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This article considers the analyses and recommendations presented in *Foundations for Success: The Final Report of the National Mathematics Advisory Panel* (2008), especially the chapters addressing teachers and teacher education (chap. 6) and instructional practices (chap. 7). The authors highlight critical recommendations; identify potential gaps in the specification of topics and review of research; and suggest ways to develop a coherent, systematic strategy to enact recommendations that will improve the quality of the teaching force and mathematics instruction. They organize their comments about the Panel's findings and recommendations around two broad questions: What issues are (and are not) part of the conversation? and What evidence informs (and does not inform) the conversation?

Keywords: learning processes/strategies; mathematics education; teacher characteristics; teacher education/development; teacher knowledge

The Report of the National Mathematics Advisory Panel (NMAP) is positioned as a response to the concern that "American students have not been succeeding in the mathematical part of their education at anything like a level expected of an international leader" (NMAP, 2008a, p. xii). Equally important, though less explicit in the report, is the need to address the "large, persistent disparities in achievement related to race and income" (p. xii). Prominent educational scholars and politicians have labeled this disparity the civil rights issue for the 21st century. Robert Moses, for example, explicitly positions math literacy—particularly algebra—as an extension of the civil rights movement, arguing that economic access is the most urgent social issue affecting poor people and people of color, and that in today's technology-dependent world, "economic access and full citizenship depend crucially on math and science literacy" (Moses & Cobb, 2001, p. 5). Improving mathematics education for all students will require a coherent, sustained, and systemic response. In this article we consider the extent to which the findings and recommendations of the NMAP report are likely to launch the reforms we need. Our focus is on instructional processes, teachers, and teacher education.

The NMAP (2008a), established by Presidential Executive Order 13398, was charged with providing advice to the president and secretary of education concerning how to "foster greater knowledge of and improved performance in mathematics among American students" (p. xiii). The Panel, composed of 20 members and 8 ex-officio members, includes experts who represent a range of intellectual backgrounds and positions. The Panel organized itself into several task groups and subcommittees, all producing individual reports that synthesized extant literature and offered recommendations. Findings and recommendations were then drawn together into the final report, *Foundations for Success,* issued in March 2008 "with the Panel's full voice" (p. xvi).

Foundations for Success presents 45 recommendations covering a broad range of issues related to curriculum, children's learning, teaching and teacher education, instructional practices, instructional materials, assessment, and research. As is the nature of advisory panels or blue-ribbon commissions, certain assumptions and parameters guided the group's work. In this case, the charge of the executive order, the delineation of topics studied by each task group or subcommittee, and the organization of the report yielded a set of sound recommendations. Collectively, these recommendations offer a checklist to improve mathematics education in the United States. However, given the assumptions framing the project along with the exigencies of producing a consensus report, the report excludes or minimizes some potentially important topics and research programs. In addition, as Thomas Good (2008) commented in his review, the report essentially summarizes each subpanel's report; it does no integrative work. These are conceptual weaknesses of the overall report. An effective response to the gravity and complexity of the problems that have produced persistent disparities in mathematics achievement in the United States will require integrating findings and recommendations and crafting a coherent, systemic vision to improve mathematics education.

This article considers the analyses and recommendations presented in chapter 6, "Teachers and Teacher Education," and chapter 7, "Instructional Practices." By now educational practitioners, researchers, and policy makers alike recognize that well-prepared teachers and high-quality teaching are key factors in fostering student learning. Value-added research investigating the impact of teachers on student achievement suggests that focusing on teacher quality is a high-leverage endeavor (McCaffrey, Lockwood, Koretz, Louis, & Hamilton, 2004;

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Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004). Thus, to the extent that the report sets the direction for future educational policy, research and development, and much-needed funding, the Panel's findings and recommendations about teachers, teaching (instructional practices), and teacher education are likely to shape the direction and scale of efforts to improve mathematics learning and performance.

In this commentary, we highlight critical recommendations; identify potential gaps in the specification of topics and review of research; and emphasize the need for a coherent, systematic strategy to enact the report's recommendations focused on the quality of the teaching force and mathematics instruction. We organize our comments about the Panel's findings and recommendations around two broad questions—questions intended to encourage readers to approach the report with a careful, critical eye:

- What evidence informs (and does not inform) the conversation?
- What issues are (and are not) part of the conversation?

What Evidence Informs (and Does Not Inform) the Conversation?

The presidential executive order specified that the Panel's recommendations be "based on the best available scientific evidence." The Panel took this charge seriously. It "set a high bar for admitting research results into consideration" and "required the work to have been carried out in a way that manifested rigor and could support generalization at the level of significance to policy" (NMAP, 2008a, p. xvi). The Subcommittee on Standards of Evidence developed a set of general principles for judging the quality of empirical evidence based on factors such as research design, psychometric properties of measures, size and diversity of student samples, and internal and external validity. It then defined five categories for sorting claims derived from research, based on the quality, quantity, and balance of evidence: *strong, moderately strong, suggestive, inconsistent,* and *weak.* These standards of evidence were "developed in a more particular way at the task-group level, because of the character and form of relevant evidence across the wide range of concerns addressed by the task groups" (p. 81). Ultimately, the principles and standards of evidence determined what studies were considered in the deliberations of the task groups and Panel. Although more than 16,000 research studies and related documents were reviewed by Panel members, "only a small percentage of available research met the standards of evidence and could support conclusions" (p. 82).

As members of the editorial team for a journal that receives approximately 500 submissions per year, we have become acutely aware of the inconsistency in methodological rigor of research in our field. And we are, of course, also aware of the numerous criticisms of the quality of research in education. In one of our first editorials, we stated, "As editors of this journal, one of the most important contributions we can make is to help push the field forward—to improve the quality and impact of empirical teacher education research" (Borko, Liston, & Whitcomb, 2007, p. 3). Thus we were glad to see the Panel's serious attention to research quality.

In that same editorial, we argued for the importance of research that "draws from multiple disciplines, is pluralistic in its methods, and is rigorously conducted and reported" (Borko et al., 2007, pp. 9–10). We further recommended that the field of teacher education research build its capacity for collaborative research, conducted by teams of researchers with expertise in multiple research methods, in order to address the kinds of questions that are best investigated through large-scale studies that combine multiple designs, data sources, and analysis procedures. Other prominent educational scholars have made similar recommendations (cf. Cochran-Smith & Fries, 2005; Shavelson & Towne, 2002; Wilson, Floden, & Ferrini-Mundy, 2001; Zeichner, 2005), as illustrated by Zeichner's comment in the concluding chapter of *Studying Teacher Education: The Report of the AERA Panel on Research on Teacher Education* (Cochran-Smith & Zeichner, 2005):

> Given the complexity of teacher education and its connections to various aspects of teacher quality and student learning, no single methodological or theoretical approach will be able to provide all that is needed to understand how and why teacher education influences educational outcomes. (p. 743)

We were pleased that the Panel also acknowledged the importance of a variety of research designs, recommending that in addition to experimental research spanning a continuum from small-scale experiments to large field trials, the nation's education research portfolio include "basic research and research and intervention development studies [that] are needed to bring interventions and models to a point such that studying their efficacy is viable" (NMAP, 2008a, p. 63). At the same time, we disagree with this statement's implicit message that the only purpose for nonexperimental research is to develop and refine programs, to ready them for large-scale efficacy trials. Rather, as the National Research Council's Committee on Scientific Principles for Education Research noted,

> A wide variety of legitimate scientific designs are available for education research. They range from randomized experiments of voucher programs to in-depth ethnographic case studies of teachers to neurocognitive investigations of number learning using positive emission tomography brain imaging. (Shavelson & Towne, 2002, p. 6)

Different designs and methods are better for different purposes. No one design is the best or most desirable; multiple types of scientific inquiries and methods are required to generate the rich body of scientific knowledge needed to improve education.

We are also concerned that experimental and quasi-experimental studies were much more central to the Panel's conversations than were other genres of empirical research. As stated by the subcommittee, "The primary interest of the Panel is experimental and quasi-experimental research designed to investigate the effects of programs, practices, and approaches on students' mathematics learning and achievement" (NMAP, 2008b, p. 2-3). Furthermore, although acknowledging that the standards for determining methodological quality will differ for different genres of research, in both the NMAP report and the report of the Subcommittee on Standards and Evidence, criteria for determining research quality are provided only for studies of the effects of interventions, descriptive surveys of population characteristics, and studies of tests and assessments.

Criteria for methodological rigor exist for the multiple genres of empirical social science research (American Educational Research Association, 2006; Shavelson & Towne, 2002), and there are rigorous, high-quality studies about teachers, teaching, and teacher education that meet these criteria. These studies deserve to be part of the conversation. Indeed, for a number of topics the Panel was charged to examine, either our basic theoretical understanding is not strong or well-articulated interventions with an adequate evidentiary base do not exist. Studies in genres such as interpretive, design, and practitioner research are particularly well suited to address these topics. For example, descriptive studies are needed to answer "What is happening?" questions such as inquiries about the processes by which students of various abilities learn mathematics. Design studies are a better choice for answering "Why or how is it happening?" questions such as the appropriate design of complex systems for delivering mathematics instruction or for fostering teacher learning about students' mathematical thinking (Shavelson & Towne, 2002). We are concerned that these types of studies were rarely included in the Panel's deliberations.

Finally, we worry that the recommendation for a national education research portfolio that includes a variety of research designs may be missed by many readers, as it is overshadowed by the prominent emphasis on experimental design throughout the report. In addressing our second framing question—what issues are (and are not) part of the conversation—we draw upon several high-quality research programs to illustrate the kinds of findings and recommendations that genres such as interpretive and design research can contribute to conversations about mathematics teaching and teacher education.

What Issues Are (and Are Not) Part of the Conversation?

In responding to this question, we consider both how the individual task groups narrowly carved out the terrain of their topics and how the NMAP report misses opportunities to integrate findings across task groups. The analytical framing of each task group's work preceded its review of extant literature. Our commentary on issues in the report—both those included and those overlooked—points out topics that are likely to be crucial to preparing teachers who have appropriate knowledge and instructional skill to close the mathematics achievement gap. Topics we highlight as "missing" have empirical support, although not all studies are experimental or quasi-experimental investigations of causal relationships.

Teachers and Teacher Education

The Panel's Task Group on Teachers and Teacher Education was charged with making recommendations regarding "the training, selection, placement, and professional development of teachers of mathematics in order to enhance students' learning of mathematics" (NMAP, 2008d, p. 5-ix). The task group organized its analysis and recommendations around four topics: (a) teachers' mathematical knowledge, (b) teacher education programs, (c) recruitment and retention strategies, and (d) elementary math specialists. These are critical topics, and the report summarizes key research findings for each; however, the task group framed each topic narrowly. As a result, the research summarized and the attendant recommendations minimize or leave out findings likely to be important in improving the teaching and learning of mathematics.

Narrow focus on content knowledge. In its discussion of teacher knowledge, the task group's report focuses entirely on knowledge of mathematics and, more specifically, on the relationships between teachers' mathematical knowledge and students' achievement. The focus on content knowledge fits with the commonsense notion that teachers must know the content they are teaching. There are two shortcomings, however, to this approach. First, teachers need to know more than mathematical content. Several essential domains of teacher knowledge go unmentioned in the report's discussion, domains that have an impact on a teacher's ability to foster students' mathematical learning. Second, the field lacks robust measures of teachers' mathematical content knowledge. The inadequacies of measures typically used—teacher certification, number of mathematics courses, or teacher licensure exams—have made it difficult to develop a definitive chain of evidence linking domains of teacher knowledge to specific instructional practices to student achievement in mathematics.

One domain noticeably missing is "pedagogical content knowledge." Shulman (1986) defined this component of teachers' professional knowledge as

> the most regularly taught topics in one's subject area, the most useful forms of representations of those ideas, the most powerful analogies, illustrations, examples, explanations, and demonstrations—in a word, ways of representing and formulating the subject that makes it comprehensible to others. Pedagogical content knowledge also includes an understanding of what makes the learning of specific topics easy or difficult; the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons. (pp. 9–10)

In the case of mathematics, for example, when considering multidigit subtraction, a teacher needs to know not only how to solve such problems accurately but also different ways to solve subtraction problems, how to identify sources of student errors swiftly and accurately in order to provide effective feedback, how to explain procedures so students learn how and why they work mathematically, and how to select problems and examples for strategic learning purposes (Ball, Thames, & Phelps, 2008). The body of experimental or quasi-experimental research on pedagogical content knowledge, although relatively small, indicates a positive relationship between teachers' pedagogical content knowledge and student learning in mathematics (Carpenter, Fennema, Peterson, Chiang, & Loef, 1989; Saxe, Gearhardt, & Nasir, 2001). Furthermore, empirical and theoretical evidence (across research genres) was sufficient for the National Research Council Committee on the Foundations of Assessment to conclude that teachers need "a deep understanding of the many approaches students might take toward a particular subject area as well as ways to guide students at different levels toward understanding" (National Research Council, 2001, p. 309).

The Panel also missed an opportunity to integrate findings from other chapters in the report; for example, the discussion of teacher knowledge does not highlight how important it is for teachers to know and understand learning processes. The report's fifth chapter—on learning processes—summarizes key findings about how children develop conceptual understanding, computational fluency, and problem-solving skills; social, motivational, and affective dimensions of learning mathematics; and considerations specific to children's developmental progression with regard to different strands of mathematics (e.g., number sense, geometry and measurement, fractions, and algebra). This chapter asserts many key findings articulated in the National Research Council's seminal synthesis, *How People Learn: Brain, Mind, Experience, and School* (2000). The chapter points to a sizeable body of knowledge that teachers must be able to draw upon, along with content knowledge, in order to foster learning. For example, the report from the Task Group on Learning Processes reiterates an established finding about motivation: A learner's goals and beliefs influence task engagement and self-efficacy, which in turn lead to higher mathematical outcomes (NMAP, 2008c). Teachers play a critical role in creating an academic context that fosters task engagement and self-efficacy. Ames's (1992) study reviewing different academic contexts that foster a mastery goal orientation in learners found that teachers in such contexts provide meaningful reasons to learn content, promote high interest and intermediate challenge, emphasize gradual skill improvement, and promote novelty and variety (NMAP, 2008a). This knowledge about the relationship between instructional practices and student motivation is essential to effective teaching and is distinct from knowledge of mathematical content.

The work of the National Academy of Education's Committee on Teacher Education (Darling-Hammond & Bransford, 2005) also underscores the breadth and depth of learners' knowledge that good teachers depend on. For example, the National Academy of Education report devotes a chapter to the role of language in learning, explaining how teachers draw upon their knowledge of how language develops, how children's language capacities shape their learning experiences, how to bridge home and school disciplinary languages to foster learning, and how to analyze curriculum and assessments with an eye toward the linguistic demands placed on learners. Such knowledge is particularly important in supporting the growing number of K–12 students who may not be fluent in the language of instruction. We look to work such as Moschkovich's (2002) conceptual analysis of how bilingual students communicate mathematically as one example of the breadth of knowledge about learners that teachers will need to close the achievement gap.

In sum, the conceptualization of teacher knowledge in the report narrowly focuses on mathematical content knowledge and thereby skips over other scholarly work illuminating equally important domains of professional knowledge that shape teachers' instruction and student learning. Although we agree that an emphasis on strengthening elementary and middle school math teachers' knowledge of mathematics is a worthwhile aim, we find the absence of other key topics problematic.

Limited measures of content knowledge. With regard to measuring teacher knowledge, the report highlights a well-recognized problem: Measures of teachers' content knowledge typically used in large-scale studies—teacher certification, mathematics courses completed, and teacher licensure tests—are imprecise proxies. As a result, studies using proxies to examine the relationship between teachers' knowledge of mathematics and student achievement have produced mixed results, in particular regarding elementary and middle school teachers. The central problem is that the mathematics implied in the proxies often has little to do with the mathematics teachers draw upon in teaching practice.

In recent work, Deborah Ball (chair, NMAP Task Group on Teachers and Teacher Education) and colleagues argue persuasively that knowledge of mathematics for teaching—the mathematical knowledge that teachers must have in order to do the mathematical work of teaching effectively—differs from the knowledge of mathematics used by other professionals such as mathematicians, engineers, and architects (Ball et al., 2008). Their domain map for this body of professional knowledge includes six components: (a) common knowledge of mathematics content, (b) specialized knowledge of mathematics content, (c) knowledge at the mathematical horizon, (d) knowledge of mathematics and students, (e) knowledge of mathematics and teaching, and (f) knowledge of curriculum. This broader conceptualization of teacher knowledge integrates content knowledge and pedagogical content knowledge in elegant ways. Thus it offers a more complete and coherent conception of the knowledge teachers must invoke in order to teach mathematics effectively for all learners.

Ball and colleagues have also begun developing measures of knowledge of mathematics for teaching. They have designed test items that assess teachers' understanding of the mathematical issues that arise in looking at students' work. For example, returning to the previous discussion of teaching subtraction, an item that tests a teacher's understanding of student thinking might ask for an explanation of the reasoning a child used to arrive at the following incorrect solution to a subtraction problem: 307 – 168 = 261. Or a multiple-choice item might provide three different approaches to solving a specific multidigit subtraction problem and ask the teacher to identify which approach (or approaches) can be generalized to solve any multidigit problem (Ball, Hill, & Bass, 2005; Hill, Ball, & Schilling, 2004; Hill, Rowan, & Ball, 2005). Given the problematic nature of many measures of teachers' mathematical knowledge, we applaud the recommendation to develop more "precise measures" that will "uncover in detail the relationships among teachers' knowledge, their instructional skill, and students' learning, and to identify the mathematical *and pedagogical* [italics added] knowledge needed for teaching" (NMAP, 2008a, p. 38). We believe this is a promising and necessary line of research, one that will add to our understanding of the depth and breadth of knowledge teachers need for teaching.

Teacher education programs. With regard to initial teacher preparation and professional development, the NMAP report points out the paucity of scientific evidence linking teacher education program components and structures with student achievement or with teachers' mathematical knowledge. The task group framed its questions around relationships between "different forms of teacher education and the learning of teachers and their students" (NMAP, 2008a, p. 39). Attention to "forms" emphasizes structural features such as length of program or university-based programs versus "alternative pathways." Although such features are important aspects of program design, recent comprehensive research on teacher education pathways finds that there is more variation within pathways than across them, thus making such comparisons inconclusive (Boyd et al., 2006).

Given this framing and its focus on large-scale studies with student achievement data, the report does not consider research that provides evidence for specific program components and activities that foster teacher learning. In the past 20 years much has been learned by studying exemplary teacher preparation programs to understand what goes on inside courses and field experiences that prepare teachers to create purposeful, learner-centered classroom worlds and to respond effectively to the exigencies of teaching in challenging contexts (Cochran-Smith & Zeichner, 2005; Darling-Hammond, 2006). For example, Grossman (2005) summarizes research showing that video and hypermedia materials can be used in teacher preparation to improve teacher candidates' understanding of a teaching strategy or concept.

Policy efforts to enhance teacher quality. The "Teachers and Teacher Education" chapter tackles two different questions regarding how the profession is organized to ensure that each child has high-quality math teachers. By examining research on recruitment and retention polices as well as elementary math specialists, the NMAP report suggests that mathematics teachers may be a distinct labor market that would benefit from targeted policies to enhance teacher quality. The task group reviews research on skills-based pay, location-based pay, and performance-based pay—all hot topics in current policy and think-tank circles. As with research on the impact of teacher preparation, the evidence for salary incentives is equivocal. The NMAP report recommends, therefore, that given the "substantial number of unknowns, policy initiatives involving teacher incentives should be carefully evaluated" (NMAP, 2008a, p. xxii). With regard to elementary mathematics specialists, the evidence is paper-thin (one study). Thus, the report recommends "that research be conducted on the use of full-time mathematics teachers in elementary schools" (NMAP, 2008a, p. xxii).

Enhancing the evidentiary basis for popular policy recommendations is welcome and reasonable, but we are curious why the Panel did not explore other teacher quality policy initiatives, particularly those that broaden the notion of incentives that recruit the best college students or graduates to choose and stay in teaching. For example, the task group tucks in a comment regarding the importance of teacher working conditions: "Beyond the uncertainties about the effects of particular incentive systems, there is substantial evidence that teachers' decisions to remain in teaching and to continue teaching in particular schools are affected by work conditions in addition to salary" (NMAP, 2008d, p. 5-47). Yet the NMAP report does not offer any recommendations to develop policies that enhance working conditions or to study the impact of working conditions on student learning. Susan Moore Johnson and colleagues studied 50 beginning teachers to identify features of the workplace that enabled or constrained powerful teaching (Johnson, 2006; Johnson & The Project on the Next Generation of Teachers, 2004). Their work demonstrates the crucial importance of working conditions such as appropriate teaching assignments, aligned curriculum, facilities and resources, and building leadership in teachers' sense of efficacy and willingness stay in schools. Students who are poor or students of color are the ones most likely to be in low-performing, hard-to-staff schools. Given the nation's need to respond to achievement gaps in mathematics, it seems particularly important to support rigorous research on these working conditions, which are potential incentives for teacher recruitment and retention.

Overall, the four topics addressed in the "Teachers and Teacher Education" chapter provide important insights into some questions of policy and practice, but they omit attention to other topics that could be equally helpful in improving mathematics education. The NMAP report's recommendations in this area follow closely from the four topics. For example, recommendations for teacher education are twofold: The Panel calls the field to "strengthen teacher preparation, early-career mentoring and support, and ongoing professional development for teachers of mathematics, with special emphasis on ways to ensure appropriate content knowledge for teaching" and to undertake "a well-designed program of research and evaluation, meeting standards permitting the generalization of results, to create a sound basis for the education of teachers of mathematics" (NMAP, 2008a, p. 40). We urge those who seek to implement the Panel's recommendations also to attend to topics omitted from the report—such as aspects of teacher knowledge other than content knowledge and the working conditions of teachers—in the programs they develop and the studies they design.

Instructional Practices

The Task Group on Instructional Practices opens its individual report by recognizing the complexity of teaching mathematics and noting that "many widely used instructional practices that might have been examined here . . . were not included because of limitations of time, resources, and available research" (NMAP, 2008e, p. 6-xiv). The task group focused on six topics "deemed important by the field" and "hotly debated" (p. 6-xiv): (a) teacher-directed and student-centered instruction in mathematics, (b) using formative assessment, (c) teaching low-achieving students and students with learning disabilities, (d) using "real-world" problems to teach mathematics, (e) technology and applications of technology, and (f) teaching mathematically gifted students.

The task group acknowledges that "no particular theoretical framework was used to generate the list" of instructional practices studied (NMAP, 2008e, p. 6-200) and adds that the list of issues allows the task group

> to draw some conclusions from a small set of rigorous research studies, thereby setting the foundation for a far more expansive program of rigorous research that would fill the gaps in the research on these issues and also take up the many other issues that practitioners face in improving mathematics teaching and learning. (NMAP, 2008e, p. 6-xiv)

We commend the task group's careful deliberations to generate and frame these topics and its commitment to speak to practitioners' questions and challenges. We also appreciate that difficult choices had to be made regarding which topics to study and include in the report. However, as we consider the topics addressed, we are concerned that the eclectic selection of discrete instructional practices, determined more by the existence of empirical findings than a coherent pedagogical vision grounded in learning theory, reinforces the perception that good teaching involves accumulating a "toolbox of best practices."

In contrast to the Panel's approach, a number of researchers are currently working to identify a set of core instructional practices with the intent of using these practices as the framework for designing teacher education programs (Grossman, Hammerness, & McDonald, in press; Kazemi & Franke, 2004; Kazemi, Lampert, & Ghousseini, 2007; Lampert, 2001). As Grossman and colleagues explain, core instructional practices are practices that occur with high frequency in teaching, are enacted across different curricula or instructional approaches, preserve the integrity and complexity of teaching, are research-based, and have the potential to improve student achievement. Two examples that appear consistently in this body of work are *learning about student understanding* and *orchestrating classroom discussions.* Each of these core practices is composed of more fine-grained components and plays out differently in each subject matter. Thus learning about student understanding includes practices such as (a) eliciting student thinking during interactive teaching, (b) anticipating student responses, (c) making sense of students' ambiguous or incomplete solutions, (d) identifying and making sense of student errors, and (e) eliciting further thinking. Component practices of orchestrating classroom discourse include (a) asking questions or posing problems to begin a discussion, (b) monitoring student participation during discussion, and (c) keeping the discussion on track. Pointing the policy and education community toward this more coherent vision of high-leverage instructional practices is a missed leadership opportunity. We argue that the place to start filling in the "gaps in the research base" is with research that strengthens the evidentiary base for these core instructional practices in mathematics classrooms.

Conclusion

To conclude we ask, "Are the findings and recommendations in the NMAP report likely to launch the reforms needed to improve the overall quality of the teaching force and mathematics instruction?" Our judgment is a qualified yes. The Panel provides a helpful starting point, but it leaves us with a set of discrete recommendations rather than a strategic blueprint for a coherent, sustained, and systemic reform approach. Based on our review of two report chapters, the lack of a coherent blueprint for systemic reform seems to be caused by at least three factors: (a) the limited kinds of research evidence considered, (b) the narrow framing of issues addressed within individual chapters, and (c) the fact that the Panel did not address its charge to make recommendations on "the role and appropriate design of systems for delivering instruction in mathematics that combine the different elements of learning processes, instruction, teacher training and support, and standards, assessments, and accountability" (NMAP, 2008a, p. 72).

These factors are not unrelated. Indeed, because they address the complex relationships among features of the educational environment such as learning processes, teacher knowledge, instructional practices, and instructional materials, the research genres omitted from the Panel's deliberations are particularly well suited to providing insights and recommendations about systemic reform. For example, design research in the educational arena—whether focused on student learning in K–12 classrooms or teacher learning in professional development and teacher education settings—is characterized by the creation, enactment, and refinement of educational tools (e.g., curricular materials, instructional strategies), as well as the development of explanatory frameworks about both the processes of learning and the instructional and contextual factors that support learning (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Design-Based Research Collective, 2003). Ethnographic studies provide insight into how classroom features such as instructional practices, curricula, tasks, and materials can work together to promote student achievement. As the research on class size reduction by Bohrnstedt and Stecher (1999) illustrates, such studies are especially useful for identifying causal mechanisms—explanations for how and why an intervention works—once a causal effect has been established (see also Shavelson & Towne, 2002).

We also agree with Good's (2008) assessment that the final report would have benefited from a synthesis linking the task group and subcommittee reports, because without an integrative framework readers "are more likely to 'pick and choose' among the separate reports rather than attempt a more comprehensive approach to reform" (p. 14). Teachers will be the engine that drives reforms in mathematics education. To ensure that teachers are not buffeted by many uncoordinated reform efforts, those seeking to develop policies and programs to improve mathematics education will need to build connections across chapter findings that the Panel does not provide. The mediocre to subpar experiences so many children have in mathematics classes is a systemic problem that will require systemic solutions. The NMAP report was well intentioned and sincerely written. Its recommendations regarding teachers and teacher education—enhance teachers' knowledge of mathematics for teaching, develop more robust measures of that knowledge, and increase support for high-quality research—offer the field a reasonable starting place. However, to address Algebra Project founder Robert Moses's challenge to make mathematical literacy the next arena of the civil rights movement, we believe that the mathematics education community must develop a more ambitious and coherent reform agenda than the one outlined in the report. The mathematics education community must insist that rigorous research in all genres be utilized to solve this problem, that a broader understanding of teacher knowledge inform teacher education and professional development, and that recommendations be synthesized into a more coherent and systematic conceptual view of teaching and learning.

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