for whom.”

- IERI researchers in Pennsylvania are studying how teacher background, school resources, and district policies affect the implementation of two major, conceptually-oriented math programs. This is a longitudinal study that works with teachers, math coaches, support teachers, and school administrators in six New York City school districts and 24 Edison Schools in four states. Preliminary findings using both quantitative and qualitative methods indicate that teacher preparation varies by district and grade. Teachers rely more on each other for advice than on consultants or coaches hired by districts but also are more likely to stay in a school with good resources. Other findings suggest that district, school, and teacher factors interact to affect program implementation. [#77]

- Investigators in Florida are studying the process of scaling up a research-validated alternative to traditional reading/language arts instruction. Based on principles of cognitive science, Science IDEAS is an instructional model for teaching science in grades 3-5 that incorporates both reading comprehension and writing. The project is being implemented sequentially (with controls) in 15 elementary and 4 middle schools in two large, diverse public school systems. Initial analysis confirmed that Science IDEAS improves reading and science achievement as it is scaled up with fidelity. Currently, implementation of the scale-up model is being phased in to help schools build the capacity and infrastructure necessary to sustain and manage the program on their own. [#95]

- A team in New York is scaling up an instructional program called the Interactive Strategies Approach (ISA) that has proven effective in reducing the number of children with severe reading difficulties at the end of first grade when used as a (pull out) intervention. The effects of the ISA are being evaluated in classroom only, intervention only, or both types of implementations in schools serving high proportions of low-income children. Three cohorts of kindergartners (approximately 650 per cohort) are being followed. Preliminary results indicate that, in kindergarten, classroom implementation is as effective as small group interventions in reducing early reading difficulties. Effects at the end of first grade are yet to be analyzed. [#65]

- Maryland-based researchers are studying factors that affect implementation of the National Network of Partnership Schools (NNPS), a program shown to increase family and community involvement in the educational process. The study is using experimental methods and is designed to determine how district policy affects program quality and how program quality affects student achievement. Data are being collected on five cohorts of 10 school districts with 8 schools in urban, suburban, and rural communities across the U.S. Preliminary results using HLM provide strong evidence that schools develop better partnership programs if they receive direct school-based support and if districts conduct strong partnership programs with many leadership and facilitative activities. These results hold regardless of district size and poverty level. [#49]

- IERI researchers in California are evaluating the effectiveness of a preschool literacy curriculum that is based on state-of-the-art scientific knowledge and focuses on at-risk children and children who are not speakers of standard English. A home literacy curriculum and two professional development courses also are being evaluated. The project involves 78 preschool classrooms (approximately 1,200 children) in Los Angeles and Tallahassee. Teacher interventions were compared with home interventions over two years using a crossed experimental design. Subjects also are being followed longitudinally to evaluate the longer term impact and sustainability of the interventions. Results are being published. [#30]

Scaling Up Education Research

The Interagency Education Research Initiative is a unique program. It supports large, long-term interdisciplinary research projects designed to improve student achievement in science, mathematics, and reading; enhance professional development and pedagogical techniques; and use technology to advance learning and instruction. Employing rigorous designs, such as random assignment or quasi-experiments, results from IERI studies show how promising innovations can be brought to scale.

One project, for example, reduced the gap between statewide and Detroit passing averages on science tests from 30 to 20 percent. An IERI project in a Houston school district cut the number of students at risk for reading problems from 20 percent to less than 3 percent of first graders. First graders in another study designed and ran their own science projects, challenging assumptions about what very young children are capable of learning. Several other IERI projects found that computers and the Internet can enhance the learning process, with one innovation being adopted spontaneously in over 400 schools from 27 countries.

Ongoing projects continue to address the most pressing questions educators face today by determining what works best, for whom, and under what conditions. As the 2002 review of the initiative quoted above noted, IERI itself demonstrates the value of investing in “sound scientific information about effective educational practices,” an investment that has started to close that “extremely important gap in U.S. research funding: education research.”
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### IERI Research Projects, 1999-2006

1. **A Longitudinal Study of the Impact of High School Mathematics Textbooks of Two Types on Student Learning—Douglas Grouws, University of Missouri**
2. **Academic Achievement and Teacher Development in Science (AATDS)—Rick Vanouard, University of Tennessee**
3. **An Evaluation of Teacher Training for Triarchic Instruction and Assessment—Robert J. Sternberg, Yale University**
4. **An Experimental Efficacy Study of Science Achievement and Attitude Development amongst 8th Grade Students Using an Inquiry, Integrated Science-Mathematics-Engineering Model of Instruction—William Cobern, Western Michigan University**
5. **An Inquiry-Based Approach to Professional Development: Using Prototypes to Help New Teachers Reflect on Project-Based Learning—Matthew Keefer, University of Missouri-St. Louis**
6. **Applying Technology and Triarchic Enhancement to Instruction and Assessment in a School Science Curriculum: Air-Traffic Control, Earthquake, and Air-Pollution Analysis—Edward A. Friedman, Stevens Institute of Technology**
7. **Assessing How Distance Learning for Teachers Can Enable Inquiry Science in Rural Classrooms—Jeffrey Osborn, University of Kentucky**
8. **Best Practices - Teacher Preparation - Technology: Connections that Enhance Children’s Literacy Acquisition and Reading Achievement—Linda D. Labbo, University of Georgia**
9. **BioKIDS: Kids’ Inquiry of Diverse Species—Nancy Songer, University of Michigan**
10. **Breakthrough to Literacy in the Chicago Public Schools: A Large Scale Evaluation of the Effectiveness of a Reading Comprehension Intervention—Richard R. Hurtig, University of Iowa**
11. **Building Biologically Based Immune System Simulations for Education and Training—Henry Kelly, Federation of American Scientists**
12. **Building Bridges to Student and Teacher Learning: Early Literacy Assessment and Intervention Planning Grant—Alison L. Bailey, University of California, Los Angeles**
13. **Catalyzing & Nurturing Online Workgroups to Power Virtual Learning Communities—Gerry Stahl, Drexel University**
14. **Classroom use and Efficacy of an Automated Reading Tutor that Listens—David J. Mostow, Carnegie Mellon University**
15. **Cognitive Neuroscience Across the Lifespan—Denise C. Park, University of Illinois at Urbana-Champaign**
16. **Cognitively-Based, Multimedia Support for a Balanced Approach to the Development of Early Reading in School and Home Contexts—Diana L. Sharp, Vanderbilt University**
17. **Collaborative Research I: Understanding and Cultivating the Transition from Arithmetic to Algebraic Reasoning—Sharon J. Derry, University of Wisconsin-Madison**
18. **Collaborative Research II: Understanding and Cultivating the Transition from Arithmetic to Algebraic Reasoning—Kenneth R. Koedinger, Carnegie Mellon University**
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20. CoMPASS: Integrating Digital Text in Design-Based Science Classes—Sadhanak Puntambekar, University of Wisconsin-Madison

21. Computational Literacy: A Study of the Efficacy of Computational Science in High School Biology and Earth and Space Science Classrooms—Margaret Honey, Education Development Center

22. Coordinating Educational Institutions for Sustained Academic Success—Michael Cole, University of California, San Diego

23. Data Research and Development Center—Barbara Schneider, National Opinion Research Center (NORC)

24. Developing Measures of Instructional Improvement—Deborah Loewenberg Ball, University of Michigan

25. Development and Evaluation of a Technology-Enhanced Success for All Reading Program—Robert E. Slavin, Success for All Foundation

26. Dick, Jane, & Spot Meet the Information Age: Diversifying Genres Used in Early Literacy Instruction—Nell K. Duke, University of Michigan


28. Early Learning and Technology for At-Risk Children—Linda Espinosa, University of Missouri

29. Early Reading Intervention: Getting Ready for Scale-Up—Benita Blachman, Syracuse University

30. Enhancing Literacy Outcomes for Young Children—Jo Ann Farver, University of Southern California

31. Examining the Effects of Highly Rated Science Curricula on Diverse Student Populations—Sharon Lynch, George Washington University

32. Explicit Explanation of Genre Within Authentic Literacy Activities in Science: Does It Facilitate Development and Achievement?—Victoria Purcell-Gates, Michigan State University

33. Exploring IDEAS: An Integrated Design Enhancing Academic Success in Science, Reading and Mathematics—Nancy R. Roman, Florida Atlantic University

34. Handheld Diagnostics: Enhancing and Scaling Rigorous Observational Reading Assessments through Handheld Computing—Margaret Honey, Education Development Center

35. Helping Disadvantaged Students Succeed by Improving Foundational Language and Reading Skills—Ronald A. Cole, University of Colorado at Boulder

36. High Quality Teaching of Foundational Skills in Mathematics and Reading—Linda Valli, University of Maryland


38. IERI: Assessments to Support the Transition to Complex Learning in Science—Eva L. Baker, University of California, Los Angeles

39. IERI: Collaborative Research I: Automating Early Assessment of Academic Standards for Very Young Native and Non-Native Speakers of American English—Shrinivas Acharya, University of California, Los Angeles

40. IERI: Collaborative Research II: Automating Early Assessment of Academic Standards for Very Young Native and Non-Native Speakers of American English—Shrikant Narayan, University of Southern California

41. IERI: Collaborative Research III: Automating Early Assessment of Academic Standards for Very Young Native and Non-Native Speakers of American English—David Pearson, University of California, Berkeley

42. IERI: Factors Influencing College Science Success (FICSS)—Philip M. Sadler, Harvard University

43. IERI: Improving Mathematics Teacher Practice and Student Learning Through Professional Development—Jo-Ellen Roseman, American Association for the Advancement of Science (AAAS)

44. IERI: Integrating Speech and User Modeling in a Reading Tutor that Listens—David J. Mostow, Carnegie Mellon University

45. IERI: Scaling Up Reading Tutors—Ronald A. Cole, University of Colorado at Boulder

46. IERI: Teachers’ Disciplinary Knowledge of Reading and its Relationship to K-3 Pedagogy and Student Achievement—Anne Cunningham, University of California, Berkeley

47. IERI: Tools for Mathematics Communication in Education—Werner Krandick, Drexel University

48. IERI/REC: Planning an Infrastructure to Support Ambitious Science for Urban School Children—Louis M. Gomez, Northwestern University

49. Implementation and Effects of Family Interventions to Promote Ambitious Science for Urban School Children—Jeanne Rose Century, Education Development Center

50. Implementation and Impact of Reading, Mathematics, and Science Instructional Interventions for Middle and High School Students—James McPartland, Johns Hopkins University

51. Increasing Reading Comprehension, Motivation and Science Knowledge through Concept Oriented Reading Instruction in a District-Wide Experiment—John T. Guthrie, University of Maryland

52. Innovation Exchange: Exploring Portability of Systemic Reform—Margaret Honey, Education Development Center

53. Instructional Intervention to Promote Science and Literacy with Linguistically Diverse Elementary Students—Okhee Lee, University of Miami


55. Investigating the Feasibility of Scaling up Effective Reading Comprehension Instruction Using Innovative Video-Case-Based Hypermedia—Annemarie Palincsar, University of Michigan

56. Learning-Oriented Dialogs in Cognitive Tutors: Toward a Scalable Solution to Performance Orientation—Vincent Aleven, Carnegie Mellon University

57. Looking Inside the Black Box: Classroom Practice that Supports High Achievement in Both Science and Reading; a Planning Grant—Jeanne Rose Century, Education Development Center

58. Modeling Across the Curriculum—Paul Horwitz, The Concord Consortium

59. Phase-I Study of the Effects of Professional Development and Long-Term Support on Curriculum Implementation and Scaling Up—Paul Brandom, University of Hawaii
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59. Phase-I Study of the Effects of Professional Development and Long-Term Support on Curriculum Implementation and Scaling Up—Paul Brandon, University of Hawaii
60. Planning a Research Program to Study How to Improve the Effectiveness of Using Telecommunications to Teach Science—Darrell M. Hull, Center for Occupational Research and Development

61. Planning a Rigorous Experimental Trial of SimCalc’s Approach to Increasing Access to Complex Mathematical Ideas—Jeremy Roschelle, SRI International

62. Planning for a System of Principled Assessment Designs of Inquiry (PADI)—Barbara Means, SRI International

63. Preventing Reading Problems in Disadvantaged Children—Donna Scanlon, SUNY at Albany

64. Professional Development Support Systems for Mathematics and Science Teaching—Drew Gitomer, Educational Testing Service

65. Promoting Active Reading Strategies to Improve Students’ Understanding of Science—Danielle McNamara, University of Memphis

66. Proposal Processing and Data Entry Support for the IERI Initiative—Robert Cooper, Allied Technology Group

67. Proposal Processing for Interagency Education Research Initiative—Peter Damon, Allied Technology Group, Inc.

68. Reading and Writing About Science: A Design-Experiment Strategy—Robert C. Calfee, University of California, Riverside

69. Representing and Learning from Classroom Processes—Kevin F. Miller, University of Illinois at Urbana-Champaign

70. Revised Version: IERI-Scaling-Up Instructional Improvements—David K. Cohen, University of Michigan

71. Scalable and Sustainable Technologies for Reading Instruction and Assessment—Walter Kintsch, University of Colorado at Boulder

72. Scaling Expert Knowledge and Practice for Teaching Elementary School Students to Comprehend Informational Text—Annemarie Palincsar, University of Michigan

73. Scaling Up a Language and Literacy Development Program at the Pre-kindergarten Level—Susan Landry, University of Texas Health Science Center

74. Scaling Up an Assessment-Driven Intervention Using the Internet and Hand-Held Computers—Barbara F. Foorman, Florida State University

75. Scaling-Up Effective Intervention for Preventing Reading Difficulties in Young Children—Patricia A. Mathes, Southern Methodist University

76. Scaling-Up Highly-Rated Science Curriculum Units for Diverse Student Populations: Using Evidence to Close Achievement Gaps—Sharon Lynch, George Washington University

77. Scaling Up Mathematics: The Interface of Curricula with Human and Social Capital—Lauren Resnick, University of Pittsburgh

78. Scaling Up Peer-Assisted Learning Strategies to Strengthen Reading Achievement—Doug Fuchs, Vanderbilt University

79. Scaling Up SimCalc: Professional Development for Integrating Technology to Teach More Complex Mathematics (Phase 1)—Jeremy Roschelle, SRI International

80. Scaling Up Standards-Based Accountability—Brian M. Stecher, Rand Corporation

81. Scaling Up the Implementation of a Pre-Kindergarten Mathematics Curricula: Teaching for Understanding with Trajectories and Technologies—Douglas H. Clements, University of Buffalo

82. Scaling Up TRIAD: Teaching Early Mathematics for Understanding with Trajectories and Technologies—Douglas H. Clements, University of Buffalo

83. SGER: Interagency Education Research Initiative - Planning Grant for National Data Collection Center—Frank Rauch, University of Illinois at Urbana-Champaign

84. Studying Robust-Design Strategies for Developing Innovations Effective and Scalable in Challenging Classroom Settings—Christopher Dede, Harvard University

85. Teacher Professional Development in Facilitated Online Learning Communities: What Do We Know and Need to Know—Sharon J. Derry, University of Wisconsin-Madison

86. Teaching Phonemic Awareness to Children in Head Start: A Randomized Evaluation of Two Approaches—David Carnell, DCHC

87. Testing a Model of Instructional Strategies to Enhance Prekindergarten Children’s Language, Literacy, and Math Skills—Susan Landry, University of Texas Health Science Center

88. Testing a Research/Technology-Based Delivery System to Improve Student Performance in Mathematics and Science in Middle Schools in Rural, High-Poverty Communities—Richard E. Basom, University of North Carolina at Greensboro

89. Testing the Effectiveness, Sustainability and Scalability of an Individualized Reading Program for African-American, Latino and Euro-American Inner-City Children—William Labow, University of Pennsylvania

90. The Development of Fluent and Automatic Reading: Precursor to Learning from Text—Paula J. Schwanenflugel, University of Georgia

91. The Early Development of Mathematical Cognition in Socioeconomic and Cultural Contexts—Prenice Starkey, University of California, Berkeley

92. The Evaluation and Analysis of an Innovative Framework for School Reading—Timothy Shanahan, University of Illinois at Chicago

93. The New 3R’s: Reading, Resilience, and Relationships in After-School Programs—Gil Noam, Harvard University

94. Using Technology to Support Preschool Teachers’ Professional Development—David K. Dickinson, Vanderbilt University

95. Validation of a Multi-Phase Scale-Up Design for a Knowledge-Based Intervention in Science and Reading Comprehension—Nancy R. Romance, Florida Atlantic University

96. What Are the ‘Developmental Needs’ of Young Children in Science? Revision of Developmental Constraints on K-3 Science Education—Kathleen Metz, University of California, Berkeley

97. Working with Teachers and Leveraging Technology to Scale Opportunities to Learn More Complex and Conceptually Difficult Middle School Mathematics—Jeremy Roschelle, SRI International

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88. Testing a Research/Technology-Based Delivery System to Improve Student Performance in Mathematics and Science in Middle Schools in Rural, High-Poverty Communities—Richard E. Basom, University of North Carolina at Greensboro

89. Testing the Effectiveness, Sustainability and Scalability of an Individualized Reading Program for African-American, Latino and Euro-American Inner-City Children—Timothy Shanahan, University of Illinois at Chicago

90. The Development of Fluent and Automatic Reading: Precursor to Learning from Text—Paula J. Schwanefflueg, University of Georgia

91. The Early Development of Mathematical Cognition in Socioeconomic and Cultural Contexts—Prentice Starkey, University of California, Berkeley

92. The Evaluation and Analysis of an Innovative Framework for School Reading—Timothy Shanahan, University of Illinois at Chicago

93. The New 3R’s: Reading, Resilience, and Relationships in After-School Programs—Gil Noam, Harvard University

94. Using Technology to Support Preschool Teachers’ Professional Development—David K. Dickinson, Vanderbilt University

95. Validation of a Multi-Phase Scale-Up Design for a Knowledge-Based Intervention in Science and Reading Comprehension—Nancy R. Romance, Florida Atlantic University

96. What Are the ‘Developmental Needs’ of Young Children in Science? Revision of Developmental Constraints on K-3 Science Education—Kathleen Metz, University of California, Berkeley

97. Working with Teachers and Leveraging Technology to Scale Opportunities to Learn More Complex and Conceptually Difficult Middle School Mathematics—Jeremy Roschelle, SRI International

Note: Planning or supplementary grants for 4 projects are not listed here.