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Final Report of National Mathematics Advisory Panel

Much of the public's "resignation" about mathematics education is based on the erroneous idea that success comes from inherent talent or ability in mathematics, not effort. A focus on the importance of effort in mathematics learning will improve outcomes. If children believe that their efforts to learn make them "smarter," they show greater persistence in mathematics learning.

National Mathematics Advisory Panel

Student effort matters! This is just one of the findings of the National Mathematics Advisory Panel in its 2008 report titled [Foundations for Success—The Final Report of the National Mathematics Advisory Panel](#). This 120-page report, commissioned by the U.S. Department of Education (ED), addresses one central question: How can schools in the United States improve mathematics curriculum, instruction, assessment, teacher training and support so that all American students learn mathematics so that they can compete with students from other nations?

In the report, the advisory panel discusses 45 findings and recommendations on key topics, such as instructional practices, materials, professional development, and assessments. The authors stress the importance of knowledgeable teachers, effective instruction, effective assessment, and the need for rigorous research in mathematics education. They also emphasize the need for a coordinated effort to achieve success: "The United States has genuine opportunities to improve mathematics education, but these improvements can be realized only if educators, policymakers, researchers and parents all work together to ensure that our students master the mathematical foundations that are so critical for achievement in algebra and beyond." A summary of the advisory panel's findings and recommendations is available in a 2-page brochure, [Foundations for Success](#), which is available on the ED Web site.



A Note from the Director

Welcome to the latest edition of the Southeast Comprehensive Center e-Bulletin. As educators, most of us have probably heard at least one child make the statement "I'm just not good at math." Some of us have actually uttered this statement ourselves or heard it from our own children. We cringe when we hear this knowing that each time a child utters it, he is feeling a sense of defeat and anxiety and that eventually those feelings may lead the child to give up on learning math. The report of the National Mathematics Advisory Panel now confirms that regardless of those statements and feelings, everyone can be successful in math with effort on the part of the student and with a high-quality teacher who has strong math content knowledge and uses explicit instructional practices and formative assessment to inform that instruction. This report provides recommendations on how we can ensure these things for all students and what additional research is needed to inform our knowledge base in the area of mathematics education.

I hope the brief synopsis of the National Mathematics Advisory Panel report provided in this edition of our e-Bulletin will be helpful and informative for you in your work with your state, districts, and schools and that it might pique your interest in learning more about the report and its findings. If we can be of any assistance to you in this area or any other issue related to improving student achievement or meeting the goals of the No Child Left Behind Act of 2001 (NCLB), please feel free to contact your state liaison or me.

We are pleased at SEDL to provide the services of the Southeast Comprehensive Center (SECC) and look forward to our continuing work with all of you.

Sincerely,

Robin Jarvis, PhD
Director, SECC

Based on information gathered by SEDL, it appears that many states are responding to the report's call to action. In 2008, SEDL's Texas Comprehensive Center queried state departments of education (SDEs) across the nation to elicit feedback on the report. A number of SDEs—California, Indiana, Maryland, Missouri, Ohio, Oklahoma, South Carolina, Virginia, and West Virginia—indicated that they have begun the process of analyzing the report to determine how to improve mathematics education and achievement in their schools and districts. One state, West Virginia, has completed a detailed study of how its mathematics initiatives, policies, and programs compare with the advisory panel's findings and recommendations.

To assist educators and decision makers with reviewing the advisory panel's report, Camille Chapman, SECC program associate, has developed a summary of the main findings and recommendations based on information gathered from the ED Web site (<http://www.ed.gov/about/bdscomm/list/mathpanel/index.html>).

Main Findings and Recommendations from the Advisory Panel Report

Curricular Content

The major topics of school algebra include symbols and expressions, linear equations, quadratic equations, functions, algebra of polynomials, and combinatorics and finite probability. The advisory panel recommends that all students should have access to an authentic algebra course and that school districts should do more to prepare students to enroll in such a course by grade 8. Early childhood teachers should know topics of whole numbers, fractions, and the appropriate geometry and measurement topics in the critical foundations of algebra. Elementary teachers should know all topics in the critical foundations of algebra and those topics typically covered in an introductory algebra course. Middle schoolteachers should know all the critical foundations of algebra and the major topics of school algebra.

Learning Processes

Most children develop considerable knowledge of mathematics before they begin kindergarten. Children from families with low incomes, low levels of parental education, and single parents often have less mathematical knowledge when they begin school than do children from more advantaged backgrounds. This tends to hinder children's learning for years to come. There are promising interventions to improve the mathematical knowledge of these young children before they enter kindergarten. To prepare students for algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, factual knowledge, and problem solving skills. Limitations in the ability to keep many things in mind

(working memory) can hinder mathematics performance. Practice can offset this through automatic recall, which results in less information to keep in mind and frees attention for new aspects of material at hand. Learning is most effective when practice is combined with instruction and related concepts. Conceptual understanding promotes transfer of learning to new problems and better long-term retention. Children's beliefs about the relative importance of effort and ability can be changed. Experimental studies have demonstrated that changing children's beliefs from a focus on ability to a focus on effort increases their engagement in mathematics learning, which in turn improves mathematics outcomes. Engagement and sense of efficacy for Black and Hispanic students can be increased in mathematical learning contexts. Teachers and other educational leaders should consistently help students and parents understand that an increased emphasis on the importance of effort is related to improved mathematics grades.

Teachers and Teacher Education

Evidence shows that a substantial part of the variability in student achievement gains is due to the teacher. Less clear from the evidence is exactly what it is about particular teachers—what they know and do—that makes them more effective. The mathematics preparation of elementary and middle schoolteachers must be strengthened as one means for improving teacher effectiveness in the classroom. Currently there are multiple pathways into teaching. Research indicates that differences in teachers' knowledge and effectiveness between these pathways are small or insignificant compared to very large differences among the performance of teachers within each pathway. The advisory panel recommends that research be conducted on the use of full-time mathematics teachers in elementary schools, often called elementary math specialist teachers. The advisory panel further recommends raising base salaries for teachers of mathematics to attract more mathematically qualified teachers into the workforce, offering salary incentives for mathematics teachers working in locations that are difficult to staff, and providing opportunities for these teachers to increase their base salaries substantially by demonstrable effectiveness in raising student achievement.

Instructional Practices

Instructional practice should be informed by high-quality research, when available, and by the best professional judgment and experience of accomplished classroom teachers. All-encompassing recommendations that instruction should be student-centered or teacher-directed are not supported by research. Formative assessment enhances mathematics achievement, particularly when the information is used to determine focus or instruction, expert teachers offer advice, and computer-assisted instruction or peer tutoring is a component.

Research on students who are low achievers, have difficulties in mathematics, or who have learning disabilities related to mathematics tells us that the effective practice includes (1) explicit methods of instruction available on a regular basis; (2) clear problem solving models; (3) carefully orchestrated examples/sequences of examples; (4) concrete objects to understand abstract representations and notation; and, (5) participatory thinking aloud by students and teachers. Use of technology shows promise when computer-assisted instruction supports drill and practice; well-designed tutorials are delivered through computer-assisted instruction; and, learning is supported by the careful, targeted application of computer programming. More research is needed. A review of 11 studies that met the advisory panel's rigorous criteria (only one study less than 20 years old) found limited or no impact of calculators on calculation skills, problem solving, or conceptual development over periods of up to 1 year. Mathematically precocious students with sufficient motivation appear to be able to learn mathematics successfully at a much higher rate than normally paced students, with no harm to their learning.

Instructional Materials

The report finds that mathematics textbooks used in the United States are far too long, often 700–1,000 pages. In contrast, mathematics textbooks are much smaller in many nations with higher mathematics achievement than the U.S. Excessive length makes U.S. textbooks unnecessarily expensive and tends to undermine coherence and focus. In addition to addressing the length of textbooks, the authors stress that publishers must ensure the mathematical accuracy of their materials.

Assessment

National Assessment of Educational Progress (NAEP) and state tests must focus on the mathematics that students should learn, with scores reported and tracked over time. States and the NAEP need to develop better quality control and oversight procedures to ensure that test items are of the highest quality, measure what is intended, and do not include design or wording problems that provide unintended sources of difficulties.

Research Policies and Mechanisms

It is essential to produce methodologically rigorous scientific research in crucial areas of national need, such as the teaching and learning of mathematics. More research is needed that identifies

- effective instructional practices, materials, and principles of instructional design;
- mechanisms of learning;

- ways to enhance teachers' effectiveness, including teacher education, that are directly tied to objective measures of student achievement; and
- item and test features that improve the assessment of mathematical knowledge.

As in all fields of education, the large quantity of studies gathered in literature searches on important topics in mathematics education is reduced appreciably once contemporary criteria for rigor and generalizability are applied. The advisory panel recommends that governmental agencies that fund research give priority not only to increasing the supply of research that addresses mathematics education but also to ensuring that such projects meet stringent methodological criteria. Leaders of graduate programs in education and related fields should ensure attention to research design, analysis, and interpretation for teachers and those entering academic and educational leadership positions in order to increase the national capacity to conduct and utilize rigorous research. New funding should be provided to establish support mechanisms for career shifts. Many accomplished researchers who study the basic components of mathematics learning are not directly engaged in relevant educational research. Support should be provided to encourage the creation of cross-disciplinary research teams, including expertise in educational psychology, sociology, economics, cognitive development, mathematics, and mathematics education. PreK–12 schools should be provided with incentives and resources to provide venues for, and encourage collaboration in, educational research. Also, unnecessary barriers to research should be lowered.

Southeast Comprehensive Center Regional Mathematics Forum

To help educators and decision makers address the advisory panel's findings and recommendations, the SECC is planning a regional mathematics forum to be held later this year. The forum will be designed to help participants review the report with respect to areas such as, state curricula, instruction, standards, initiatives, teacher education and professional development as well as to develop action plans for achieving improvement. Additional information on the mathematics forum will be provided on the SECC Web site.

State Highlights and Events

Alabama

State Incorporates Math Panel Recommendations in Curriculum and Teacher Education Standards

Provided By Tod Beers, AMSTI Math Coordinator, Alabama State Department of Education

Mary Lou Meadows, SECC State Liaison

After release of the National Mathematics Advisory Panel's report in March 2008, personnel from the Alabama State Department of Education (ALSDE) attended conferences to gain firsthand information from the advisory panel and have worked to incorporate the panel's recommendations in the state's curriculum and teacher education standards and the Alabama Math, Science, and Technology Initiative (AMSTI), which is the department's statewide initiative to improve K–12 mathematics and science teaching. Research from the advisory panel's report is a major resource that is being used extensively in the writing of Alabama's mathematics content standards. As part of the process for revision of the Alabama Course of Study (COS) for Mathematics, Dr. Francis "Skip" Fennell was invited to our state, and members of the COS committee attended a meeting with Dr. Fennell during which the committee reviewed findings from the report.

The recommendations from the advisory panel also have been used by AMSTI to update its framework for professional development in mathematics by giving increased attention to the benchmarking and foundations of algebra; to align AMSTI Best Practices in mathematics with the current research on learning processes, instructional materials and practice, and assessment; and to impact preservice preparation in teacher education programs. Draft revisions of the Alabama Board of Education teacher education program approval standards include language indicating that candidates must demonstrate specific knowledge and abilities prior to program completion, such as "knowledge of . . . The Final Report of the National Mathematics Advisory Panel (2008) and its benchmarks addressing the Critical Foundations of Algebra," and "ability to . . . apply inquiry strategies to teach mathematics and science, including those advocated by the AMSTI and The Final Report of the National Math Advisory Panel (2008)." Our involvement with implementing the findings from the advisory panel's report will help the ALSDE provide the standards, resources, and support local education agencies need to ensure that all students graduate college or career ready.

Georgia

Georgia's Mathematics Curriculum

Provided By Kathy Cox, State Superintendent of Schools, Georgia Department of Education

Glenda Copeland, SECC State Liaison

The Georgia Performance Standards (GPS) for mathematics have been a frequent topic of discussion over the last several years. Much of that discussion has been helpful, while some has been based on misinformation. The following is an explanation of why Georgia made this change and why it's right for Georgia's students.

In rewriting the GPS for mathematics, we wanted to ensure that our kids had a competitive advantage in the 21st century economy. Teachers and educators from both K–12 and higher education developed the GPS for mathematics in conjunction with leaders in government, business, and industry. Committee members examined math standards from other states and nations in which the content focused on fewer, integrated topics at each grade level. Following extensive public input and revisions, the standards were approved by the state board of education in 2005.

Many groups have endorsed what we are doing in Georgia. The mathematics curriculum is closely aligned to the standards of the National Council of Teachers of Mathematics, the American Statistical Association, Achieve Inc., and the College Board, which administers the SAT.

The state's new mathematics standards received further validation when the National Mathematics Advisory Panel's 2008 report was released. This advisory panel, which included some of the most distinguished mathematics experts in the nation, made recommendations of what concepts students should know by 8th grade.

The good news is that Georgia is right in line with what the advisory panel recommended. Here are some highlights

- Pre–K through grade 8 curricula must be streamlined and well defined. The GPS is more focused and well defined.
- A balance is needed between concepts, skills and problem solving. That is the GPS in math—a balance.
- Algebra skills are vitally important for students to be successful in the 21st century. Both the advisory panel and the GPS support this notion. Under Georgia's old curriculum, only the most advanced students got algebra in 8th grade. Now ALL students have algebra in 8th grade.

The most important point made in the advisory panel's report was that "high expectations matter." The United States is the only industrialized nation that believes that students have to have "talent" in math in order to be successful. The countries that are most successful in math and science do NOT believe that. They

give all their students a strong math foundation, and a large majority of them meet those high expectations. The problem isn't that students can't do high-level math—we just haven't expected them to. And, now we do!

In today's competitive world, all students must have strong core classes (mathematics, English, social studies, science) in order to be successful in college or in the world of work. Parents, educators, and community leaders can help Georgia lead the nation in improving student achievement by working together to successfully implement this new mathematics curriculum. For more information on Georgia's mathematics curriculum, visit www.GeorgiaMath.org.

Louisiana

Literacy and Numeracy Initiatives Target Students' and Teachers' Needs

By Darlene Morgan Brown, SECC State Liaison

The Louisiana Department of Education's vision is to create a world-class education system for all students in the state. This can only be achieved by ensuring that ALL students read, write, and perform mathematics at or above grade level—at all grade levels. Louisiana's Ensuring Literacy and Numeracy for All Initiative is designed to accomplish this vision by

- developing the reading and mathematics foundation students need for future success;
- providing the technical assistance and professional development essential for PreK–4th grade teachers and administrators to address the diverse needs of all learners; and
- providing the support necessary at the district level to have all students reading, writing, and performing mathematics at or above grade level by grade 4.

During the 2008–2009 school year, the department selected 10 schools to pilot the numeracy portion of this initiative at the PreK–4th grade levels. This instructional coaching model offers professional development for mathematics content and classroom management strategies to teachers in the selected schools. Ongoing professional development opportunities are provided for the instructional coaches.

In addition, the LDE has launched the Louisiana Math Fellows Academy (LMFA). The LMFA is a competitive initiative designed to select the “best of the best” PreK through 12th grade teachers of mathematics in the state. Superintendents had the opportunity to nominate teachers from each academic level. The selected applicants meet on a regular basis to review the National Mathematics Advisory Panel report and similar reports; participate in professional development opportunities; make presentations at district, state, and regional levels; and serve on committees and boards involving PreK–12 mathematics.

Mississippi

Tier 2 Interventions in Mathematics

*Provided By Maria Torres and Concepcion Molina, SECC Program Associates
Debra Meibaum, SECC State Liaison*

At the request of the Mississippi Department of Education (MDE), SECC staff investigated the available research on effective Tier 2 mathematics interventions and strategies for students who do not succeed in the initial (Tier 1) instruction of a 3-tiered Response to Intervention (RtI) model. SECC staff reviewed numerous studies that focused on RtI tiered interventions and incorporated the findings into a report submitted to the MDE. The findings of this report were primarily dependent on studies done at the elementary school level (primarily grades K–3), research done through the Center on Instruction, and 2 meta-analyses on the topic of mathematics instruction for struggling students.

The research done for this report was similar to another research project (focused on formative assessment and progress monitoring tools) in that it illuminated the progressively decreasing research available as one progresses upward from elementary to middle and high school levels. This Tier 2 investigation found a new initiative that will explore high school intervention models that are emerging in high schools across the country. Results of the initiative will be available in Summer 2009.

South Carolina

Focus on Sound Mathematics and Science Instruction

By Sandra Lindsay, SECC State Liaison

The South Carolina Department of Education (SCDE) has implemented two initiatives that focus on providing sound mathematics and science instruction for students throughout the state, the South Carolina Mathematics Advisory Panel and the Mathematics and Science Unit, which is coordinated by the Office of Instructional Promising Practices.

To reflect on South Carolina's mathematics standards as well as policies and practices in light of the recommendations of the National Mathematics Advisory Panel, the SCDE developed the South Carolina Mathematics Advisory Panel (SCMAP). The SCMAP is composed of educators from all levels in the South Carolina educational community. A major goal of the SCMAP is to ensure that the South Carolina Mathematics Academic Standards provide clear guidance to South Carolina classroom teachers as well as to parents about the quality of curricula, instruction, and assessment required to ensure successful students. One of the principal products of the SCMAP will be a Mathematics Support Guide with resources to assist teachers in their day-to-day work.

The Office of Instructional Promising Practices at the SCDE provides statewide leadership and services to schools and districts in the areas of mathematics and science. The SECC has worked on several joint projects with the office over the past 4 years when specific assistance was requested.

The Mathematics and Science Unit (MSU) has primary responsibility for coordinating support of mathematics and science instruction. The unit includes an SCDE-based administrative team, along with an infrastructure of eight regional centers that are staffed with a coordinator and mathematics and science specialists who work with teachers and administrators in the local districts and schools in their region. The MSU is charged with providing statewide leadership and services to schools and districts to ensure implementation of grade-level, standards-based instruction for all students in mathematics and in science, which is accomplished by

1. developing and revising academic standards and expanding support materials;
2. promoting the use of effective evidence-based instructional practices by schools and districts; and
3. facilitating the implementation of programs, projects, grants, and activities that support standards-based instruction.

A major success of the MSU and the eight regional centers has been the creation and support of a cadre of mathematics and science coaches in South Carolina's schools, the Math Science Coaching Initiative. Through this initiative, each coach works exclusively in one of 33 elementary schools around the state. The coaches work to improve instructional practices of teachers in their schools by working directly with teachers in the context of teachers' classrooms. The Math Science Coaching Initiative has received national recognition and was highlighted at the 2007 Conference of the National Science Teacher's Association (NSTA). The NSTA presents professional development institutes with focused, content-based programs led by NSTA partners. South Carolina's Coalition for Mathematics and Science (SCCMS) in partnership with the SCDE Mathematics and Science Unit

was selected to offer a pathway titled Coaching as a Pathway to Reflective Practice in Science.

The Mathematics and Science Coaching Initiative has completed its 6th year. Participating schools are selected through a competitive grant process. Successful schools receive 3 years of training and support. Since 2003, the 1st year of the initiative, more than 250 coaches have been trained. The MSU is currently supporting 157 mathematics or science coaches in elementary and middle schools in 46 school districts. There is an ongoing data collection process that monitors the effectiveness of the coaching initiative, and data suggest that students whose teachers have been coached are more successful on state tests and other measures of growth in student knowledge and skills than students whose teachers do not have access to a coach.

In an effort that builds on the Mathematics and Science Coaching Initiative, the Mathematics and Science Unit began a high school initiative called the South Carolina Algebra Project (SCAP) in 2007. The goal of this project is the improvement of algebra instruction by supporting teachers with high-quality professional development and research-validated curricula. Now in its 2nd year, the SCAP team is working with 135 teachers in 55 middle and high schools. The Mathematics and Science Unit provides monthly professional development, school visits, and access to the Agile Mind online curriculum that was developed by the Dana Center at the University of Texas.

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The Southeast Comprehensive Center (SECC) is one of 16 regional centers established by the U.S. Department of Education. The primary goal of the regional centers is to build the capacity of the state education agencies and statewide systems of support to implement NCLB. Links to the other regional centers, the content centers, and the U.S. Department of Education may be found on the SECC Web site (secc.sedl.org).

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