Implementation of 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.


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](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)


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](http://www.nmsa.org)


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.

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.


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.


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](http://www.ascd.org)


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](http://www.nctm.org)

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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.


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

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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](http://www.nctm.org)

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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


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


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

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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


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.


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.

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.


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.


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.


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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


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


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 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.


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.


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.