

Research summary for *Transition to Algebra*
Prepared for Heinemann by Education Development Center

Habits-of-mind approach, mathematical practices, mathematics for understanding

- Cuoco, A., Goldenberg, E. P., & Mark, J. (1996). Habits of mind: An organizing principle for a mathematics curriculum. *Journal of Mathematical Behavior*, 15(4), 375–402.
- Cuoco, A., Goldenberg, E. P., & Mark, J. (2010). Organizing a curriculum around mathematical habits of mind. *Mathematics Teacher* 103(9), 682-688.
- Cuoco, A., et al. (2009). *CME Project*. Boston, MA: Pearson.
- Driscoll, M. (2001). *Fostering Algebraic Thinking: A guide for teachers, grades 6–10*. Portsmouth, NH: Heinemann.
- Fennema E. & Romberg, T. (Eds.). (1999). *Mathematics classrooms that promote understanding*. Mahwah, NJ: Lawrence Erlbaum.
- Goldenberg, E. P. (1996). ‘Habits of mind’ as an organizer for the curriculum. *Journal of Education*, 178(1), 13–34.
- Goldenberg, E. P., et al. (2006). *Think math!* Nashua, NH: School Specialty Math.
- Hiebert, J., & Carpenter, T.P. (1992). Learning and teaching with understanding. In D.A. Grouws (Ed.), *Handbook of researching on mathematics teaching and learning* (65-97). New York: Macmillan Publishing Company.
- National Governors Association Center for Best Practices, & Council of Chief State School Officers. (2010). *Common Core State Standards: Mathematics*. Retrieved from http://www.corestandards.org/assets/CCSSI_Math_Standards.pdf
- National Research Council. (2001). *Adding it up: Helping children learn mathematics*. J. Kilpatrick, J. Swafford, & B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.
- Vance, J. H. (1998). Number operations from an algebraic perspective. *Teaching Children Mathematics*, 4(5), 282–285.

Research on teaching and learning of algebra, decimals

- Goldenberg, E.P. (1991). “The difference between graphing software and *educational* graphing software.” In Demana, F., and B. Waits, (eds.), *Proceedings of the Second Annual Conference on Technology in Collegiate Mathematics*. Addison-Wesley, 1991; co-published in Zimmerman, W., & S. Cunningham, (eds.) *Visualization in Mathematics*, Mathematical Assoc. of America, 1991.
- Goldenberg, E.P. (1998, September) “Mathematics, Metaphors, and Human Factors,” *J. Math. Behav.*, 7, pp. 135-173.
- Goldenberg, E.P. (1987). “Believing is seeing: how preconceptions influence the perception of graphs” *Proceedings of the Int. Conference on the Psychology of Mathematics Education*,

XI, Montreal.

- Kieran, C. (2007). Learning and teaching algebra at the middle school through college levels. In F. Lester (Ed.), *Second handbook of research on mathematics teaching and learning*. Greenwich, CT: Information Age Publishing.
- Kaput, J. J. (1993). Long-term algebra reform: Democratizing access to big ideas. In C. A. Lacampagne, W. Blair, & J. J. Kaput (Eds.), *The algebra colloquium 1* (pp. 33–52). Washington, DC: U.S. Department of Education.
- Kieran, C., & Chalouh, L. (1993). Prealgebra: The transition from arithmetic to algebra. In D.T. Owens & S. Wagner (Eds.), *Research ideas for the classroom, middle grades mathematics* (pp. 179–198). New York: Macmillan.
- Lodholz, R. (1990). The transition from arithmetic to algebra. In E. L. Edwards (Ed.), *Algebra for everyone* (pp. 24–33). Reston, VA: National Council of Teachers of Mathematics.
- Smith, J. S. (2006). Research summary: Transition from middle school to high school. Retrieved March 9, 2011 from <http://www.nmsa.org/Research/ResearchSummaries/TransitionfromMStoHS/tabid/1087/Default.aspx>
- Stacey, K., Helme, S. & Steinle, V. (2001) [Confusions between decimals, fractions and negative numbers: A consequence of the mirror as a conceptual metaphor in three different ways](#). In Marja van den Heuvel-Panhuizen (Ed) *Proceedings of the 25th Conference of the International Group for the Psychology of Mathematics Education*. Vol 4. (pp217 - 224). Utrecht: PME.
- Steinle, V. & Stacey, K. (1998). [The incidence of misconceptions of decimal notation amongst students in Grades 5 to 10](#). In Clive Kanes, Merrilyn Goos, Elizabeth Warren. (Eds). *Teaching Mathematics in New Times, MERGA 21*. Volume 2, pp548-555. Mathematics Education Research Group of Australasia.

Need to improve teaching of algebra; national challenge

- Achieve, Inc. (2011, February). *Closing the expectations gap 2011* (Policy Brief). Washington, DC: Author. Retrieved from <http://www.achieve.org>.
- Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education.
- American Diploma Project. (2004, February). *Ready or not: Creating a high school diploma that counts*. Washington, DC: Achieve, Inc. Retrieved from <http://www.achieve.org/node/552>.
- Ham, S., & Walker, E. (1999). *Getting to the right algebra: The Equity 2000 initiative in Milwaukee public schools*. Princeton, NJ: Manpower Demonstration Research Corporation.
- McKnight, C., Crosswhite, F., Dossey, J., Kifer, E., Swafford, J., Travers, K., & Cooney, T.J. (1987). *The underachieving curriculum: Assessing U.S. school mathematics from an international perspective*. Champaign, IL: Stipes Publishing Co.
- Pappano, L. (2012). The algebra problem: how to elicit algebraic thinking in students before eighth grade. *Harvard Education Letter*, 28(3), 1-3.

- Stein, M. K., Kaufman, K., Sherman, M., & Hillen, A. (2011). Algebra: A challenge at the crossroads of policy and practice. *Review of Educational Research*, 81(4), 453–492.
- Horwitz, A., & Snipes, J. (2008). *Supporting successful transitions to high school*. Washington, DC: The Council of the Great City Schools.
- Loveless, T. (2008). *The Misplaced Math Student: Lost in Eighth-Grade Algebra*. Washington, DC: The Brookings Institution, 2008.
- Loveless, T. (2013). *The Algebra Imperative: Assessing Algebra in a National and International Context*. Washington, DC: Brown Center for Education, The Brookings Institution.
- Slavin, R.E., Lake, C. & Groff, C. (2009). Effective programs in middle and high school mathematics: A best evidence synthesis. *Review of Educational Research*, 79(2), 839–911.

Existing interventions for underprepared students

- Balfanz, R., McPartland, J., & Shaw, A. (2002, April). *Re-conceptualizing extra help for high school students in a high standards era*. Prepared for Preparing America’s Future: The High School Symposium, U.S. Department of Education, Washington, D.C.
- Nomi, T., & Allensworth, E. (2009). Double-dose algebra as an alternative strategy to remediation: Effects on students’ academic outcomes. *Journal of Research on Educational Effectiveness*, 2, 111–148.

Instructional design principles and other resources

- Koedinger, K. R. (2002). Toward evidence for instructional design principles: Examples from Cognitive Tutor Math 6. In *Proceedings of the twenty-fourth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 21–49). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.
- Shell Centre for Mathematical Education. (1985). *The Language of functions and graphs: an examination module for secondary schools*. Manchester, UK: Joint Matriculation Board.
- Swan, M. (2002). *Learning Mathematics through Discussion and Reflection*. London: Learning and Skills Development Agency.
- Swan, M. (2008) A designer speaks. *Educational Designer*, 1(1), 1-17.

Puzzles

- Wanko, J.J. (2009). Talking points: experiencing deductive reasoning through puzzle discussions. *Proceedings of the ICMI study 19 conference: Proof and proving in mathematics education*, Retrieved from http://140.122.140.1/~icmi19/files/Volume_2.pdf#page=272
- Wanko, J. J. (2010). Deductive puzzling. *Mathematics Teaching in the Middle School*, 15(9), 524–529.

Learning mindsets, affective factors

Dweck, C. S. (2006). *Mindset*. New York: Random House.

Newstead, K. (1998). Aspects of children's mathematics anxiety. *Educational Studies in Mathematics*, 36(1), 53-71. Sawyer, W.W. (1964). *Vision in Elementary Mathematics*. Mineola, NY: Dover Publications, Inc.

Classroom discussion and mathematical discourse

Chapin, S., O'Connor, C., & Anderson, N. (2009). *Classroom Discussions: Using Math Talk to Help Students Learn, Grades K-6* (second edition). Sausalito, CA: Math Solutions Publications

Smith, M.S. & Stein, M.K. (2011). *5 Practices for Orchestrating Productive Mathematics Discussions*. Reston, VA: National Council of Teachers of Mathematics.

Curriculum implementation, professional development, teacher supports

Ball, D. (2003, February). *What mathematical knowledge is needed for teaching mathematics?* Remarks prepared for the U.S. Department of Education Secretary's Summit on Mathematics, Washington, DC.

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), 6–8, 14.

Century, J., Freeman, C., & Rudnick, M. (2008). *A framework for measuring and accumulating knowledge about fidelity of implementation (FOI) of science instructional materials*. Paper presented at the National Association for Research in Science Teaching Annual Meeting, Baltimore, MD.

Cohen, D., & Ball, D. (1999). *Instruction, capacity, and improvement*. (CPRE Research Report Series RR-42). Philadelphia: Consortium for Policy Research in Education, University of Pennsylvania.

Durwood, C., Krone, E., & Mazzeo, C. (2010). *Are two algebra classes better than one? The effects of double-dose instruction in Chicago*. Chicago: Consortium on Chicago School Research.

Mark, J., Louie, J. & Fries, M. (2012, April). *Supporting students to succeed in algebra: Strategies and resources*. Session presented at the annual meeting of the National Council of Supervisors of Mathematics, Philadelphia, PA.

Penuel, W. R., Fishman, B. J., Yamaguchi, R., & Gallagher, L. P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal*, 44(4), 921–958.

Tarr, J. E., Grouws, D., Chávez, Ó, McNaught, M., Huey, M., & Ross, D. (2009, April). *Characterizing high school mathematics teachers' curriculum implementation*. Presentation at the Research Pre-session of the annual meeting of the National Council of Teachers of Mathematics, Washington, DC.

- Tarr, J. E., Reys, R., Reys, B., Chávez, Ó, Shih, J., & Osterlind, S. (2008). The impact of middle grades mathematics curricula and the classroom learning environment on student achievement. *Journal for Research in Mathematics Education*, 39(3), 247–280.
- 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.
- Van Zoest, L., & Bohl, J. (2002). The role of reform curricular materials in an internship: The case of Alice and Gregory. *Journal of Mathematics Teacher Education*, 5(3), 265–288.