Elementary " Go To" List: Key Articles for Getting Started with the Selection and Implementation of Mathematics Instructional Materials

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/

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

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

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.

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

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.

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.

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/

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=

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.

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

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=

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.

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

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.

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