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

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

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.

Chazen, 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.

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.

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

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/

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/

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=

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

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.

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

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.

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/

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.

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.