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The K–12 Mathematics Curriculum Center

Established in 1997, the K–12 Mathematics Curriculum Center (K–12 MCC) at Education Development Center, Inc., assists teachers, curriculum leaders and administrators in making thoughtful, informed decisions about mathematics instructional materials. Our recent work, funded through a National Science Foundation grant, investigates decision-making about the selection and implementation of mathematics instructional materials.

Through this project we had the opportunity to interview over 150 K–12 mathematics curriculum decision-makers representing districts in eight states. These states—Colorado, Louisiana, Maine, New York, Ohio, Texas, Washington, and West Virginia—were carefully selected to investigate curriculum decision-making in a variety of state-adoption and open-territory states across the country. Districts participating in interviews within each state reflected a range of characteristics in terms of performance level, geographic region, percent of students in poverty, size, and instructional materials used.

Our interviewees were, in most cases, the individuals in each district directly responsible for overseeing the selection of new mathematics textbooks. Interviewers sought to understand curriculum decision-making processes in various settings, to identify the decisions curriculum leaders make, and to identify the role various sources of information play in those decisions. Of particular interest was the curriculum leaders' use of research, particularly in light of national calls for a broader perspective on the research needed to properly evaluate instructional materials in mathematics (National Research Council, 2004).

In these interviews, we learned that curriculum leaders use research (e.g., books, journal articles) throughout the adoption process, especially in preparing themselves and selection committees for the upcoming adoption. However, leaders also reported they sometimes struggled to locate applicable and appropriate research and often relied on a mixture of materials gathered from state leaders, the Internet, and colleagues. Given the numerous responsibilities and tasks our interviewees handle on a daily basis, they also expressed frustration over the challenge of finding the time to engage in a more thorough search. These leaders spoke of the need to find relevant research in a centrally located, easily accessible place. Consequently, an important product of our current study is an annotated bibliography that serves to point curriculum leaders to relevant articles they might use in the process of selecting mathematics instructional materials.

About this Publication

This publication, an annotated bibliography of articles relevant to the selection and implementation of mathematics instructional materials, is intended as a resource for mathematics curriculum leaders across all phases of the selection process. Whether preparing for an upcoming textbook adoption, actively involved in choosing materials, or preparing to launch the implementation of a recently selected text, this publication provides relevant information in an easily accessible format. While this edition builds on the popular earlier editions of the Annotated Bibliography published by the K–12 MCC, the intent here is to focus specifically on mathematics curriculum leaders' needs, and not limit the included articles to those solely linked to *Standards*-based curriculum reform. Instead we cast a wider net, so leaders would have a helpful resource regardless of whether the ultimate decision leads to an NSF-funded or commercially-developed set of materials.

In gathering resources for this publication, the K–12 Mathematics Curriculum Center staff

reviewed articles from a comprehensive set of peer-reviewed journals. The following criteria were used to determine inclusion in this publication:

- Relevance for curriculum leaders involved in materials selection or implementation
- Accessible for curriculum leaders (e.g., readability)
- Peer-reviewed
- Specific connection to instructional materials
- Published in 2000 or later

In a few cases, slight exceptions were made to this list of criteria. For example, a handful of articles published prior to the year 2000, were identified as seminal pieces in the field, and therefore valuable resources for the selection and implementation of mathematics curricula. We also chose to include a handful of books in which the content is directly tied to instructional materials, as their absence would have resulted in an incomplete list. It should also be noted that other resources with specific links to instructional materials such as conference proceedings and presentations, doctoral dissertations, and newspaper articles, are available. Generally, these resources are not peer-reviewed and are difficult to comprehensively search and access.

On a related note, this bibliography does not attempt to be comprehensive and certainly does not include every article written about mathematics curriculum or related relevant issues, such as how children learn mathematics or best teaching practices. (You will find articles on these topics when specifically connected to instructional materials.) In fact, if comprehensively and exhaustively searched, each of these topics would be worthy of their own annotated bibliography. Rather, the goal was to increase curriculum leaders' understanding of topics relevant to the selection and implementation of mathematics instructional materials.

The articles in this bibliography are organized into three primary categories: preparation for selection and implementation, effectiveness studies, and implementation of instructional materials. We designed this organizing framework to mirror the phases of the adoption process, during which curriculum leaders typically begin by preparing their committee to evaluate materials, the committees evaluate the quality of the materials, and after a selection decision, districts then arrange for implementation. Articles in the preparation category are generally those perceived to be helpful to curriculum leaders as they ready themselves and their committee for an examination of potential materials. The effectiveness studies category includes pieces that largely look at student achievement results for specific textbooks. The final set of articles grouped under implementation of instructional materials includes articles that address issues that arise when considering the implementation of newly adopted materials, including providing professional development.

Other organizational structures would have been possible, but we felt this representation addressed the needs expressed by our interviewees. It should also be noted that in more than one instance an article fit reasonably well into more than one category. However, we have chosen to take a best-fit approach, and articles only appear once throughout the annotated bibliography.

An abstract is provided with each article, which in most cases, was written by the original author or publishers. These abstracts are reprinted with permission from the publishers. Some publishers requested we include a link to their website, or in a few cases, a direct link to the article, as a condition of granting permission. Occasionally, articles were selected that did not include an

abstract. For these items, we have written an abstract. Abstracts were also written if we were unable to secure permission from the publisher.

Preparation for Selection and Implementation

Many mathematics curriculum leaders begin preparing for the adoption of mathematics instructional materials several months before the selection must occur. For some, it is even a multi-year process. During this preparation phase, curriculum leaders often convene a selection committee and then share information they believe will assist committee members in evaluating materials and in eventually making an selection that best meets the needs of their students and teachers. Information shared and discussed with committees may include such topics as what it means to be *Standards*-based, various views on the teaching and learning of mathematics, criteria to be used for evaluation, or implications of state and national recommendations. This section includes articles that curriculum leaders may find helpful as they ready themselves and their committee for a mathematics adoption.

The learning of mathematics

Many of the curriculum leaders we interviewed felt one of the first steps in preparing the teachers in their district for an upcoming adoption was to have them look broadly at the learning of mathematics. This group of articles includes classic pieces that share how children learn mathematics. The items in this group were frequently mentioned by curriculum leaders and were used to engage in committee members in thinking about how children learn mathematics and the implications of this work for instructional materials selection. As noted in the introduction, we did not engage in a comprehensive search of the vast literature on the learning of mathematics, but did want to include a few seminal pieces that would serve as a jumping off point for those curriculum leaders wanting to take a step back and look at the bigger picture.

Carpenter, T. P., & Lehrer, R. (1999). Teaching and learning mathematics with understanding. In E. Fennema & T. A. Romberg (Eds.), *Mathematics classrooms that promote understanding* (pp. 19–32). Mahwah, NJ: Erlbaum.

Carpenter and Lehrer describe how understanding is developed in both the learning of and the teaching of mathematics. They conjecture that understanding is built through constructing relationships, extending and applying mathematical knowledge, reflecting about experiences, articulating what one knows, and making mathematical knowledge one's own. The authors highlight how teachers can create an environment (e.g., developing norms, creating meaningful tasks to promote understanding) to foster student understanding. Additionally, they caution readers that it is not just student understanding that is important, but also teachers' understanding of mathematics and student thinking.

Cuoco, A., Goldenberg, E. P., & Mark, J. (1996). Habits of mind: An organizing principle for mathematics curricula. *Journal of Mathematical Behavior, 15*(4), 375–402.

By emphasizing the ways of thinking that are essential in mathematics, one can design mathematics courses that simultaneously serve the needs of students who will go on to advanced mathematical study and students who will not. The authors address a series of mathematical "habits of mind," arguing that students should be pattern sniffers, experimenters, describers, tinkerers, inventors, visualizers, conjecturers, and guessers. Using mathematical examples, the authors discuss mathematical approaches to things, and how geometers and algebraists approach their world. Materials for teaching and

learning provide students with problems and activities to develop these habits of mind and put them into practice.

Garfunkel, S., & Froelich, G. (1999). Helping students see the world mathematically. In L. J. Sheffield (Ed.), *Developing mathematically promising students* (pp. 93-100). Reston, VA: National Council of Teachers of Mathematics.

In order to engage students who are mathematically promising, mathematics classes need to attract and challenge students by helping them see the importance of mathematics in their world. The authors of this article suggest that good mathematics problems are engaging, accessible at different levels for students with varying degrees of mathematical experience, and extendible. The article cites several sources for such problems, including National Science Foundation-funded curriculum projects that have student engagement as one of their goals. In closing, the authors suggest that not only are engaging problems good tools for mathematically promising students, but that problems such as these can actually help teachers identify students who have potential for looking at the world mathematically.

Hiebert, J., Carpenter, T. P., Fennema, E., Fuson, K., Human, P., Murray, H., et al. (1996). Problem solving as a basis for reform in curriculum and instruction: The case of mathematics. *Educational Researcher, 25*(4), 12-21.

We argue that reform in curriculum and instruction should be based on allowing students to problematize the subject. Rather than mastering skills and applying them, students should be engaged in resolving problems. In mathematics, this principle fits under the umbrella of problem solving, but our interpretation is different from many problem-solving approaches. We first note that the history of problem solving in the curriculum has been infused with a distinction between acquiring knowledge and applying it. We then propose our alternative principle by building on John Dewey's idea of "reflective inquiry," argue that such an approach would facilitate students' understanding, and compare our proposal with other views on the role of problem solving in the curriculum. We close by considering several common dichotomies that take on a different meaning from this perspective.

Link: http://edr.sagepub.com/content/vol25/issue4/

National Research Council. (2000). *How people learn: Brain, mind, experience, and school*. J. D Bransford, A. L. Brown, & R. L. Cocking (Eds.). Developments in the Learning of Science Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

This popular trade book, originally released in hardcover in the Spring of 1999, has been newly expanded to show how the theories and insights from the original book can translate into actions and practice, now making a real connection between classroom activities and learning behavior. This paperback edition includes far-reaching suggestions for research that could increase the impact that classroom teaching has on actual learning.

Like the original hardcover edition, this book offers exciting new research about the mind and the brain that provides answers to a number of compelling questions. When do infants begin to learn? How do experts learn and how is this different from non-experts? What can teachers and schools do-with curricula, classroom settings, and teaching

methods--to help children learn most effectively? New evidence from many branches of science has significantly added to our understanding of what it means to know, from the neural processes that occur during learning to the influence of culture on what people see and absorb.

Link: www.nap.edu/catalog.php?record_id=9853#description

National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, & B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Adding it Up explores how students in pre-K through 8th grade learn mathematics and recommends how teaching, curricula, and teacher education should change to improve mathematics learning during these critical years. The committee identifies five interdependent components of mathematical proficiency and describes how students develop this proficiency. The committee discusses what is known from research about teaching for mathematics proficiency, focusing on the interactions between teachers and students around educational materials and how teachers develop proficiency in teaching mathematics.

Link: www.nap.edu/catalog.php?record_id=9822#description

The effects of accountability and state standards

The No Child Left Behind (NCLB) legislation and recent state mandates demand greater accountability for students' learning. Changes at the national and state level have an impact on what instructional materials look like, including mathematics content, and the district context in which mathematics instructional materials are used. The articles in this subsection address how changes in state standards and accountability pressures affect instructional materials development and use. Mathematics curriculum leaders need to consider the implications of these findings as they evaluate mathematics textbooks.

Chazan, D. (2008). The shifting landscape of school algebra in the United States: No child left behind, high school graduation requirements, principles and standards, and technology. In C. Greenes & R. Rubenstein (Eds.), *Algebra and algebraic thinking in school mathematics* (Vol. 70, pp. 19–31). Reston, VA: National Council of Teachers of Mathematics.

Schools across the country are revising mathematic requirements in response to calls from state leaders and others for substantial changes in mathematics education. Not only are students taking additional mathematics courses, but the look of mathematics they are taking, particularly algebra, is also shifting. In this chapter, Chazan details the structural changes in school algebra, including offering algebra earlier, the use of integrated courses (e.g., Core-Plus) to study algebra, and assessments linked to graduation. The author also explores the implications of these structural changes for those teaching algebra. These changes in teaching and learning also affect the curriculum, a point Chazan highlights through the use of an example that details the various ways an algebra curriculum might present the idea of what an equation is. The chapter concludes with opportunities and challenges emerging from these changes.

Firestone, W. A. (2009). Accountability nudges districts into changes in culture. *Phi Delta Kappan, 90*(9), 670–676.

The accountability movement has focused more districts on improvements in student learning, but that has not necessarily created cultures of student learning in those districts. Moving from an accountability culture to a student learning culture requires a mix of board and community support and leadership from the top.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Accountability&text=&lname_1=Firestone&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Reys, B., & Lappan, G. (2007). Consensus or confusion? The intended math curriculum in state-level standards. *Phi Delta Kappan, 88*(9), 676–680.

Since the passage of No Child Left Behind legislation in 2002, nearly all the states have developed or revised mathematics curriculum standards that specify learning goals for each year of schooling. However, each is unique in design, organization, and grade-placement of specific learning expectations. As a collection they highlight a consistent lack of national consensus regarding common learning expectations in mathematics at particular grade levels. Recommendations for the future development of mathematics curriculum standards include focusing on a few major goals or big ideas at each grade level and collaborating across states or at a national level in the development and refinement of curriculum standards.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Confusion&text=&lname_1=Reys&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Reys, B. J., Chval, K., Dingman, S., McNaught, M., Regis, T. P., & Togashi, J. (2007). Grade-level learning expectations: A new challenge for elementary mathematics teachers. *Teaching Children Mathematics, 14*(1), 6–11.

This article summarizes the similarities and differences in grade-level learning expectations for fourth grade as described in state curriculum standards.

Link: www.nctm.org

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Reys, B. J., & Reys, R. E. (2007). An agent of change: NSF sponsored mathematics curriculum development. *NCSM Journal of Mathematics Education Leadership, 9*(1), 58-64.

This article identifies factors that make it difficult for publishers of commercial textbooks to make significant changes consistent with curricular visions put forth by the National Council of Teachers of Mathematics (NCTM). Central among these factors is the lack of consensus of state standards on what and when certain topics in mathematics should be addressed. The variability of grade placement of key mathematics learning goals across different state standards results in excessive repetition and superficial treatment of topics in school mathematics textbooks.

Implications of the NCTM Standards

When the National Council of Teachers of Mathematics published the *Curriculum and Evaluation Standards for School Mathematics* in 1989 and then the *Principles and Standards for School Mathematics* in 2000 discussion quickly erupted about what content children should learn and how they should learn it. The articles included in this subsection explore how instructional materials changed in response to the NCTM documents, including what *Standards*-based mathematics is all about and how the design and content differs from more traditional looking materials. This subsection also features articles that highlight some of the controversies emerging following the publication of the NCTM *Standards*, such as the debate about basic skills.

Ball, D. L., Ferrini-Mundy, J., Kilpatrick, J., Milgram, R. J., Schmid, W., & Schaar, R. (2005). Reaching for common ground in K-12 mathematics education. *Notices of the American Mathematical Society, 52*(9), 1055–1058.

This article is the result of conversations between mathematicians and mathematics educators around forging areas of common agreement over several, sometimes contentious, issues in K-12 mathematics education. Three fundamental assertions (e.g., proficiency with computational procedures) are detailed and explained, followed by seven areas of agreement. These areas of agreement center around the automatic recall of basic facts, calculator use, algorithms, fractions, "real-world" contexts, instructional methods and teacher knowledge. Readers of this article may be interested in the areas of common ground sometimes overlooked in "math wars" discussions.

Ball, D. L., Hill, H. C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator, 29*(3), 14, 16–17, 20–22, 43–46.

There is general agreement that teachers' knowledge of the mathematical content to be taught is the cornerstone of effective mathematics instruction. But the actual extent and nature of the mathematical knowledge teachers need remains a matter of controversy. A new program of research into what it means to know mathematics for teaching—and how that knowledge relates to student achievement—may help provide some answers.

Link: www.aft.org/pubs-reports/american_educator/issues/fall2005/BallF05.pdf

Brucker, E. L. (2008). Journey into a standards-based mathematics classroom. *Mathematics Teaching in the Middle School, 14*(5), 300–303.

This article will encourage teachers to continue teaching Standards-based mathematics and take advantage of available training to produce students who are better prepared in mathematics and who enjoy the process.

Link: www.nctm.org

Harris, K., Marcus, R., McLaren, K., & Fey, J. (2001). Curriculum materials supporting problem-based teaching. *School Science and Mathematics, 101*(6), 310–318.

The vision for school mathematics described by the National Council of Teachers of Mathematics (NCTM) suggests a need for new approaches to the teaching and learning of

mathematics, as well as new curriculum materials to support such chance. This article discusses implications of the NCTM standards for mathematics curriculum and instruction and provides three examples of lessons from problem-based curricula for various grade levels. These examples illustrate how the teaching of important mathematics through student exploration of interesting problems might unfold, and they highlight the differences between a problem-based approach and more traditional approaches. Considerations for teaching through a problem-based approach are raised, as well as reflections on the potential impact on student learning.

Link: www.ssma.org

Hirsch, C. R. (Ed.). (2007). *Perspectives on the design and development of school mathematics curricula*. Reston, VA: National Council of Teachers of Mathematics.

Prepared in conjunction with the Center for the Study of Mathematics Curriculum and with support from the National Science Foundation, *Perspectives on the Design and Development of School Mathematics Curricula* offers multiple perspectives on the design and development of Standards-based curricula by fifteen comprehensive curriculum development projects.

The book represents more than fifteen years of work on the part of teams of mathematics curriculum developers in designing, developing, testing, and revising innovative curriculum materials for grades K–12. The curricula that evolved out of these projects represent an approach to mathematics teaching and learning that is qualitatively different from conventional practice in content, priorities, organization, and approaches. The insight in this volume provides invaluable guidance to current and future curriculum developers and curriculum users.

Link: www.nctm.org/catalog/product.aspx?id=13233

Lubienski, S. T. (2002). Research, reform, and equity in U.S. mathematics education. *Mathematical Thinking and Learning, 4*(2&3), 103–125.

This article discusses mathematics education research in relation to equity and current U.S. reforms. Although mathematics education researchers and reformers give attention to equity, work in this area tends to ignore relevant social and cultural issues. I begin by surveying articles on equity published in recent, mainstream education journals, highlighting the lack of attention given to social class and ethnicity. I discuss the implications of this limited research base. Specifically, I argue that current mathematics education reforms have been shaped by good intentions and existing research, neither of which offers adequate guidance to address the complexities of equity in mathematics classrooms today. Drawing from a study of social class differences in students' experiences in one reform-oriented classroom, I discuss the challenges and dilemmas inherent in sociocultural approaches to research in mathematics education and their potential contributions. I call for research from a sociocultural perspective, focusing on ways in which students from underrepresented groups can struggle when encountering particular instructional approaches, and ways in which teachers and students are able to address such struggles.

Link: http://www.informaworld.com/smpp/title~db=jour~content=g785828302

Marcus, R., Fukawa-Connelly, T., Conklin, M., & Fey, J. T. (2007). New thinking about college mathematics: Implications for high school teaching. *Mathematics Teacher, 101*(5), 354–358.

Article describes recommendations made by participants in a large project of the Mathematical Association of America (MAA), in which representatives of "partner disciplines" shared what they would like students to learn in the first two years of college mathematics. The article further suggests implications for high school mathematics.

Link: www.nctm.org

Martin, T. S., Hunt, C. A., Lannin, J., Leonard, W., Marshall, G. L., & Wares, A. (2001). How reform secondary mathematics textbooks stack up against NCTM's *Principles and Standards*. *Mathematics Teacher, 94*(7), 540–545, 589.

Our analysis of the five NSF-funded secondary mathematics curricula describes their alignment with the Process Standards and Content Standards in Principles and Standards for School Mathematics. Distinctive features and examples are included.

Link: www.nctm.org

Meyer, M. R., Dekker, T., & Querelle, N. (2001). Context in mathematics curricula. *Mathematics Teaching in the Middle School, 6*(9), 522–527.

This article explains the increased use of context in Standards-based mathematics curricula and then focuses on the role that context plays in teaching and learning mathematics. Using examples from five Standards-based curricula, the authors describe five different roles for context: motivating students to explore new mathematics, offering students opportunities to apply mathematics, serving as a source of new mathematics, suggesting a source for problem-solving strategies, and providing students with models to increase their understanding. In addition, the authors identify characteristics of contexts that support student understanding and positively impact learning. Through the exploration of the roles context plays in learning as well as the characteristics that distinguish high-quality contexts, the authors develop criteria to assess uses of context in mathematics education.

Link: www.nctm.org

Reys, B. J., & Bay-Williams, J. M. (2003). The role of textbooks in implementing the curriculum principle and the learning principle. *Mathematics Teaching in the Middle School, 9*(2), 120–125.

This article serves as a summary of the curriculum and learning principles from NCTM's Principles and Standards for School Mathematics. The authors provide an overview of both principles, explain what each advocates, and suggest ways to apply the principles to

practice in schools. The article also compares a sample exercise from a traditional textbook with one from a textbook developed to comply with the NCTM Standards. In closing, the authors make recommendations for effective ways of reviewing textbooks so as to judge their alignment with the Principles and Standards.

Link: www.nctm.org

Reys, R. E. (2001). Curricular controversy in the math wars: A battle without winners. *Phi Delta Kappan, 83*(3), 255-258.

Controversy surrounding standards-based mathematics curricula continues to swirl. Discussions often reflect a comfort with the status quo and a reluctance to consider options to traditional mathematics curricula. The recently released Principles and Standards for School Mathematics provides an opportunity for rich forums and dialogues. Significant progress in resolving the controversy requires the collective energies and wisdom of all of the quarreling parties be harnessed and headed in a positive direction.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Curricular+Controversy&text=&lname_1=Reys&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Robinson, E., Robinson, M., & Maceli, J. (2000). The impact of *Standards*-based instructional materials in the classroom. In M. Burke & F. R. Curcio (Eds.), *Learning mathematics for the new century: 2000 Yearbook* (pp. 112–126). Reston, VA: National Council of Teachers of Mathematics.

The article describes features of curriculum programs developed in response to NCTM's Curriculum and Evaluation Standards, and the impact these features can have on students and teachers in the classroom. With examples from several comprehensive secondary mathematics curricula, the article examines the philosophical focus of these programs, as well as instructional strategies fostered in their use. For instance, in these programs, algorithms are considered tools that result from a thought process or points from which further mathematical thinking can proceed. Contexts are used to set mathematics in real-world situations and develop mathematical understanding, and mathematical topics are integrated within problems and units. In addition, the article discusses differences in the content of these materials as compared with their more traditional counterparts, as well as the implications for teachers to understand concepts of statistics and probability, geometry, calculus, and algebra and functions at all grade levels, as well as some discrete mathematics at the middle and high school levels. Finally, it explains the use of technology within these curricula as a tool for learning and seeing mathematics concepts. The article closes by pointing out that within these curricula that there are many different ways to construct effective mathematics learning across topics.

Russell, S. J. (2000). Developing computational fluency with whole numbers. *Teaching Children Mathematics, 7*(3), 154-158.

Russell explains the goal of NCTM's Principles and Standards for School Mathematics with regard to expectations for students' computational fluency. She highlights eight main messages from Principles and Standards regarding computation, and defines three key

ideas about fluency: efficiency, accuracy, and flexibility. She explores how fluency is grounded on strong mathematical knowledge and understanding of the following areas: meanings of operations and their relationships with one another, number relationships (including, but not limited to, "facts"), and the structure and behavior of numbers in the base-ten number system. The article includes multiple computational examples to illustrate varying levels of mathematical understanding and fluency in students, and relates some vignettes from the author's observation of elementary students' computation. She also addresses the assessment of computational fluency and provides questions to consider when analyzing students' work.

Link: www.nctm.org

Schoenfeld, A. H. (2002). Making mathematics work for all children: Issues of standards, testing, and equity. *Educational Researcher, 31*(1), 13–25.

"Mathematics Education is a civil rights issue," says civil rights leader Robert Moses, who argues that children who are not quantitatively literate may be doomed to second-class economic status in our increasingly technological society. The data have been clear for decades: poor children and children of color are consistently shortchanged when it comes to mathematics. More broadly, the type of mathematical sophistication championed in recent reform documents, such as the National Council of Teachers of Mathematics' (2000) *Principles and Standards for School Mathematics*, can be seen as a core component of intelligent decision making in everyday life, in the workplace, and in our democratic society. To fail children in mathematics, or to let mathematics fail them, is to close off an important means of access to society's resources. This article discusses the potential for providing high quality mathematics instruction for all students. It addresses four conditions necessary for achieving this goal: high quality curriculum; a stable, knowledgeable, and professional teaching community; high quality assessment that is aligned with curricular goals; and stability and mechanisms for the evolution of curricula, assessment, and professional development. The goal of this article is to catalyze conversations about how to achieve sustained, beneficial changes.

Link: http://edr.sagepub.com/content/vol31/issue1/

Trafton, P. R., Reys, B. J., & Wasman, D. G. (2001). Standards-based mathematics curriculum materials: A phrase In search of a definition. *Phi Delta Kappan, 83*(3), 259–264.

The authors present six central characteristics of standards-based mathematics curriculum materials. They focus their discussion on the central aspects of each one, the ways materials that are built around them differ from conventional curriculum materials, how they relate to each other, and how each one sets the stage for and supports the others. They also address the implications of these materials for teaching and the support for teachers that is required when using such materials.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Curriculum&text=&lname_1=Trafton&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Usiskin, Z. (1997). Applications in the secondary school mathematics curriculum: A generation of change. *American Journal of Education, 106*(1), 62-84.

In the 1960s, the ideal curriculum, as seen from recommendations in journals and reports,

and the implemented curriculum, as viewed from textbooks, referred very little to applications of mathematics outside the subject. Yet today the teaching of real-world applications of mathematics is seen as a necessary component of a good mathematics education. A number of factors are responsible for this change: changing enrollment trends; changing theories toward how students learn and what they can learn; the arrivals of computers and calculators in schools; the public perception of performance of students on standardized tests; and recommendations of business and industry regarding what they would like to see in the people they hire. The change is manifested in various ways beyond the inclusion of problems that relate mathematics to the world outside the classroom. The most widely used of the newer curricula develops important application ideas from basic principles over many years. Newer influences on the thinking of mathematics educators come from advances in applied mathematics that have resulted in major changes in the workplace and a corresponding desire that no students be excluded from significant applied mathematics. As a result, some of the more recent curricula include entire courses based on units, each with a particular application theme, with the expectation that students will work both individually and in groups.

Link: http://www.journals.uchicago.edu/toc/aje/1997/106/1

Wu, H. (1999). Basic skills versus conceptual understanding: A bogus dichotomy in mathematics education. *American Educator, 23*(3), 14-19, 50-52.

In mathematics, skills and understanding are completely intertwined. There is not "conceptual understanding" and "problem-solving skill" on the one hand and "basic skills" on the other. Nor can one acquire the former without the latter. This false dichotomy impedes efforts to improve math education.

Link: www.aft.org/pubs-reports/american_educator/fall99/wu.pdf

Designing selection and evaluation processes

Designing the selection process can be a daunting task. For some curriculum leaders there are state, board or district directives that provide guidance, but most curriculum leaders still need to make many choices about the selection process. These choices may include who is included on the selection committee, what criteria will be used to evaluate materials, and which materials are under consideration. Articles in the grouping provide a broad look at what curriculum decision-making looks like across the country, as well as a more intimate look at the selection process within particular districts. Also included are articles that offer specific suggestions for frameworks or criteria that would be helpful in evaluating instructional materials under consideration.

American Association for the Advancement of Science (2000). *Middle grade mathematics textbooks: A benchmarks-based evaluation*. Washington, DC: American Association for the Advancement of Science.

Noting that textbook analyses are “largely cursory, impressionistic, and unreliable,” the American Association for the Advancement of Science (AAAS) embarked on Project 2061 in order to provide an alternative to the traditional textbook review process. Project 2061 developed a rigorous benchmarks-based tool to assess both traditional and reform-oriented middle grades mathematics curricula. Their evaluation process 1) was rigorous and uniformly applied, 2) employed an evidence-based analysis, 3) identified key

mathematical benchmarks, and 4) rated each text on 24 criteria related to instruction and learning. Twelve textbook series were analyzed and rated, with the findings presented in a comprehensive report available online. Based on Project 2061's criteria the texts that received the highest rankings were: Connected Mathematics, Mathematics in Context, MathScape, and MATH Thematics. The report includes both statistical ratings and narrative summaries for each of the twelve series so that mathematics educators and textbook adoption committees can compare and contrast a wide variety of curricula and make an informed purchasing decision. Although the AAAS only reviewed curricula for the middle grades, elementary and high school committees could make their adoption process more rigorous and research-based by utilizing Project 2061's model: determining criteria, evaluating materials in light of those criteria, and creating a quantitative score and qualitative profile for each text before making a decision.

Bolster, L. C., & Reys, R. E. (2002). Modeling middle school mathematics: A technology-based professional development resource. *NCSM Journal of Mathematics Education Leadership, 6*(1), 36–39.

How might a district help teachers become interested in and knowledgeable about Standards-based materials and practices? Ideally, teachers would talk with colleagues who had implemented Standards-based curricula in nearby districts and observe lessons using these materials. Even if this first-hand opportunity is lacking, however, teachers can still get an in-depth look at Standards-based lessons through Modeling Middle School Mathematics (MMM), a video project sponsored by the Show-Me Center, the National Center for Standards-based Middle Grades Mathematics Curricula (www.showmecenter.missouri.edu). The MMM website (www.mmmproject.org) hosts ten full-length lessons that showcase five Standards-based middle school curricula and address all five NCTM content strands. In addition to being useful during the textbook selection and adoption process, MMM materials (VHS tapes of the lessons are also available) could be used as a professional development resource during the implementation phase, or utilized with administrators, parents, and community stakeholders to help explain what a Standards-based curriculum looks like in practice.

Bryant, B. R., Bryant, D. P., Kethley, C., Kim, S. A., Pool, C., & Seo, Y. (2008). Preventing mathematics difficulties in the primary grades: The critical features of instruction in textbooks as part of the equation. *Learning Disability Quarterly, 31*(1), 21–35.

High-quality core instruction in kindergarten and first and second grade is critical to prevent mathematics difficulties. Evidence-based critical features of instruction should be part of core instruction and be included in mathematics textbooks. This study examined lessons from kindergarten and first- and second- grade basal mathematics textbooks to determine the extent to which 11 critical features of instruction were present. Overall, results showed an "Approaching Acceptable" rating, meaning that the features were not fully incorporated. Implications include the need for textbook adoption committees to be mindful of the importance of including effective instructional practices when making textbook decisions and for teachers to scrutinize the components of lessons to determine if these features of effective instruction are included.

Link: http://www.cldinternational.org

Bush, W. S., Kulm, G., & Surati, D. (2000). Getting together over a good book. *Journal of Staff Development, 21*(2), 34–38.

The focus of this article is on a professional development program in Kentucky that was designed to assist middle school leaders with textbook selection. Specifically, the professional developed was geared toward helping these mathematic leaders evaluate and select materials aligned with the NCTM standards. Teachers were trained to use a four-step process that included the following phases: preliminary, content analysis, instructional, and summary/reporting. Both the benefits and lessons learned from the program are discussed and have implications for anyone involved in textbook adoption.

Goldsmith, L. T., & Kantrov, I. (2000). Evaluating middle grades curricula for high standards of learning and performance. *NASSP Bulletin, 84*(615), 30–39.

This article discusses the emergence of new curriculum materials as a result of mathematics education reform, noting the challenge that educators face when selecting a curriculum. The authors describe resources designed to assist with curriculum selection and identify implementation issues that surface when using these new instructional materials. They highlight three key criteria to use when determining curricular excellence for middle grades mathematics: academic rigor, equity, and developmental appropriateness. They also discuss the characteristics of a curriculum meeting these criteria.

Goldsmith, L. T., Mark, J., & Kantrov, I. (2000). *Choosing a Standards-based mathematics curriculum*. Portsmouth, NH: Heinemann.

A publication of the K-12 Mathematics Curriculum Center at EDC, this guide focuses on the thirteen programs supported by the Center, though the ideas discussed are not specific to these programs. Its aim is to present a comprehensive view of how individual districts should go about adopting new mathematics curricula. The authors address a range of issues districts may confront, decisions committees will have to make, and strategies they may use, and describe many different procedures and processes that others have found useful. For the selection phase, the book explores how to assemble a selection committee, assess resources and needs, and create guidelines and criteria for evaluating different programs. The curriculum implementation section focuses on ways to work toward successful use of materials by planning a realistic and effective roll-out strategy, supporting teachers, and building community buy-in and assistance. Different resources are provided, including stories and examples from practitioners, suggestions for further support, and sample selection criteria from school districts and other educational organizations.

Link: www.heinemann.com/

Grandgenett, N., Jackson, R., & Willits, C. (2004). Evaluating a new mathematics curriculum: A district's multi-stakeholder approach. *NCSM Journal of Mathematics Education Leadership, 7*(1), 13–21.

What does an effective data-driven curriculum adoption look like? This article describes the structured curriculum evaluation and adoption process undertaken by the Westside Community Schools in Omaha, Nebraska, in collaboration with the University of Nebraska at Omaha. The district's goal was to assess the impact of a pilot implementation

of Everyday Mathematics. The study began with a field test process involving three matched control groups and examined standardized test scores from 425 students. In addition, the district solicited direct feedback from stakeholders, using survey results from 132 teachers, 596 parents, and 2,172 students to inform the review process. This comprehensive evaluation process, designed to examine new curriculum's impact, confirmed that a full implementation of Everyday Mathematics was warranted.

Huntley, M. A. (2008). A framework for analyzing differences across mathematics curricula. *NCSM Journal of Mathematics Education Leadership, 10*(2), 10–17.

This paper offers a framework to examine differences across curricula, and can be used with either reform or traditional materials. The framework consists of three pieces, including descriptive information, content variables, and instructional variables. Huntley argues that differences among reform curricula are seldom examined and compares Connected Mathematics and Math Thematics to illustrate use of the framework. This framework may be useful for curriculum leaders and others responsible for selecting materials.

Kulm, G. (1999). Making sure that your mathematics curriculum meets standards. *Mathematics Teaching in the Middle School, 4*(8), 536-541.

In this article, the author describes how to determine to what extent mathematics standards are addressed in curriculum materials and discusses some important characteristics of new as well as traditional mathematics materials. Finally, the author summarizes how a group of Kentucky mathematics teachers used the analysis procedure in their state textbook-adoption process.

Link: www.nctm.org

Mark, J., Spencer, D., Zeringue, J. K., & Schwinden, K. (in press). How do districts choose mathematics textbooks? In B. Reys & R. Reys (Eds.), *The K–12 mathematics curriculum: Issues, trends, and future directions* (Vol. 72). Reston, VA: National Council of Teachers of Mathematics.

The selection of mathematics textbooks has become a key component of district improvement plans as curriculum leaders face increasing accountability pressures to raise student achievement. In this chapter, the authors describe the selection processes districts used for choosing mathematics instructional materials and detail a view of these processes not previously described in the literature. Interviews of mathematics curriculum leaders revealed the influence state standards and tests had on the decisions they made and portrayed how these leaders use research and resources as part of the selection process. This study highlights the key role curriculum leaders play in the design of the selection process and the strategic choices they make as the process unfolds.

Meier, S. L. (2000). Curriculum Integration: Part one, what are the issues? *NCSM Journal of Mathematics Education Leadership, 4*(1), 2–8.

Part one of this two part series outlines potential benefits of curriculum integration and provides a summary overview of the available research supporting integration of the

curriculum. Meier highlights areas of concern over integration and discusses the changes that must take place in staff development, teacher training, assessment, and in the beliefs of teachers, administrators, parents and others about mathematics in order for integration to be successful. The availability of high quality integrated materials serves to address some of these concerns.

Meier, S. L. (2001). Curriculum integration: Part two, choosing and implementing an integrated curriculum. *NCSM Journal of Mathematics Education Leadership, 5*(1), 10–20.

Part two of this series provides several checklists for those considering adopting integrated curriculum materials. The first is a readiness checklist from the Integrated Mathematics, Science and Technology (IMaST) project. The first items on this list focus on the curriculum content and the goals of the school, district and state. Subsequent checklists focus on selecting materials that match reform efforts and also include criteria for worthwhile mathematical tasks. A checklist of characteristics of good performance tasks is provided from the Connecticut Common Core of Learning, Mathematics Assessment Project (CCCLMAP), which may be useful in appraising mathematical performance tasks. Meier goes on to discuss implementation concerns, including effective professional development and parent involvement. She also discusses the issue of writing curriculum over adopting a set curriculum.

National Research Council (2004). Framework for evaluating curricular effectiveness. In J. Confrey & V. Stohl (Eds.), *On evaluating curricular effectiveness: Judging the quality of K-12 mathematics education* (pp. 36–64). Washington, DC: National Academies Press.

With the task of evaluating the effectiveness of current curriculum materials (both those supported by the NSF and those commercially generated) a committee designated by the National Research Council issued a report offering guidelines for evaluating curriculum materials and determining curricular effectiveness. This highlighted chapter lays out the framework that they created for evaluating curricula. The factors (e.g., program components (mathematical content), implementation components (professional development), student outcomes) that they articulate as determining curricular effectiveness and affecting implementation are important to consider when selecting a curriculum or reviewing the effectiveness of one's current program. The proposed framework also describes research methodologies (content analysis, comparative studies, and case studies) that can be used to study a curriculum's programmatic theory, depth, timeliness, balance, engagement, and support for diversity. The three research designs along with data from specific curriculum studies, are described in later chapters of the report. The committee also incorporates into the framework other items (e.g., evaluator independence, time elements) that need to be considered when thinking about curriculum adoption, evaluating current materials, or assessing studies involving curriculum materials.

Newman, W. J. (2004). Serving on a mathematics text selection committee: A tale of woe. *School Science and Mathematics, 104*(8), 361–367.

In this editorial piece, the author details the emotional and intellectual issues he encountered as a parent representative on the local school district's selection committee. His background as a math and science educator sometimes made him feel at odds with other committee members, and he expresses frustration with the process and methods

used to evaluate elementary textbooks.

Link: www.ssma.org

Reys, B. J., & Reys, R. E. (2006). The development and publication of elementary mathematics textbooks: Let the buyer beware! *Phi Delta Kappan, 87*(5), 377–383.

Research shows that the mathematics students experience in elementary school is closely related to what is included in their textbooks. There is increasing pressure on publishers to provide evidence of the effectiveness of their materials, but many factors militate against the development of high-quality, research-based mathematics textbooks. For example, publishing timeliness preclude longitudinal studies of the impact of textbooks on student learning. As a result, textbook publishers have historically assumed the role of curriculum developers with research on their products left to others. This article highlights some issues and questions to consider when reviewing and choosing mathematics textbooks for elementary schools.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Development+and&text=&lname_1=Reys&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

St. John, M., Fuller, K. A., Houghton, N., Huntwork, D., & Tambe, P. (2000). *High school mathematics curricular decision-making: A national study of how schools and districts select and implement new curricula*. Inverness, CA: Inverness Research Associates.

The research presented in this monograph explores the decision-making processes of schools and districts in choosing high school mathematics curricula, and the implications of these processes on Standards-based comprehensive secondary mathematics materials. The monograph reports findings from over 570 survey respondents in 1998-1999, as well as interview data from a small sub-sample of survey respondents. This monograph focuses on data about four key questions: 1) Who chooses the mathematics curriculum at the high school level? 2) What factors influence the choice of a new curriculum? 3) What is the nature of secondary mathematics curricula that are currently adopted and in use? 4) What is the level of interest in changing the high school mathematics curriculum and what is the vision for that change? Major findings reported include the fact that high school teachers play a significant role in determining curriculum; state standards have a strong influence on curriculum selection; most current high school mathematics teachers primarily rely on a traditional textbook for instruction; and most high school teachers are satisfied with their current mathematics program. The authors discuss a wide range of implications of these findings for authors of Standards-based curricula and their supporters and funders. Included among them are two over-arching recommendations: 1) Efforts to disseminate innovative curricula must be focused on individual teachers; 2) Dissemination of information about these curricula must help schools change their mindsets about curriculum adoption and implementation.

St. John, M., Tambe, P., Fuller, K. A., & Hirabayashi, J. (2004). *Mathematics curricular decision-making: The national landscape*. Inverness, CA: Inverness Research Associates.

This article provides an overview of factors that influence and affect curricular decision-making. Serving as an external evaluator for the K-12 Mathematics Curriculum Center, Inverness Research Associates designed a survey for K-8 mathematics curriculum leaders

to document the status of curriculum in mathematics education. Respondents were representative of the national percentage of urban, rural, suburban, and small city schools but were more familiar with visions of reform. The survey questions targeted such areas as how mathematics texts are used, what factors influence the choice of mathematics curricula, and the level of familiarity districts have with reform-oriented materials. Drawing on a similar survey given to mathematics curriculum leaders at the high school level, the authors contrast the results of both surveys by sharing responses from each grade band individually and then providing an analysis of what the data mean.

The findings from the survey speak to the complexity of curricular decision-making. Mathematics education leaders are often more oriented toward reform than their peers, so they face the challenge of balancing external constraints with personal and professional beliefs. The results also suggest that the process of curriculum selection and adoption are quite similar at the elementary, middle, and high school levels. When considering the status of mathematics education, the focus often turns to looking solely at student achievement or teacher quality. Yet there are multiple factors at play, including curriculum, a factor on which schools are dependent. The authors conclude by noting that regardless of whether districts are making incremental or radical changes there is a need for ongoing curricular support.

Tarr, J. E., Reys, B. J., Barker, D. D., & Billstein, R. (2006). Selecting high-quality mathematics textbooks. *Mathematics Teaching in the Middle School, 12*(1), 50–54.

This article provided a general framework for reviewing mathematics textbooks, including a set of quality considerations organized around three key dimensions – Mathematics Content Emphasis, Instructional Focus, and Teacher Support. The quality considerations are intended to stimulate discussion of issues surrounding textbook selection.

Link: www.nctm.org

The role of instructional materials

When you think about your district's vision, where do instructional materials fit? Are they central to district improvement of mathematics program, or do they play a less pivotal role? In the subsection the authors of the articles examine the potential impact of instructional materials and shed light on why the selection of mathematics textbooks is an opportunity for change.

Ball, D. L., & Cohen, D. K. (1996). Reform by the book: What Is or might be the role of curriculum materials in teacher learning and instructional reform? *Educational Researcher, 25*(9), 6–14.

In this article, Ball and Cohen discuss the central role of curriculum materials in the instructional system and examine the concept of materials as agents of improvement. The authors also analyze the relationship between textbooks, teachers, and teaching and offer suggestions regarding how curriculum materials might contribute to reform efforts.

Link: http://edr.sagepub.com/content/vol25/issue9/

Dillon, N. (2008). The e-Volving textbook. *American School Board Journal, 195*(7), 20–23.

This article presents a general overview of the constantly shifting landscape of digital textbooks. While highlighting the benefits of digital content, including increased assessment options, self-paced learning, and richer material, Dillon also outlines some of the issues districts face when considering an electronic option. Cost is an issue, both in terms of the materials and in terms of improving schools' infrastructures. Districts and publishers face additional challenges in attempting to work within the traditional textbook selection process when selecting electronic materials.

House, J. E., & Taylor, R. T. (2003). Leverage on learning: Test scores, textbooks, and publishers. *Phi Delta Kappan, 84*(7), 537–541.

Classroom materials represent substantive discretionary dollars in all schools and districts, and often represent the unofficial curriculum in classrooms. As an often overlooked strategy for improving student achievement, aligning classroom materials with specific data-driven learning needs can be an answer for classroom teachers. Additionally, the authors provide 10 recommendations for selecting, negotiating, and implementing new classroom materials to improve instruction in a cost-efficient manner.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Leverage&text=&lname_1=House&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Kauffman, D., Johnson, S. M., Kardos, S. M., Liu, E., & Peske, H. G. (2002). Lost at sea: Without a curriculum, navigating instruction can be tough--especially for new teachers. *American Educator, 26*(2), 6-8, 46.

Based on interviews with 50 first- and second-year teachers in Massachusetts, this article explores the issue of how new teachers experience curriculum. Teachers expressed frustration over a perceived lack of guidance, support, and materials. The authors examine the additional demands placed on new teachers when a curriculum is not provided, and call for legislators and other officials to consider this issue in the context of standards-based reform.

Link: www.aft.org/pubs-reports/american_educator/summer2002/index.html

Reys, B. J., Reys, R. E., & Chavez, O. (2004). Why mathematics textbooks matter. *Educational Leadership, 61*(5), 61-66.

In mathematics classes, textbooks wield real power. They often dictate how teachers should sequence material, suggest the content teachers should teach, and provide activities and instructional ideas for engaging students. According to the authors, the great limitation of the traditional mathematics textbook is its presentation of mathematical ideas as facts to memorize rather than as a web of meaningful relationships. New models of mathematics textbooks, specifically those developed by the National Science Foundation, help correct this flaw. Using a common problem from a mathematics lesson—solving for the volume of a cylinder and a cone—the authors show that the new instructional approach challenges students to think and engages them in discovering the mathematical relationships that are at the heart of the discipline.

Link: www.ascd.org

Schmidt, W., Houang, R., & Cogan, L. (2002). A coherent curriculum: The case of mathematics. *American Educator, 26*(2), 10–26, 47–48.

A new analysis shows that the mathematics curricula used in the highest achieving countries are very similar--and very coherent. Through a stunning visual comparison, we can see where the U.S. comes up short. We've all heard that curricula in the U.S. are a "mile wide and an inch deep." Here's the research behind the rhetoric.

Link: www.aft.org/pubs-reports/american_educator/summer2002/curriculum.pdf

Schmidt, W. H. (2004). A vision for mathematics. *Educational Leadership, 61*(5), 6-11.

A common, coherent, and challenging curriculum can transform mathematics education in the United States. The No Child Left Behind Act's vision is to provide rigorous and demanding subject matter content for all students. As a crucial subject area, mathematics is vital to this effort. How can educators change the curriculum of mathematics to make it rigorous and accessible to all students? The author reviews the Third International Mathematics and Science Study (TIMSS) data showing significant curricular differences between the United States and other countries, especially in the degrees of standardization, coherence, and challenge. He examines briefly the role of teachers, noting that differences in subject matter background account for significantly different levels of achievement in different countries. The author argues that even the best teachers need an effective curriculum to be effective and that such a curriculum does not substantially threaten the U.S. commitment to local control of schools.

Link: www.ascd.org

Using research to inform your selection

As a mathematics leader, how do you use research? What can you learn from the available research and how should it inform the selection process? The articles grouped in this section offer a set of perspectives on interpreting research and understanding where in the process research might be the most helpful. We conclude this preparation section with the category, *Leading curricular change*, which includes a set of articles that describe what it takes to lead curricular change.

Clements, D. H. (2007). Curriculum research: Toward a framework for "research-based curricula." *Journal for Research in Mathematics Education, 38*(1), 35–70.

Government agencies and members of the educational research community have petitioned for research-based curricula. The ambiguity of the phrase "research-based," however, undermines attempts to create a shared research foundation for the development of, and informed choices about, classroom curricula. This article presents a framework for the construct of research-based curricula. One implication is that traditional strategies such as market research and research-to-practice models are insufficient; more adequate is the use of multiple phases of the proffered Curriculum Research Framework.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=813

Fashola, O. S. (2004). Being an informed consumer of quantitative educational research. *Phi Delta Kappan, 85*(7), 532–538.

Before schools invest their scarce resources in the products that educational researchers have developed, teachers, administrators, and community members need to become informed consumers of educational research. This article strives to begin this process by communicating information that is relevant and timely for both researchers and educators by providing insightful tips on how to be an informed consumer of quantitative research.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Being&text=&lname_1=Fashola&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Hiebert, J. (2000). What can we expect from research? *Mathematics Teacher, 93*(3), 168–169.

Research cannot specify exactly which materials or methods are the best, but the guidelines can help educators judge whether particular materials and methods fall within the range of practices that are likely to help students reach the goals.

Link: www.nctm.org

Schoenfeld, A. H. (2006). What doesn't work: The challenge and failure of the what works clearinghouse to conduct meaningful reviews of studies of mathematics curricula. *Educational Researcher, 35*(2), 13-21.

An early version of this article, discussing curricular interventions in mathematics, was written for the What Works Clearinghouse (WWC). The Institute of Education Sciences (IES), which funds WWC, instructed WWC not to publish it. An expanded version, written at WWC's invitation for a special issue of an independent electronic journal and a book to be published by WWC, argued that methodological problems rendered some WWC mathematics reports potentially misleading and/or uninterpretable. IES instructed WWC staff not to publish their chapters--thus canceling the publication of the special issue and the book. Those actions, chronicled here, raise important issues concerning the role of federal agencies and their contracting organizations in suppressing scientific research that casts doubt on current or intended federal policy.

Link: http://edr.sagepub.com/content/vol35/issue2/

Leading curricular change

Burch, P., & Spillane, J. P. (2003). Elementary school leadership strategies and subject matter: Reforming mathematics and literacy instruction. *Elementary School Journal, 103*(5), 519-535.

Interviews and observations of 15 elementary school administrators and 15 curriculum coordinators from 8 urban elementary schools suggested that leaders' views of subject matter both shaped and were shaped by their leadership strategies. Relative to mathematics, leaders' agendas for improving literacy instruction focused on teachers' input and on literacy skills that applied to a variety of academic subjects. In contrast, leaders' strategies for improving math instruction focused on external supports such as

professional developers and on building skills through sequenced instruction. Leaders who interacted regularly with teachers about instruction also articulated the importance of using internal and external expertise to improve both literacy and mathematics instruction. In this article we illuminate the reciprocal relation between subject matter and leadership and consider the implications of this relation for school leadership development.

Link: http://www.journals.uchicago.edu/toc/esj/2001/101/5

Reys, B., Chavez, O., & Reys, R. (2003). Middle school mathematics curriculum--A guide for principals. *Principal Leadership, 3*(7), 61-66.

Reys, Chavez, and Reys argue that principals can and should influence the choice of mathematics instructional materials in their schools. The article, which begins by exploring the recent status of curriculum in the U.S., asserts that principals need to understand the characteristics of a coherent mathematics curriculum and its benefits for their students. The authors explain why textbooks are crucial to what actually is taught in mathematics classrooms and make recommendations for effective instructional leadership. The article also includes two sidebar discussions, one examining the debate about whether algebra should be a stand-alone course or a strand within broader mathematics instruction, and the other advocating what mathematics middle-grade students need to know.

Stein, M. K., & Nelson, B. S. (2003). Leadership content knowledge. *Educational Evaluation and Policy Analysis, 25*(4), 423-448.

Drawing inspiration from Shulman 's (1986) construct of pedagogical content knowledge, we propose that leadership content knowledge is a missing paradigm in the analysis of school and district leadership. After defining leadership content knowledge as that knowledge of academic subjects that is used by administrators when they function as instructional leaders, we present three cases of instructional leadership-situated at different school and district levels--and examine each for evidence of leadership content knowledge in use. Based on a cross-case analysis, we argue that as administrative levels increase and functions become broader, leadership content knowledge becomes less fine-grained, though always anchored in knowledge of the subject, how it is learned (by adults as well as students), and how it is taught. We go on to suggest that all administrators have solid mastery of at least one subject (and the learning and teaching of it) and that they develop expertise in other subjects by "postholing," that is, conducting in-depth explorations of an important but bounded slice of the subject, how it is learned, and how it is taught. We conclude with an exploration of how content knowledge and leadership knowledge might be intertwined and suggestions for further research.

Link: http://epa.sagepub.com/content/vol25/issue4/

Effectiveness Studies

Another area of interest to districts during the selection process is achievement data for students using the instructional materials under consideration. Before adopting new materials, especially those that might differ philosophically from those used previously, individuals involved in decision-making often look for studies that include student achievement data. Acquiring students' performance data is important for many reasons, including addressing teacher and parent concerns about how the new materials might affect student performance on district and state assessments, and considering how students using NSF-funded materials versus those using commercially-developed materials compare in achievement. Given that these effectiveness studies are usually concentrated by grade level, we have organized this section by elementary, middle, and high school grade levels.

It is important to note that much of the research involving effectiveness studies focuses on the student achievement data for students in classrooms using NSF-funded materials, because most of the recent research on the efficacy of mathematics instructional materials is centered on these materials. For example, several articles at the elementary level describe computational and problem-solving data for children using NSF-funded materials. A number of the middle school studies focus on student achievement data for students using *Standards*-based materials. At the high school level there is also a predominance of studies examining the achievement data of students using NSF-funded materials, including studies that investigate the preparedness of these students for college mathematics.

When reading the set of effectiveness studies in this section, it will be helpful to consider the context of the study and how this is similar or different from your district. Another consideration is to reflect on the methodology of the study and acknowledge your comfort level with the data being shared. For example, despite appearing in peer-reviewed journals, some curriculum leaders expressed doubt in trusting studies they felt might have been funded or conducted by those with a vested interest in the materials being studied. Since researchers continue to explore the effectiveness of both NSF-funded and commercially-developed materials, be sure to ask colleagues, regional support centers, state leaders, etc., about any studies that may be in progress or recently published. Interviewed curriculum leaders also found it helpful to gather anecdotal evidence on the effectiveness and use of different curriculum programs from surrounding districts, as well as state achievement results to see which districts were having success with which programs.

Senk, S. L., & Thompson, D. R. (2003). *Standards-based school mathematics curricula: What are they? What do students learn?* Mahwah, NJ Lawrence Erlbaum Associates Publishers.

The Curriculum and Evaluation Standards for School Mathematics published by the National Council of Teachers of Mathematics in 1989 set forth a broad vision of mathematical content and pedagogy for grades K-12 in the United States. These Standards prompted the development of Standards-based mathematics curricula. What features characterize Standards-based curricula? How well do such curricula work?

To answer these questions, the editors invited researchers who had investigated the implementation of 12 different Standards-based mathematics curricula to describe the effects of these curricula on students' learning and achievement, and to provide evidence

for any claims they made. In particular, authors were asked to identify content on which performance of students using Standards-based materials differed from that of students using more traditional materials, and content on which performance of these two groups of students was virtually identical. Additionally, four scholars not involved with the development of any of the materials were invited to write critical commentaries on the work reported in the other chapters.

Link: http://www.routledge.com/

Stein, M. K., Remillard, J., & Smith, M. S. (2007). How curriculum influences student learning. In F. K. Lester, Jr. (Ed.), *Second handbook of research on mathematics teaching and learning* (pp. 319–369). Charlotte, NC: Information Age Publishing, Inc.

A common goal in preparing for an adoption of mathematics instructional materials is the hope that the selected materials will improve mathematics achievement and, ultimately, students' learning of mathematics. This handbook chapter serves as an important resource for curriculum leaders seeking an understanding of research connecting curriculum and student learning. It includes reviews of both effectiveness studies about specific materials (e.g., what students using a particular curriculum learned) and more general discussions about how teachers and students use curricula (e.g., how teachers interpret written materials). The authors discuss how curriculum is often defined in multiple ways and highlight the distinction between the written, intended, and enacted curriculum. They also point to the differences in available curriculum materials (standards-based and conventional) and the importance of readers carefully interpreting research that evaluates these materials. Given that much of the research is specifically about standards-based curricula, the authors bring to light common findings detailing the challenges of successfully enacting these materials and the factors being suggested for effective implementation.

Elementary

Baxter, J. A., Woodward, J., & Olson, D. (2001). Effects of reform-based mathematics instruction on low achievers in five third-grade classrooms. *Elementary School Journal, 101*(5), 529–547.

In this study we examined the responses of 16 low-achieving students to reform-based mathematics instruction in 5 elementary classrooms for 1 year. We used qualitative methods at 2 schools to identify the needs of low achievers in these classrooms, which were using an innovative curriculum. Through classroom observations and interviews with teachers, we studied the involvement of low achievers in whole-class discussions and pair work. Results suggested that both the organization and task demands of the reform classrooms presented verbal and social challenges to low achievers that need to be ad- dressed if these students are to benefit from reform-based mathematics instruction.

Link: http://www.journals.uchicago.edu/toc/esj/2001/101/5

Briars, D. J., & Resnick, L. B. (2000). *Standards, assessments--and what else? The essential elements of standards-based school improvement. CSE Technical Report 528*. Los Angeles, CA: Center for the Study of Evaluation at the National Center for Research on Evaluation, Standards, and Student Testing.

This paper describes the Pittsburgh Public Schools mathematics program, using data from

a three-year period to explore the effects of Everyday Mathematics at the elementary level. The report addresses the following implementation components: content and performance standards, Standards-based assessment, Standards-based instructional materials, Standards-based professional development for teachers and administrators, and accountability. The authors address questions that highlight effects of Standards-based policy, the balance and measurement of skill mastery and conceptual understanding, achievement gains related to program implementation, curriculum, teacher quality, and the performance of minority students. Results from the analyzed studies show large gains in elementary students' mathematics learning, including improvement on norm-referenced tests that were not aligned with the curriculum. The noted improvement, however, was not uniform, which could be attributed to variability in implementation and use of the curriculum and/or variability with regard to accountability for the success of the program.

Carroll, W. M. (2000). Invented computational procedures of students in a standards-based curriculum. *Journal of Mathematical Behavior, 18*(2), 111–121.

This study investigated the use of invented algorithms and computational proficiency by fourth-graders who had used the Everyday Mathematics curriculum since kindergarten. Through third grade, Everyday Mathematics encourages students to create their own computational strategies rather than emphasizing specific algorithms for addition and subtraction. For this study, students were individually interviewed and a whole-class test was administered. Researchers examined the types of student-invented procedures that students used as well as their computational accuracy. Data showed that many students created sophisticated strategies for mental calculation, while many others used the standard written algorithm, also with high accuracy. However, the study suggests that the students who used invented procedures showed greater understanding of place value, as well as better mental flexibility. Overall, the Everyday Mathematics students' results on the whole-class written tests (fourth-grade items from the NAEP) showed their performance to be much high than normative samples on the more challenging computation problems.

Carroll, W. M., Fuson, K. C., & Diamond, A. (2000). Use of student-constructed number stories in a reform-based curriculum. *The Journal of Mathematical Behavior, 19*(1), 49–62.

Twelve classes using the reform-based curriculum, Everyday Mathematics (EM), were observed early in first grade. The two lessons observed involved students generating and solving addition and subtraction number stories. In these lessons, teachers were directed to help students link these number stories to representations (pictures or objects) and equations. Because this curriculum emphasizes invented procedures and number sense, the lessons also call for whole-class discussions of students' solutions. Further, the curriculum assumes that teachers will build upon and extend the children's mathematical thinking, highlighting these alternative solution methods and supporting the students' explanations. Results show that students were successful at making up, telling, and solving number stories and used a range of solution methods, including the mathematical representations available in the classrooms. However, only about three-quarters of the teachers established explicit links between the stories and mathematical representations, with fewer than half representing the stories as numbers and equations. Although student-based explanations play an important role in helping children develop solution

procedures with understanding, solution methods were only elicited in half of the classes observed, and multiple methods in one-fourth of the classes. Implications for reform curricula, especially how they might clarify new goals for teachers, are discussed.

Fuson, K. C., Carroll, W. M., & Drueck, J. V. (2000). Achievement results for second and third graders using the standards-based curriculum Everyday Mathematics. *Journal for Research in Mathematics Education, 31*(3), 277–295.

Students using Everyday Mathematics (EM), developed to incorporate ideas from the NCTM Standards, were at normative U. S. levels on multidigit addition and subtraction symbolic computation on traditional, reform-based, and EM-specific test items. Heterogeneous EM 2nd graders scored higher than middle- to upper-middle-class U. S. traditional students on 2 number sense items, matched them on others, and were equivalent to a middle-class Japanese group. On a computation test, the EM 2nd graders outperformed the U. S. traditional students on 3 items involving 3-digit numbers and were outperformed on the 6 most difficult test items by the Japanese children. EM 3rd graders outscored traditional U. S. students on place value and numeration, reasoning, geometry, data, and number-story items.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=24

Hook, W., Bishop, W., & Hook, J. (2007). A quality math curriculum in support of effective teaching for elementary schools. *Educational Studies in Mathematics, 65*(2), 125–148.

This paper presents a curriculum, textbook and test result analysis for the new (to California) elementary school "Key Standard" mathematics curriculum, transplanted in 1998 from it's foreign roots in Asia and Europe, locations with far different cultural and economic backgrounds. Based on topic analysis methods developed by Michigan State University, this curriculum is a "quality" curriculum, since it is closely aligned with the curriculum of the six leading TIMSS math countries. Five-year test results are presented for two cohorts totaling over 13,000 students, all from four "early adoption" urban districts where 68% of the students were economically disadvantaged. Included are two cohorts of English learning immigrants totaling over 4,400 students. Performance was found to be statistically superior to similar (control) districts which continued with the old 1991 curriculum and textbooks ($0.003 < p < 0.015$). The focus of this paper is on the transition from far-below to above average learning performance of these students over the 1998–2002 period.

Link:http://www.springerlink.com/content/q486043t71q9/?p=716be6b88c8c465496d0ab895cbdc036&pi=20

Riordan, J. E., & Noyce, P. E. (2001). The impact of two standards-based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics Education, 32*(4), 368–398.

Since the passage of the Education Reform Act in 1993, Massachusetts has developed curriculum frameworks and a new statewide testing system. As school districts align

curriculum and teaching practices with the frameworks, standards-based mathematics programs are beginning to replace more traditional curricula. This paper presents a quasi-experimental study using matched comparison groups to investigate the impact of one elementary and one middle school standards-based mathematics program in Massachusetts on student achievement. The study compares statewide standardized test scores of fourth-grade students using *Everyday Mathematics* and eighth-grade students using *Connected Mathematics* to test scores of demographically similar students using a mix of traditional curricula. Results indicate that students in schools using either of these standards-based programs as their primary mathematics curriculum performed significantly better on the 1999 statewide mathematics test than did students in traditional programs attending matched comparison schools. With minor exceptions, differences in favor of the standards-based programs remained consistent across mathematical strands, question types, and student sub-populations.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=167

Sconiers, S., McBride, J., Isaacs, A., Kelso, C. R., & Higgins, T. (2003). *The ARC Center Tri-state achievement study*. Lexington, MA: COMAP.

In this study funded by the National Science Foundation (NSF), the ARC Center looked at the effects of three elementary curricula designed to align with the vision of the NCTM Standards. The Tri-state Achievement Study compares the achievement of elementary students using Everyday Mathematics, Investigations, and Math Trailblazers to students not using these materials. In this large-scale study, the ARC Center gathered math achievement data, state mandated test scores, and survey data from schools in Illinois, Massachusetts, and Washington, all states with large numbers of students using one of the three NSF programs. Students needed to have had at least two years of exposure to the program in order to be included in the data. A set of comparison schools that were not using any of the three reform curricula were then matched according to reading score, socioeconomic level, and other factors, including percent of white and Title I students. The authors examined achievement comparisons at multiple levels (e.g., family income, race) and consistently found that when a statistical difference in math scores was detected for a particular math strand (e.g., geometry, algebra) the students using one of the three NSF curricula were always favored. In general, the authors found that the reform curricula yielded an improvement in student performance on many levels including basic skills and higher-order processes.

Slavin, R. E., & Lake, C. (2008). Effective programs in elementary mathematics: A best-evidence synthesis. *Review of Educational Research, 78*(3), 427–515.

This article reviews research on the achievement outcomes of three types of approaches to improving elementary mathematics: mathematics curricula, computer-assisted instruction (CAI), and instructional process programs. Study inclusion requirements included use of a randomized or matched control group, a study duration of at least 12 weeks, and achievement measures not inherent to the experimental treatment. Eighty-seven studies met these criteria, of which 36 used random assignment to treatments. There was limited evidence supporting differential effects of various mathematics

textbooks. Effects of CAI were moderate. The strongest positive effects were found for instructional process approaches such as forms of cooperative learning, classroom management and motivation programs, and supplemental tutoring programs. The review concludes that programs designed to change daily teaching practices appear to have more promise than those that deal primarily with curriculum or technology alone.

Link: http://rer.sagepub.com/content/vol78/issue3/

Middle School

Balfanz, R., Mac Iver, D. J., & Byrnes, V. (2006). The implementation and impact of evidence-based mathematics reforms in high-poverty middle-schools: A multi-site, multi-year study. *Journal for Research in Mathematics Education, 37*(1), 33-64.

This article reports on the first 4 years of an effort to develop comprehensive and sustainable mathematics education reforms in high poverty middle schools. In four related analyses, we examine the levels of implementation achieved and impact of the reforms on various measures of achievement in the first 3 schools to implement the Talent Development (TD) Middle School Model's mathematics program that combines coherent research-based instructional materials from the University of Chicago School Mathematics Project with a multi-tiered teacher support system of sustained professional development and in-class coaching. A moderate level of implementation was achieved. TD students outperformed students from control schools on multiple measures of achievement. The average effect size, Δ, by the end of middle school was .24.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=774

Boaler, J. (2002). Learning from teaching: Exploring the relationship between reform curriculum and equity. *Journal for Research in Mathematics Education, 33*(4), 239-258.

Some researchers have expressed doubts about the potential of reform-oriented curricula to promote equity. This article considers this important issue and argues that investigations into equitable teaching must pay attention to the particular practices of teaching and learning that are enacted in classrooms. Data are presented from two studies in which middle school and high school teachers using reform-oriented mathematics curricula achieved a reduction in linguistic, ethnic, and class inequalities in their schools. The teaching and learning practices that these teachers employed were central to the attainment of equality, suggesting that it is critical that relational analyses of equity go beyond the curriculum to include the teacher and their teaching.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=197

Cain, J. S. (2002). An evaluation of the Connected Mathematics Project. *Journal of Educational Research, 95*(4), 224–233.

A formative, internal evaluation was conducted on the Connected Mathematics Project (CMP), a middle school reform mathematics curriculum used in Lafayette Parish,

Louisiana, by the author (lead teacher of said project). Approximately 3,500 students in this public school system were enrolled in this program, and the district school board planned to expand the program to include all 12 public middle schools. An analysis of the Iowa Test of Basic Skills and the Louisiana Education Assessment Program mathematics data indicate that the program is working: The CMP schools significantly outperformed the non-CMP schools on both standardized tests. Questionnaires distributed to the teachers and to a sample of the students indicated that both groups believe the program is helping students become better problem solvers.

Link: www.heldref.org/pubs/jer/about.html

Jansen, A. (2006). Seventh graders' motivations for participating in two discussion-oriented mathematics classrooms. *Elementary School Journal, 106*(5), 409-428.

In this study I examined the self-reported motivational beliefs and goals supporting the participation of 15 seventh graders in whole-class discussions in 2 discussion-oriented Connected Mathematics Project classrooms. Through this qualitative investigation using semistructured interviews, I inductively identified and described the students' motivational beliefs and goals and relations among them. Results demonstrated beliefs that constrained students' participation and ones that supported their participation. Students with constraining beliefs were more likely to participate to meet goals of helping their classmates or behaving appropriately, whereas students with beliefs supporting participation were more likely to participate to demonstrate their competence and complete their work. Results illustrated how the experiences of middle school students in discussion-oriented mathematics classrooms involve navigating social relationships as much as participating in opportunities to learn mathematics.

Link: http://www.journals.uchicago.edu/toc/esj/2006/106/5

Krebs, A. S. (2003). Middle grades students' algebraic understanding in a reform curriculum. *School Science and Mathematics, 103*(5), 233–245.

The National Council of Teachers of Mathematics' Curriculum and Evaluation Standards in 1989 was pivotal in mathematics reform. The National Science Foundation funded several curriculum projects to address the vision described in the Standards. This study investigates students' learning in one of these Standards-based curricula, the Connected Mathematics Project (CMP). The authors of CMP believe that the teaching and learning of algebra is an ongoing activity woven through the entire curriculum, rather than being parceled into a single grade level. The content of the study investigates students' ability to symbolically generalize functions. The data regards the solutions of four performance tasks dealing with three different types of relationships--linear, quadratic, and exponential situations--completed by five pairs of eighth-grade students. The major finding claims that middle to high achieving students who had 3 years in the CMP curriculum demonstrated achievement in five strands of mathematical proficiency of a significant piece of algebra.

Link: www.ssma.org

Lubienski, S. T. (2000). Problem solving as a means toward mathematics for all: An exploratory look through a class lens. *Journal for Research in Mathematics Education, 31*(4), 454-482.

As a researcher-teacher, I examined 7th-graders' experiences with a problem-centered curriculum and pedagogy, focusing on SES differences in students' reactions to learning mathematics through problem solving. Although higher SES students tended to display confidence and solve problems with an eye toward the intended mathematical ideas, the lower SES students preferred more external direction and sometimes approached problems in a way that caused them to miss their intended mathematical points. An examination of sociological literature revealed ways in which these patterns in the data could be related to more than individual differences in temperament or achievement among the children. I suggest that class cultural differences could relate to students' approaches to learning mathematics through solving open, contextualized problems.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=27

Post, T. R., Harwell, M. R., Davis, J. D., Maeda, Y., Cutler, A., Andersen, E., et al. (2008). Standards-based mathematics curricula and middle-grades students' performance on standardized achievement tests. *Journal for Research in Mathematics Education, 39*(2), 184–212.

Approximately 1400 middle-grades students who had used either the Connected Mathematics Project (CMP) or the MATHThematics (STEM or MT) program for at least 3 years were assessed on two widely used tests, the Stanford Achievement Test, Ninth Edition (Stanford 9) and the New Standards Reference Exam in Mathematics (NSRE). Hierarchical Linear Modeling (HLM) was used to analyze subtest results following methods described by Raudenbush and Bryk (2002). When *Standards*-based students' achievement patters are analyzed, traditional topics were learned. Students' achievement levels on the Open Ended and Problem Solving subtests were greater than those on the Procedures subtest. This finding is consistent with results documented in many of the studies reported in Senk and Thompson (2003), and other sources.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=861

Reys, R., Reys, B., Lapan, R., Holliday, G., & Wasman, D. (2003). Assessing the impact of "standards" based middle grades mathematics curriculum materials on student achievement. *Journal for Research in Mathematics Education, 34*(1), 74–95.

This study compared the mathematics achievement of eighth graders in the first three school districts in Missouri to adopt NSF-funded Standards-based middle grades mathematics curriculum materials (MATH Thematics or Connected Mathematics Project) with students who had similar prior mathematics achievement and family income levels from other districts. Achievement was measured using the mathematics portion of the Missouri Assessment Program (MAP) administered to all 8th graders in the state annually beginning in the spring of 1997. Significant differences in achievement were identified between students using Standards-based curriculum materials for at least 2 years and students from comparison districts using other curriculum materials. All of the significant differences reflected higher achievement of students using Standards-based materials.

Students in each of the three districts using Standards-based materials scored higher in two content areas (data analysis and algebra), and these differences were significant.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=219

Show-Me Center (2001). *Research on use of standards-based middle-grades curriculum materials. Show-Me Center brief*. Columbia, MO: Show-Me Project.

This article provides a summary of research on the use of Standards-based mathematics curricula in the middle grades. In addition to noting student achievement studies, the article also highlights research on the impact new curricula have had on teachers' practice and their use of the new materials. It closes with a summary of research findings, indicating important points about teachers' needs when implementing Standards-based curricula, as well as students' responses to using these programs.

Tarr, J. E., Reys, R. E., Reys, B. J., Chavez, O., Shih, J., & Osterlind, S. J. (2008). The impact of middle-grades mathematics curricula and the classroom learning environment on student achievement. *Journal for Research in Mathematics Education, 39*(3), 247-280.

We examine student achievement of 2533 students in 10 middle schools in relation to the implementation of textbooks developed with funding from the National Science Foundation (NSF) or publisher-developed textbooks. Using hierarchical linear modeling (HLM), curriculum type was not a significant predictor of student achievement on the Balanced Assessment in Mathematics (BAM) or TerraNova Survey (TNS) after controlling for student-level variables. However, the Standards-Based Learning Environment (SBLE) moderated the effect of curriculum type. Students were positively impacted on the BAM by NSF-funded curricula when coupled with either Moderate or High levels of SBLE. There was no statistically significant impact of NSF- funded curricula on students in classrooms with a Low level of SBLE, and the relationship between publisher-developed textbooks and SBLE was not statistically significant. Moreover, there was no significant impact of either curriculum type when coupled with varying levels of SBLE on the TNS as the dependent measure.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=866

High School

Bussey, J. (2001). Mathematics for the alternative high school student. *The Journal of Court, Community, and Alternative Schools, 14*, 45–51.

This article presents the Interactive Mathematics Program (IMP) as an ideal curricular option for alternative high schools whose students have generally been unsuccessful or turned off to mathematics. The author notes the success of IMP in these types of schools and identifies five reasons for the effectiveness of the program. The Interactive Mathematics Program 1) recognizes diverse learning styles; 2) uses open-ended problems and explorations; 3) employs real-world context, humor, and emotion; 4) presents mathematical ideas useful to the average adult; and 5) uses a variety of assessment tools.

In concluding, the author notes some of the challenges in implementing the curriculum in an alternative school and emphasizes the importance of professional development.

Link: www.jccasac.org

Davis, J. D. (2007). Real-world contexts, multiple representations, student-invented terminology, and y-intercept. *Mathematical Thinking and Learning, 9*(4), 387–418.

One classroom using two units from a *Standards*-based curriculum was the focus of a study designed to examine the effects of real-world contexts, delays in the introduction of formal mathematics terminology, and multiple function representations on student understanding. Students developed their own terminology for y-intercept, which was tightly connected to the meaningfulness and implicit/explicit temporality of the contexts that students investigated as part of their classroom activities. This terminology held great promise for promoting the concept of y-intercept within a multiple representation environment. However, the teacher's interpretation of different activities and his assumptions about the transparency of different representations, as well as students' past experiences left the student-generated terminology and the concept of y-intercept disconnected from one another. This resulted in student-generated terminology that had limited applicability, a fragile understanding of y-intercept within different representations, and for some students, interference between their invented terminology and the concept of y-intercept itself.

Link: http://www.informaworld.com/smpp/title~db=jour~content=g787981856

Davis, J. D., & Shih, J. C. (2007). Secondary options and post-secondary expectations: Standards-based mathematics programs and student achievement on college mathematics placement exams. *School Science & Mathematics, 107*(8), 336–346.

Research on student achievement within the University of Chicago School Mathematics Project (UCSMP) and Core-Plus Mathematics Project (CPMP) at the secondary level is beginning to accumulate, however, much less is known about how prepared these students are for post-secondary education. Therefore this study involving students within one tracked school district used multiple linear regression to examine the role of differential experience within two secondary Standards-based mathematics programs, gender, and prior mathematics achievement on college algebra and calculus readiness placement test scores. Results show that there are no significant differences between students who had completed three and four years of the CPMP curriculum. UCSMP students with four or five years of experience significantly outperformed CPMP students on both assessments. Prior achievement was a significant predictor of student achievement on both examinations. Male students outperformed female students on the algebra placement exam. Students who had studied from both CPMP and UCSMP significantly outperformed students who had studied from CPMP for four years on the calculus readiness examination.

Link: www.ssma.org

Harwell, M., Post, T. R., Cutler, A., Maeda, Y., Anderson, E., Norman, K. W., et al. (2009). The preparation of students from National Science Foundation-funded and commercially developed high school mathematics curricula for their first university mathematics course. *American Educational Research Journal, 46*(1), 203-231.

The selection of K-12 mathematics curricula has become a polarizing issue for schools, teachers, parents, and other educators and has raised important questions about the long-term influence of these curricula. This study examined the impact of participation in either a National Science Foundation-funded or commercially developed mathematics curriculum on the difficulty level of the first university mathematics course a student enrolled in and the grade earned in that course. The results provide evidence that National Science Foundation-funded curricula do not prepare students to initially enroll in more difficult university mathematics courses as well as commercially developed curricula, but once enrolled students earn similar grades. These findings have important implications for high school mathematics curriculum selection and for future research in this area.

Link: http://aer.sagepub.com/content/vol46/issue1/

Harwell, M. R., Post, T. R., Maeda, Y., Davis, J. D., Cutler, A. L., Andersen, E., et al. (2007). Standards -based mathematics curricula and secondary students' performance on standardized achievement tests. *Journal for Research in Mathematics Education, 38*(1), 71-101.

The current study examined the mathematical achievement of high school students enrolled for 3 years in one of three NSF funded Standards-based curricula (IMP, CMIC, MMOW). The focus was on traditional topics in mathematics as measured by subtests of a standardized achievement test and a criterion-referenced test of mathematics achievement. Students generally scored at or above the national mean on the achievement subtests. Hierarchical linear modeling results showed that prior mathematics knowledge was a significant but modest predictor of achievement, student SES had a moderate effect, and increasing concentrations of African American students in a classroom were associated with a stronger effect of attendance on achievement. No differences on the standardized achievement subtests emerged among the Standards-based curricula studied once background variables were taken into account. The two suburban districts providing data for the criterion-referenced test achieved well above the national norm.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=813

Hill, R. O., & Parker, T. H. (2006). A study of Core-Plus students attending Michigan State University. *American Mathematical Monthly, 113*(10), 905–921.

The authors argue that the success high school students have in university mathematics courses should be a consideration when examining secondary materials. In this article they describe a study that examined the university records of incoming Michigan State University freshmen from four high schools, which used the Core-Plus Mathematics program. Researchers looked for trends over time over various levels of success in the college mathematics performance of the graduates of the schools. While acknowledging limitations in their study, Hill and Parker found these students placed in lower-level mathematics courses and generally earned lower grades than their peers.

Huntley, M. A., Rasmussen, C. L., Villarubi, R. S., Sangtong, J., & Fey, J. T. (2000). Effects of standards-based mathematics education: A study of the Core-plus Mathematics Project algebra and functions strand. *Journal for Research in Mathematics Education, 31*(3), 328–361.

To test the vision of Standards-based mathematics education, we conducted a comparative study of the effects of the Core-Plus Mathematics Project (CPMP) curriculum and more conventional curricula on growth of student understanding, skill, and problem-solving ability in algebra. Results indicate that the CPMP curriculum is more effective than conventional curricula in developing student ability to solve algebraic problems when those problems are presented in realistic contexts and when students are allowed to use graphing calculators. Conventional curricula are more effective than the CPMP curriculum in developing student skills in manipulation of symbolic expressions in algebra when those expressions are presented free of application context and when students are not allowed to use graphing calculators.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=24

Kramer, S. L., & Keller, R. (2008). An existence proof: Successful joint implementation of the IMP curriculum and a 4 x 4 block schedule at a suburban U.S. high school. *Journal for Research in Mathematics Education, 39*(1), 2–8.

This "Brief Report" summarizes results from a study that investigated joint effects of two innovations adopted at a high school in an affluent suburban community in the northeast United States: 4 x 4 block scheduling and the Standards-based curriculum, the Interactive Mathematics Program (IMP). By the end of 12th grade, cohorts of students who had studied IMP under a block schedule scored higher on most measures of mathematics achievement than had earlier cohorts of students who had studied a traditional high school mathematics curriculum under a traditional schedule. This article also describes actions taken by the school to build capacity before adopting the reforms. The results can be seen as an "existence proof" of what can happen when these reforms are adopted jointly at a site that has put considerable effort into building capacity to implement them well.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=848

McCaffrey, D. F., Hamilton, L. S., Stecher, B. M., Klein, S. P., Bugliari, D., & Abby, R. (2001). Interactions among instructional practices, curriculum, and student achievement: The case of standards-based high school mathematics. *Journal for Research in Mathematics Education, 32*(5), 493–517.

A number of recent efforts to improve mathematics instruction have focused on professional development activities designed to promote instruction that is consistent with professional standards such as those published by the National Council of Teachers of Mathematics. This paper describes the results of a study investigating the degree to which teachers' use of instructional practices aligned with these reforms is related to

improved student achievement, after controlling for student background characteristics and prior achievement. In particular we focus on the effects of curriculum on the relationship between instructional practices and student outcomes. We collected data on tenth-grade students during the 1997-98 academic year. Some students were enrolled in integrated math courses designed to be consistent with the reforms, whereas others took the more traditional algebra and geometry sequence. Use of instructional practices was measured through a teacher questionnaire, and student achievement was measured using both the multiple-choice and open-ended components of the Stanford achievement tests. Use of standards-based or reform practices was positively related to achievement on both tests for students in integrated math courses, whereas use of reform practices was unrelated to achievement in the more traditional algebra and geometry courses. These results suggest that changes to instructional practices may need to be coupled with changes in curriculum to realize effects on student achievement.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=172

Schoen, H. L., Cebulla, K. J., Finn, K. F., & Fi, C. (2003). Teacher variables that relate to student achievement when using a standards-based curriculum. *Journal for Research in Mathematics Education, 34*(3), 228–259.

We report results from a study of instructional practices that relate to student achievement in high school classrooms in which a standards-based curriculum (Core-Plus) was used. We used regression techniques to identify teachers' background characteristics, behaviors, and concerns that are associated with growth in student achievement and further described these associations via graphical representations and logical analysis. The sample consisted of 40 teachers and their 1,466 students in 26 schools. Findings support the importance of professional development specifically aimed at preparing to teach the curriculum. Generally, teaching behaviors that are consistent with the standards' recommendations and that reflect high mathematical expectations were positively related to growth in student achievement.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=663

Schoen, H. L., & Hirsch, C. R. (2003). Responding to calls for change in high school mathematics: Implications for collegiate mathematics. *American Mathematical Monthly, 110*(2), 109–123.

In some districts, especially those where high-achievement in mathematics has been the norm, the use of reform curricula such as Contemporary Mathematics in Context (Core-Plus) has become a focal point for debate. Schoen and Hirsch address this issue by posing two questions: How does the pattern of student learning in Core-Plus differ from that of comparable students using traditional curricula? Do reform curricula prepare students for college mathematics? After describing features that distinguish a reform curriculum from a traditional one, the authors cite statistics comparing the performance of Core-Plus and traditionally taught students on several widely used tests, including Educational Testing

Service's *Algebra End of Course Evaluation* and *SAT I Mathematics*.

Their findings show that while there was a great deal of overlap, Core-Plus students almost always performed better than students in the comparison groups on measures of higher-order thinking in mathematics such as conceptual understanding, interpretation of mathematical representations and calculations, and problem-solving in applied contexts. (Paper-and-pencil equation solving, a skill often practiced extensively by traditionally taught students, was the one area where Core-Plus students underperformed the comparison groups. Material to address this was added to subsequent editions of Core-Plus.) With regard to readiness for college mathematics, the authors found that Core-Plus students performed at a higher level than pre-calculus students on the concepts and applications sections of placement tests. In addition, when studying data regarding course enrollment and grades in Calculus I and higher mathematics courses they found that Core-Plus "did no harm to either the percent of students enrolling in these courses or their course grades--and may have helped the latter."

Senk, S. L., & Thompson, D. R. (2006). Strategies used by second-year algebra students to solve problems. *Journal for Research in Mathematics Education, 37*(2), 116–128.

This Brief Report describes a secondary analysis of the solutions written by 306 second-year algebra students to four constructed-response items representative of content at this level. The type of solution (symbolic, graphical, or numerical) used most frequently varied by item. Curriculum effects were observed. Students studying from the second edition of the University of Chicago School Mathematics Project's (UCSMP) Advanced Algebra curriculum used a higher percentage of graphical and numerical strategies than comparison students. Achievement and choice of strategy were also related. Both UCSMP and non-UCSMP students who used symbolic or graphing strategies were generally successful on the quadratic comparison item; UCSMP students who used graphing strategies were also successful on items dealing with logarithm properties and a quadratic application.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=781

Smith, J. P., III, & Star, J. R. (2007). Expanding the notion of impact of K-12 standards-based mathematics and reform calculus programs. *Journal for Research in Mathematics Education, 38*(1), 3-34.

Research on the impact of Standards-based, K-12 mathematics programs (i.e., written curricula and associated teaching practices) and of reform calculus programs has focused primarily on student achievement and secondarily, and rather ineffectively, on student attitudes. This research has shown that reform programs have competed well with traditional programs in terms of student achievement. Results for attitude change have been much less conclusive because of conceptual and methodological problems. We critically review this literature to argue for broader conceptions of impact that target new dimensions of program effect and examine interactions between dimensions. We also briefly present the conceptualization, design, and broad results of one study, the Mathematical Transitions Project (MTP), which expanded the range of impact along

those lines. The MTP results reveal substantial diversity in students' experience within and between research sites, different patterns of experience between high school and university students, and surprising relationships between achievement and attitude for some students.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=813

Star, J. R., Smith, J. P., III, & Jansen, A. (2008). What students notice as different between reform and traditional mathematics programs. *Journal for Research in Mathematics Education, 39*(1), 9-32.

Research on the impact of Standards-based mathematics and reform calculus curricula has largely focused on changes in achievement and attitudes, generally ignoring how students experience these new programs. This study was designed to address that deficit. As part of a larger effort to characterize students' transitions into and out of reform programs, we analyzed how 93 high school and college students perceived Standards-based and reform calculus programs as different from traditional ones. Results show considerable diversity across and even within sites. Nearly all students reported differences, but high-impact differences, like Content, were not always related to curriculum type (reform or traditional). Students' perceptions aligned moderately well with those of reform curriculum authors, e.g., concerning Typical Problems. These results show that students' responses to reform programs can be quite diverse and only partially aligned with adults' views.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=848

Thompson, D. R., & Senk, S. L. (2001). The effects of curriculum on achievement in second-year algebra: The example of the University of Chicago School Mathematics Project. *Journal for Research in Mathematics Education, 32*(1), 58–84.

We examine the performance of 8 pairs of 2nd-year algebra classes that had been matched on pretest scores. One class in each pair used the UCSMP Advanced Algebra curriculum, and the other used the 2nd-year-algebra text in place at the school. Achievement was measured by a multiple-choice posttest and a free-response posttest. Opportunity-to-learn (OTL) measures were used to ensure that items were fair to both groups of students. UCSMP students generally outperformed comparison students on multistep problems and problems involving applications or graphical representations. Both groups performed comparably on items testing algebraic skills. Hence, concerns that students studying from a Standards-oriented curriculum will achieve less than students studying from a traditional curriculum are not substantiated in this instance.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=18

Implementation of Instructional Materials

Selecting instructional materials that are right for your district takes time and involves careful attention to criteria important to your stakeholders. Choosing materials, however, is only the beginning. It is equally important to be aware of challenges and considerations that accompany the implementation of your mathematics textbook. The articles in this section share the thoughts and experiences of teachers, students, parents, administrators, and researchers—all of whom have been affected by the implementation of materials, especially when they are different from what was previously used in the school or district. Given that the adoption of NSF-funded materials often represents a pedagogical shift for teachers and students, the bulk of the research in this area describes implementation experiences with NSF-funded instructional materials.

Implementation challenges and strategies

In this subsection, the articles address factors that often act as barriers to successful implementation (e.g., issues of change, teacher support, teacher beliefs), strategies for overcoming these challenges, changes in teacher and student learning, and other topics that often arise when planning for implementation (e.g., assessment, equity). Again, it is important to note that topics such as equity and assessment are critical and essential topics in their own right and articles in this section are those that provide a specific link to instructional materials.

Bay, J. M., Reys, B. J., & Reys, R. E. (1999). The top 10 elements that must be in place to implement standards-based mathematics curricula. *Phi Delta Kappan, 80*(7), 503–506.

Several common factors contribute to the effectiveness of teachers in implementing a standards-based mathematics curriculum in their classrooms, the authors maintain. Awareness of these factors and the development of ways to address them will increase the likelihood of success. In this article they list 10 critical elements of implementation: administrative support, opportunities to study, sampling the curricula, daily planning, interaction with experts, collaboration with colleagues, incorporating new assessments, communicating with parents, helping students adjust, and planning for transition.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Top+10&text=&lname_1=Reys&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1

Bay-Williams, J. M., Reys, B. J., & Reys, R. E. (2003). Effectively implementing standards-based mathematics curricula in middle schools. *Middle School Journal, 34*(4), 36–41.

The article opens with an explanation of what Standards-based curricula are and the challenges they pose for students and teachers. The principles of effective implementation shared in the article are gleaned from 23 Missouri teachers who piloted Standards-based materials during a teacher enhancement project. Their suggestions include: building support among local administrators and community members; helping teachers and parents understand the scope, content, and approach of the new materials; and creating long-term support for the implementation. The authors recommend that schools utilize recommendations of those who have gone through an implementation and learn from their mistakes.

Link: www.nmsa.org

Boaler, J. (2006). Urban success: A multidimensional mathematics approach with equitable outcomes. *Phi Delta Kappan, 87*(5), 364-369.

The author describes the ways in which the mathematics department of an urban, ethnically diverse school brought about high and equitable mathematics achievement. The teachers employed a range of practices focused upon equity, including heterogeneous grouping, the use of group-worthy problems, encouraging shared responsibility among students, block scheduling, and departmental collaboration.

Link:http://www.pdkmembers.org/members_online/members/orders.asp?action=results&t=A&desc=Urban&text=&lname_1=Boaler&fname_1=&lname_2=&fname_2=&kw_1=&kw_2=&kw_3=&kw_4=&mn1=&yr1=&mn2=&yr2=&c1=

Burrill, J., Feijs, E., Meyer, M., van Reeuwijk, M., Webb, D., & Wijers, M. (2001). *The role of assessment in standards-based middle school mathematics curriculum materials*. St. Louis, MO: Show-Me Center.

This brochure is designed as a resource on assessment in five Standards-based middle grades mathematics curricula: Connected Mathematics, Mathematics in Context, MathScape, MATH Thematics, and Middle School Mathematics through Applications. It also provides information pertinent to users of Standards-based programs at other grade levels. The document details the role of classroom assessment when using Standards-based materials, and includes samples of assessment tasks as well as expectations for both teachers and students. The brochure also addresses external assessments, providing information about a range of alternatives for external assessment.

Empson, S. B., & Junk, D. L. (2004). Teachers' knowledge of children's mathematics after implementing a student-centered curriculum. *Journal of Mathematics Teacher Education, 7*(2), 121–144.

Our study investigated the knowledge 13 elementary teachers gained implementing a student-centered curriculum in the context of district-wide reform. Participants comprised all the teachers in grades three, four and five at a single elementary school. We believed that investigating teachers' responses to fictional pedagogical scenarios involving nonstandard algorithms would yield insights into critical components of their knowledge base. We looked in particular at teachers' knowledge of *children's mathematics*. We found that teachers were in the midst of creating a knowledge base focused on children's mathematics and grounded in knowledge about alternative conceptual trajectories through the elementary curriculum. Teachers' knowledge of nonstandard strategies supported by the curriculum materials was stronger and more coherent than their knowledge of students' novel nonstandard strategies. Strong mathematical knowledge was not necessarily associated with strong knowledge of children's mathematics. Teachers' thinking varied by a topic's treatment in the written curriculum materials used, suggesting implementation of the curriculum as a source of learning.

Link:http://www.springerlink.com/content/aa87lufc76ru/?p=12dfe8b0365342f791e2acd673d5f114&pi=28

Frykholm, J. (2004). Teachers' tolerance for discomfort: Implications for curricular reform in mathematics. *Journal of Curriculum and Supervision, 19*(2), 125-149.

Deficiencies in mathematics achievement in the United States have spurred calls for reform in K-12 curricula and pedagogy. Based on contemporary learning theories, numerous curriculum programs have been developed that emphasize problem solving, critical thinking, mathematical connections, and mathematical communication. These innovations require new—sometimes uncomfortable—roles for both teachers and learners. If students are to construct mathematical knowledge through these curriculum programs, teachers must vitalize classrooms, model problem solving, explore relevant contexts, and give students time to create, discuss, refute, hypothesize, and investigate. This kind of teaching necessarily fosters dissonance that is challenging, and often unnerving, for teachers. The research study described here pursued questions related to these facets of curricular reform in mathematics education. In particular, four case studies illustrate various forms of teacher discomfort (as connected to reform-based mathematics curricula) and the impact that uncertainty has on classroom practice in particular, and, more broadly, the likelihood of widespread reform in mathematics education.

Link: www.ascd.org

Frykholm, J., & Pittman, M. (2001). Fostering student discourse: "Don't ask me! I'm just the teacher!". *Mathematics Teaching in the Middle School, 7*(4), 218-221.

Citing changes in curricula in response to the NCTM Standards, the authors argue for changes in teachers' facilitation of student-directed investigations in mathematics classrooms. This article outlines pedagogical changes that teacher Mary Pittman made as part of her implementation of Mathematics in Context, such as having students take notes during classroom discussions and add their peers' solution strategies to their own completed homework assignments. She also created a list of questions that encouraged greater student dialogue. Most importantly, she tuned in to "her own perceived need to be the mathematical authority in the classroom." The article ends by offering tips to help teachers make changes in their practice in order to provide an energetic yet safe environment in which students can construct understanding and share their thinking with one another.

Link: www.nctm.org

Gutstein, E. (2003). Teaching and learning mathematics for social justice in an urban, Latino school. *Journal for Research in Mathematics Education, 34*(1), 37–73.

This article reports on a 2-year study about teaching and learning mathematics for social justice in an urban, Latino classroom and about the role of an NCTM Standards-based curriculum. I was the teacher in the study and moved with the class from seventh to eighth grade. Using qualitative, practitioner-research methodology, I learned that students began to read the world (understand complex issues involving justice and equity) using mathematics, to develop mathematical power, and to change their orientation toward mathematics. A series of real-world projects was fundamental to this change, but the Standards-based curriculum was also important; such curricula can theoretically promote

equity, but certain conditions may need to exist. Social justice pedagogy broadens the concept of equity work in mathematics classrooms and may help promote a more just society.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=219

Herbel-Eisenmann, B. A., Lubienski, S. T., & Id-Deen, L. (2006). Reconsidering the study of mathematics instructional practices: The importance of curricular context in understanding local and global teacher change. *Journal of Mathematics Teacher Education, 9*(4), 313-345.

This paper discusses the case of one teacher, Jackie, whose instructional practices illuminate the importance of textbooks and student/parent expectations in shaping pedagogy. Jackie teaches in the Plainview district, which offers parents and students a choice between a reform-oriented, integrated curriculum (*Core Plus*) and a more conventional algebra sequence (the University of Chicago series). Each day, Jackie teaches two very different sections of accelerated eighth-grade mathematics using each of these curricular materials. Drawing from students' survey responses, classroom observations, and teacher interview data, we show ways in which Jackie's pedagogy differs considerably between the two courses and we shed light on reasons underlying this variation. By examining one teacher who enacts different practices in each of the two curricular contexts, this paper highlights factors that contribute to teachers' enacted curricula – factors that have been understated in previous mathematics education research on teacher development. The study establishes the importance of distinguishing between *global* and *local* teacher change, and suggests implications for future studies of teaching and reform.

Link:http://www.springerlink.com/content/v81180100615/?p=955eb786babc45c0b6ce8c86ea813596&pi=16

Isaacs, A. C., & Carroll, W. M. (1999). Strategies for basic facts instruction. *Teaching Children Mathematics, 5*(9), 508-515.

A strategies-based approach to the basic facts has several advantages. First of all, it works: children do learn their facts. Rathmell (1978) found that teaching children thinking strategies facilitates their learning and retention of basic facts. More recent studies have confirmed this effect again and again. A strategies-based approach also builds students' understanding and confidence.

Link: www.nctm.org

Lloyd, G. M. (2008). Teaching mathematics with a new curriculum: Changes to classroom organization and interactions. *Mathematical Thinking and Learning, 10*(2), 163–195.

This report describes a high school mathematics teacher's decisions about classroom

organization and interactions during his first two years using a new curriculum intended to support teachers' development of student-centered, contributive classroom discourse. In year one, the teacher conducted class and interacted with students primarily in small groups. In year two, he conducted more whole-class instruction. In both years, teacher-student interactions contained univocal and contributive discourse, but in year two the teacher sustained contributive discourse with students for longer periods. The teacher facilitated the most significant changes to classroom discourse in the instructional format with which he had the greatest experience (whole-class instruction). Over the period of this study, two key factors appeared to affect the teacher's decisions about classroom organization and interactions: his perception of students' expectations about mathematics classroom roles and activity, and his own discomfort associated with using a new curriculum. These areas are important candidates for future research about teachers' use of innovative mathematics curricula.

Link: http://www.informaworld.com/smpp/title~db=jour~content=g792672547

Lobato, J., Ellis, A. B., & Munoz, R. (2003). How "focusing phenomena" in the instructional environment support individual students' generalizations. *Mathematical Thinking and Learning, 5*(1), 1–36.

This article sets forth a way of connecting the classroom instructional environment with individual students' generalizations. To do so, we advance the notion of focusing phenomena, that is, regularities in the ways in which teachers, students, artifacts, and curricular materials act together to direct attention toward certain mathematical properties over others. The construct of focusing phenomena emerged from an empirical study conducted during a 5-week unit on slope and linear functions in a high school classroom using a reform curriculum. Qualitative evidence from interviews with 7 students revealed that students interpreted the m value in y = b + mx as a difference rather than a ratio as a result of counterproductive generalization afforded by focusing phenomena. Classroom analysis revealed 4 focusing phenomena, which regularly directed students' attention to various sets of differences rather than to the coordination of quantities.

Link: http://www.informaworld.com/smpp/title~db=jour~content=g785828312

Manouchehri, A., & Goodman, T. (2000). Implementing mathematics reform: The challenge within. *Educational Studies in Mathematics, 42*(1), 1–34.

A qualitative case study research was conducted to investigate the process of evaluation and implementation of a Standard-based textbook by two seventh grade middle school mathematics teachers over a period of two years. The data suggested that teachers' mathematical knowledge was the greatest influence on how they evaluated and implemented the textbook. This mathematical knowledge manifested itself in how the teachers planned their instruction, interacted with students, and used the textbook in their classes.

Link:http://www.springerlink.com/content/6nd005wgelkd/?p=28776e7cb2c14490a54f57aca59a92f9&pi=75

Meyer, M. (2004). New tricks for old dogs. *Mathematics Teaching in the Middle School, 10*(1), 6–7.

In this short "On My Mind" article, Meyer discusses why learning to teach new, Standards-based mathematics curricula challenges all teachers, from new to experienced. She highlights some of the new expectations for teachers: using materials that have an unfamiliar format and sometimes different approach to the mathematics than more traditional materials; working on problems with colleagues, as if they are students; planning and assessing student learning collaboratively; and communicating with skeptical or angry parents who are having difficulty helping their children with homework. In short, she compares the experience to that of being a new teacher, but uses that comparison to suggest that the experience can be rejuvenating and exciting for teachers who enter the endeavor with open minds.

Link: www.nctm.org

Meyer, M. R., & Langrall, C. W. (Eds.). (2008). *A decade of middle school mathematics curriculum implementation: Lessons learned from the Show-Me project*. Charlotte, NC: Information Age Publishing.

The purpose of this book is to document the work of the Show-Me Project (1997–2007) and to highlight lessons learned about curriculum implementation. Although the Show-Me Project was charged with promoting the dissemination and implementation of four distinct comprehensive curriculum programs (Connected Mathematics, Mathematics in Context, MathScape, and MathThematics), most of the lessons learned from this work are not curriculum specific. Rather, they cut across the four programs and share commonalities with standards-based curriculum reform at any level. We believe that documenting these lessons learned will be one of the legacies of the Show-Me Project.

We anticipate that the comprehensive nature of this work will attract readers from multiple audiences that include state and district mathematics supervisors, middle grades mathematics teachers and administrators involved in curriculum reform, as well as mathematics teacher educators. Those about to embark on the review of curriculum materials will appreciate reading about the processes employed by other districts. Readers with interests in a particular curriculum program will be able to trace the curriculum-specific chapters to gain insights into how the design of the curricula relate to professional development, adoption and implementation issues, and teachers' personal experience using the curriculum materials. Individuals who provide professional development at the middle grades level will find chapters that they can use for both general and focused discussions. Teachers at all stages of implementation will recognize their own experiences in reading and reflecting on the stories of teacher change. Mathematics educators will find ideas on how these curricula can be used in the preparation of preservice middle grades teachers.

Link: www.infoagepub.com/products/Decade-of-Middle-School-Mathematics-Curriculum-Implementation

Remillard, J. T. (2005). Examining key concepts in research on teachers' use of mathematics curricula. *Review of Educational Research, 75*(2), 211–246.

Studies of teachers' use of mathematics curriculum materials are particularly timely given the current availability of reform-inspired curriculum materials and the increasingly widespread practice of mandating the use of a single curriculum to regulate mathematics teaching. A review of the research on mathematics curriculum use over the last 25 years reveals significant variation in findings and in theoretical foundations. The aim of this review is to examine the ways that central constructs of this body of research--such as curriculum use, teaching, and curriculum materials--are conceptualized and to consider the impact of various conceptualizations on knowledge in the field. Drawing on the literature, the author offers a framework for characterizing and studying teachers' interactions with curriculum materials.

Link: http://rer.sagepub.com/content/vol75/issue2/

Remillard, J. T., & Bryans, M. B. (2004). Teachers' orientations toward mathematics curriculum materials: Implications for teacher learning. *Journal for Research in Mathematics Education, 35*(5), 352–388.

This study was prompted by the current availability of newly designed mathematics curriculum materials for elementary teachers. Seeking to understand the role that reform-oriented curricula might play in supporting teacher learning, we studied the ways in which 8 teachers in the same school used one such curriculum, Investigations in Number, Data, and Space (TERC, 1998). Findings revealed that teachers had orientations toward using curriculum materials that influenced the way they used them regardless of whether they agree with the mathematical vision within the materials. As a result, different uses of the curriculum led to different opportunities for student and teacher learning. Inexperienced teachers were most likely to take a piloting stance toward the curriculum and engage all of its resources fully. Findings suggest that reform efforts might include assisting teachers in examining unfamiliar curriculum resources and developing new approaches to using these materials.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=726

Remillard, J. T., Herbel-Eisenmann, B. A., & Lloyd, G. M. (Eds.). (2009). *Mathematics teachers at work: Connecting curriculum materials and classroom instruction*. New York, NY: Routledge.

This book compiles and synthesizes existing research on teachers' use of mathematics curriculum materials and the impact of curriculum materials on teaching and teachers, with a particular emphasis on – but not restricted to – those materials developed in the 1990s in response to the NCTM's Principles and Standards for School Mathematics. Despite the substantial amount of curriculum development activity over the last 15 years and growing scholarly interest in their use, the book represents the first compilation of research on teachers and mathematics curriculum materials and the first volume with this focus in any content area in several decades.

Link: http://www.routledge.com

Ross, J. A., McDougall, D., Hogaboam-Gray, A., & LeSage, A. (2003). A survey measuring elementary teachers' implementation of standards-based mathematics teaching. *Journal for Research in Mathematics Education, 34*(4), 344–363.

Intensive case study is an expensive tool for measuring teachers' instructional practice. Previous research suggests that teacher self-report surveys provide a low-cost and relatively accurate picture of classroom practice. To examine the extent to which teachers implement mathematics education reform, we developed a 20-item survey based on nine dimensions of standards-based teaching. In this article, we provide evidence of the reliability (i.e., internal consistency) and validity of the instrument. The evidence consists of correlations of survey scores with a mandated performance assessment in Grade 6 mathematics, congruence with classroom observations of a small sample of teachers, and demonstrations that teachers who are similar in their claims about using a standards-based text series differ in how they use the text in ways predicted by the survey.

Link: http://www.nctm.org/eresources/toc.asp?journal_id=1&Issue_id=665

Stein, M. K., & Coburn, C. E. (2008). Architectures for learning: A comparative analysis of two urban school districts. *American Journal of Education, 114*(4), 583–626.

This article explores the usefulness of communities of practice theory for understanding how districts can create organizational environments that foster teachers' opportunities to learn the new ideas and practices required to carry out ambitious reforms. It draws on data from a longitudinal study of the implementation of ambitious mathematics curricula in two urban districts. By analyzing the contrasting ways that teachers in two schools in each district were linked to each other and reform efforts at the district level, the article shows how the district reform effort in one district led to significant opportunities for teacher learning and alignment with reform goals while efforts in the other district coordinated action but failed to spur meaningful opportunities for teacher learning. The article closes with implications for policy and practice.

Link: http://www.journals.uchicago.edu/toc/aje/2008/114/4

Superfine, A. C. (2009). The "problem" of experience in mathematics teaching. *School Science and Mathematics, 109*(1), 7–19.

Prior research has established that teachers' use of curriculum materials is affected by a range of factors, such as teachers' conceptions of mathematics teaching, and the nature and extent of their teaching experience. What is less clear and far less examined, in prior research is the role that the teacher guide (TG) may play in mediating the influence of these and other factors on teachers' decisions and actions. Accordingly, this study examines how two 6th grade teachers use the TG from Connected Mathematics Project as a resource in making planning and enactment decisions, and factors associated with patterns of TG use. Through cross-case analysis, the author found that these teachers seemed to draw largely from their previous experiences and their own conceptions of mathematics teaching and learning when making planning and enactment decisions related to mathematical tasks, and not particularly from the TG. For example, when faced with certain planning and instructional challenges, such as students struggling with the

content, teachers tended to rely on their particular conceptions of mathematics teaching to address these challenges. Despite the fact that the TG provided suggestions for teachers as to how address such challenges, it was not extensively used as a resource by the teachers in this study in their planning and enactment of lessons.

Link: www.ssma.org

Tarr, J. E., Chavez, O., Reys, R. E., & Reys, B. J. (2006). From the written to the enacted curricula: The intermediary role of middle school mathematics teachers in shaping students' opportunity to learn. *School Science and Mathematics, 106*(4), 191-201.

In this paper is reported the extent of textbook use by 39 middle school mathematics teachers in six states, 17 utilizing a textbook series developed with funding from the National Science Foundation (NSF-funded) and 22 using textbooks developed by commercial publishers (publisher-generated). Results indicate that both sets of teachers placed significantly higher emphasis on Number and Operation, often at the expense of other content strands. Location of topics within a textbook represented an oversimplified explanation of what mathematics gets taught or omitted. Most teachers using an NSF-funded curriculum taught content intended for students in a different (lower) grade, and both sets of teachers supplemented with skill-building and "practice" worksheets. Implications for documenting teachers' "fidelity of implementation" (National Research Council, 2004) are offered.

Link: www.ssma.org

Thompson, D. R., & Kersaint, G. (2002). Impediments to the implementation of a successful middle-grades mathematics program: Implications for mathematics. *NCSM Journal of Mathematics Education Leadership, 6*(1), 21–27.

Thompson and Kersaint describe how a mix of teachers, mathematics supervisors, and administrators came to consensus on ten barriers (e.g., an unfocused curriculum, time, lack of professional development opportunities, insufficient time for planning) that would impede effective curricular implementation. Once these factors were identified the team developed solutions either to prevent them or to address them if and when they occurred. Most importantly, they specified at what level responsibility for dealing with each impediment lay. While this article focuses on the mathematics supervisor's responsibility in an effective implementation plan, the full report (available at http://www.coedu.usf.edu/fjer/2001/FJERV41P4378.pdf) includes recommendations for other members of the implementation team. The article would also be helpful for districts that are revisiting their implementation plan because of the impediments they have encountered.

Van Zoest, L. R., & Stockero, S. L. (2008). Interactions with curriculum: A study of beginning secondary school mathematics teachers. *NCSM Journal of Mathematics Education Leadership, 10*(2), 18–27.

This paper investigates the teaching practices of seven second-year mathematics teachers. These teachers had a background in Standards-based materials from their teacher education program, and as interns were placed in classrooms using materials and teaching methods that were consistent with the vision of the NCTM Standards. Each expressed an aspiration to implement Standards-based practices. Researchers assessed the degree to

which these teachers were able to act on their goal of implementing these practices in their classrooms. The study also examines the ways in which the curriculum supported them. The authors conclude by discussing implications of the findings for those responsible in fostering the development of beginning mathematics teachers.

Wilson, M., & Lloyd, G. M. (2000). Sharing mathematical authority with students: The challenge for high school teachers. *Journal of Curriculum and Supervision, 15*(2), 146–169.

The article describes the experiences of three mathematics teachers in the United States as they implemented a new high school curriculum (Core-Plus Mathematics Project) during the 1994-95 academic year. All three teachers dealt with their own and their students' expectations about what constitutes appropriate and possible mathematical activity in the classroom. In particular, the teachers worked to renegotiate where mathematical authority should lie--with the teacher, the students, or both. The results reported here significantly extend previous findings by illustrating specific aspects of high school teachers' experiences in changing mathematics classroom instruction.

Professional development

When districts chose new instructional materials it is essential to consider what professional development will be available to support staff with implementation. For many teachers, both classroom veterans and those new to the field, the adopted materials are unfamiliar and require a change in the way teachers think about the learning and teaching of mathematics. The articles in this section focus on providing professional development in the mathematical and pedagogical content knowledge that teachers need to know in order to be more successful with implementation. Also included are articles that share models and elements of professional development that are necessary if professional development is to effectively support implementation.

Arbaugh, F., Lannin, J., Jones, D., & Park-Rogers, M. (2006). Examining instructional practices in Core-Plus lessons: Implications for professional development. *Journal of Mathematics Teacher Education, 9*(6), 517-550.

In the research reported in this article, we sought to understand the instructional practices of 26 secondary teachers from one district who use a problems-based mathematics textbook series (Core-Plus). Further, we wanted to examine beliefs that may be associated with their instructional practices. After analyzing data from classroom observations, our findings indicated that the teachers' instructional practices fell along a wide continuum of lesson implementation. Analysis of interview data suggested that teachers' beliefs with regard to students' ability to do mathematics were associated with their level of lesson implementation. Teachers also differed, by level of instructional practices, in their beliefs about appropriateness of the textbook series for all students. Results strongly support the need for professional development for teachers implementing a problems-based, reform mathematics curriculum. Further, findings indicate that the professional development be designed to meet the diverse nature of teacher needs.

Link:http://www.springerlink.com/content/qhx803m41l36/?p=ac40fb5597644963be48feb01e1fb14e&pi=14

Bahr, D. L., Bosse, M. J., & Egget, D. (2008). Gauging the relative effects of reform-based curriculum materials and professional development in promoting changes in teacher beliefs. *NCSM Journal of Mathematics Education Leadership, 10*(2), 28–37.

This study examines two groups of teachers involved in professional development and how their beliefs about mathematics changed. The first group used Investigations, while the second used a traditional curriculum. Since both groups were receiving the same professional development, the researchers questioned whether receiving professional development could potentially change teacher beliefs in three major categories: beliefs about mathematics, beliefs about learning or knowing mathematics, and beliefs about children's learning and doing mathematics. Teachers in both groups experienced changes in beliefs.

Collopy, R. (2003). Curriculum materials as a professional development tool: How a mathematics textbook affected two teachers' learning. *Elementary School Journal, 103*(3), 287–311.

This study reports on 2 upper-elementary teachers' learning through their use of potentially educative mathematics curriculum materials without additional professional development. 41 observations of the teachers' mathematics lessons and 28 interviews of the teachers were collected from October to May of an academic year. The case study analyses indicated that curriculum materials can be an effective professional development tool, but perhaps not for all teachers. 1 teacher's instructional focus and rationale for instructional practices remained stable throughout the school year, whereas the other's changed dramatically. The cases illustrated the teachers' dynamic and divergent nature of opportunities to learn through reading materials and enacting lessons. Findings also indicated that consideration of the interaction between beliefs integral to teachers' identity and those that are targets for change may illuminate responses to potentially educative curriculum materials.

Link: http://www.journals.uchicago.edu/toc/esj/2003/103/3

Davenport, L. (2000). *Elementary mathematics curricula as a tool for mathematics education reform: Challenges of implementation and implications for professional development. Center for the Development of Teaching (CDT) Paper Series*. Newton, MA: Education Development Center, Inc.

A number of standards-based elementary mathematics curricula have been created to serve as a tool for mathematics education reform. Although these curricula have much to offer teachers, they also pose serous challenges; In order to use these curricula as intended, teachers mush shift how they think about mathematics, mathematics learning, and mathematics teaching. This paper provides two stories of teachers learning to work with an innovative elementary mathematics curriculum while they are participating in a year-long *Developing Mathematical Ideas* seminars. In the first story, a teacher using *Investigations in Number, Data, and Space* is working through the question of what her students should be learning; as she learns more mathematics herself, she finds that she is better able to articulate mathematics learning goals for her students. In the second story, a teacher using the *Everyday Mathematics* curriculum is developing a curiosity about her

students' mathematical thinking; as she becomes more intrigued with the different ways her own students are thinking about the problems she is posing, she begins to make more space for their thinking in her classroom. An examination of these stories shows how professional development that engages teachers in thinking deeply about the mathematics content of the elementary mathematics curriculum, and exploring how students think about that mathematics content, can help prepare teachers to use standards-based curricula as a tool for reforming their practice.

Frakes, C., & Kline, K. (2000). Teaching young mathematicians: The challenges and rewards. *Teaching Children Mathematics, 6*(6), 376–381.

This article provides an overview of a professional development project designed for a group of kindergarten teachers implementing the Investigations in Number, Data, and Space curriculum. Two main questions are posed to the teachers: 1) How does a teacher recognize young mathematicians? 2) What is the teacher's role in developing mathematicians? The article explores one teacher's reflection on these questions and chronicles her changing vision of what it means to teach and learn mathematics.

Link: www.nctm.org

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Grant, T., Kline, K., & Van Zoest, L. R. (2001). Supporting teacher change: Professional development that promotes thoughtful and deliberate reflection on teaching. *NCSM Journal of Mathematics Education Leadership, 5*(1), 29–37.

The authors describe a professional development session they designed over the course of two long-term Local Systemic Change (LSC) grants. In implementing innovative mathematics curricula, teachers involved in the LSC programs struggled with eliciting and engaging with students' mathematical ideas. The resulting "Reflecting on Teaching" session used videotapes of lessons taught by colleagues in order to engage teachers in thinking about the launch of a lesson, the support students need during their work, and the closure of the lesson.

Kent, L. B., Pligge, M., & Spence, M. (2003). Enhancing teacher knowledge through curriculum reform. *Middle School Journal, 34*(4), 42–46.

Standards-based curricula for the middle grades include new content, content that many teachers, particularly those who are elementary certified, may not find familiar. How can teachers increase not only their content knowledge, but their pedagogical content knowledge—the knowledge required for teaching this new content so that students understand it? Kent, Pligge, and Spence propose that the obvious solution, additional graduate level courses, may not be the best one. Instead, they look to research showing that teacher content knowledge can actually be increased through the use of Standards-based materials. This model of professional development, "curriculum enactment," was used to help teachers learn new mathematics content in the context of their daily work. The authors found that staff development workshops focusing on new content and how it might be taught allowed teachers who were using an NSF-funded curriculum to learn necessary pedagogical content knowledge in concrete, non-threatening ways. Furthermore, once they were back in the classroom, teachers were better able to

understand the deeper mathematics present in the alternative problem-solving strategies their students used.

Link: www.nmsa.org

Krebs, A. S., & Burgis, K. (2003). Using standards-based curriculum materials: A professional development model. *NCSM Journal of Mathematics Education Leadership, 6*(2), 8–12.

Krebs and Burgis outline a professional development model designed to support middle school teachers' implementation of Standards-based materials and increase their content and pedagogical content knowledge. After originally questioning what it takes to implement Standards-based materials, the authors investigated whether the original workshop participants were still implementing a reform curriculum five years after the initial year of professional development. This question was of particular interest because many of the original 34 participants taught in low-income schools, and research has suggested the importance of changed practice and ongoing support if implementation of Standards-based material is to be successful. Fourteen teachers were available for interviews that focused on their professional growth and on implementation issues. All reported that their districts were still using Standards-based materials. The interviews also revealed growth in the teachers' content and pedagogical content knowledge, leading them to feel they had become better teachers. Although current use of a Standards-based curriculum cannot be directly attributed to the original workshop, the participants did report that their initial year of professional development provided them with the necessary base for supporting implementation.

Working with parents

Textbook adoptions can raise issues within the community, especially among parents. The articles in this group highlight the efforts of districts to address parent concerns and also explore the challenges parents face when they want to help their children but are unfamiliar with the materials.

Anhalt, C. O., Allexsaht-Snider, M., & Civil, M. (2002). Middle school mathematics classrooms: A place for Latina parents' involvement. *Journal of Latinos & Education, 1*(4), 255–262.

The study is of 3 Latina parents of children in an Arizona middle school in which parents made observations and participated in three different reform mathematics classrooms. The parents' expectations, concerns, and reactions to the observations of the lessons were discussed and recorded. The goal of the study was to better understand the Latina parents' perspectives about their children's mathematics education. The findings from this study can be used to guide teachers' and parents' efforts to develop effective programs for educating parents about mathematics education reform.

Link: www.informaworld.com/HJLE

Bay-Williams, J. M., & Meyer, M. (2003). Help! Parents and standards-based mathematics. *Principal Leadership, 3*(7), 54–60.

Bay-Williams and Meyer outline questions and concerns of parents that often accompany the adoption and implementation of a Standards-based curriculum. They then emphasize the need for principals to understand the tenets of reform in order to respond to the issues raised by parents. According to the authors, parent queries often deal with pedagogy (e.g.,

the teacher's role), content (e.g., the learning of basic skills), evidence (e.g., data showing increased test scores), and questions that are curriculum specific (e.g., transitions to a different curriculum). The article provides principals with recommendations: hosting a parent math night, documenting effectiveness of the curriculum, and describing specific strategies associated with Standards-based classrooms, such as heterogeneous grouping and cooperative learning. The authors believe that administrators using these suggestions will be helping parents understand why, how, and what their children are learning, and what Standards-based mathematics is all about.

Hendrickson, S., Siebert, D., Smith, S. Z., Kunzler, H., & Christensen, S. (2004). Addressing parents' concerns about mathematics reform. *Teaching Children Mathematics, 11*(1), 18–23.

After working with hundreds of parents during their district's reform mathematics curricular implementation, the authors (K-12 mathematics teachers, mathematics specialists, and researchers) found that two types of settings have been particularly effective in addressing parent concerns: evening meetings with groups of parents, and informal one-to-one conversations that addressed common concerns. The purpose of the evening group meeting was to introduce the curriculum, explain the purpose for change, and answer participant questions. The meeting began with a general presentation where commonly anticipated concerns were addressed and parents could work on a mathematics problem. Print material providing tips on helping with homework was handed out. This general session was followed by either classroom visits for parents who seemed satisfied by the information they had received or a question-and-answer session with school and district representatives for the smaller group of parents who were more vocal about curricular change. The one-on-one conversations allowed teachers to talk to parents about what is important to know and be able to do in mathematics, the way students will be taught, and how students will be prepared for higher mathematics, college, and the world of work. An important component in these discussions was sharing with parents what educators value in children's mathematics understanding, and suggesting to parents how they could encourage those values despite the differences in how they may have learned mathematics when they were in school. Through this two-pronged approach the authors have been able to gain parents' trust, show them the complexity involved in learning mathematics, prepare them to help their children with homework, and share with them the power of the mathematics that their children will be learning.

Link: www.nctm.org

Lubienski, S. T. (2004). Traditional or standards-based mathematics? The choice of students and parents in one district. *Journal of Curriculum and Supervision, 19*(4), 338–365.

This study examines students' and parents' choices in one district that recently began offering a new problem-centered high school mathematics program aligned with the National Council of Teachers of Mathematics Standards, in addition to its traditional mathematics sequence. Despite the district's previous implementation of Standards-based instruction in grades K through 8, the vast majority of students and parents have chosen the traditional high school sequence. Survey data from more than 300 students and

parents were analyzed with attention to parent education level and option chosen. Parents with limited formal education were less likely than college-educated parents to access information about the options but were more likely to rank college preparation as a top factor in their decision. Additionally, although college-educated parents were more likely than other parents to discuss the options with teachers, they were less likely to be influenced by teachers' comments. Parents who chose the traditional sequence expressed more concern about college preparation, whereas parents who chose the Standards-based sequence placed a higher priority on student understanding and enjoyment of mathematics. Overall, many parents and students in the district held strong, persistent antireform beliefs. This study highlights the difficulties and dilemmas of introducing change into the firmly entrenched mathematics curriculum, particularly at the high school level.

Link: www.ascd.org

Remillard, J. T., & Jackson, K. (2006). Old math, new math: Parents' experiences with standards-based reform. *Mathematical Thinking and Learning, 8*(3), 231–259.

We focus on how African American parents in a low-income neighborhood experience, interpret, and respond to current reform efforts as implemented in their children's school. As part of a larger project on parent-child numeracy connections in an elementary school, we interviewed 10 parents and held 2 focus group meetings, during which parents shared their experiences with mathematics as students themselves and as parents of children using a Standards-based curriculum. Even though parents saw themselves as critical players in their children's learning, we found that the implementation of reform-oriented curriculum tended to disempower parents with respect to school mathematics. Parents had little understanding of the reform-based approaches, and thus limited access to the discourse of reform. Our findings call for examination of the effect that reforms have on parents, particularly when the current educational climate calls for increased parent participation and involvement.

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