Aisling, Leavy M., Friel, Susan N., Mamer James D. (2009). It's a Fird!: Can You Compute a Median of Categorical Data? *Mathematics Teaching in the Middle School, 14*(6), 344-351.

Asquith, P., Stephens, A.C., Knuth, E.J., Alibali, M.W. (2005). Middle School Mathematics Teachers' Knowledge of Students' Understanding of Core Algebraic Concepts: Equal Sign and Variable. *Mathematical Thinking and Learning, 9*(3), 249-272.
ABSTRACT: This article reports results from a study focused on teachers' knowledge of students' understanding of core algebraic concepts. In particular, the study examined middle school mathematics teachers' knowledge of students' understanding of the equal sign and variable, and students' success applying their understanding of these concepts. Interview data were collected from 20 middle school teachers regarding their predictions of student responses to written assessment items focusing on the equal sign and variable. Teachers' predictions of students' understanding of variable aligned to a large extent with students' actual responses to corresponding items. In contrast, teachers' predictions of students' understanding of the equal sign did not correspond with actual student responses. Further, teachers rarely identified misconceptions about either variable or the equal sign as an obstacle to solving problems that required application of these concepts. Implications for teacher professional development are discussed.

Ball, D.L. (1996). Teacher learning and the mathematics reforms - What we think we know and what we need to learn. *Phi Delta Kappan*, *77*(7), 500-508.
ABSTRACT: The work of professional development is as uncertain as practice itself, Ms. Ball points out. Our challenge is to experiment, study, reflect on, and reformulate our hypotheses. All of these are necessary if we are to successfully engage a wider community - to "scale up" reform by sowing ideas.

Bay-Williams, J., Scott, M., & Hancock, M. (2007). Case of the mathematics team: Implementing a team model for simultaneous renewal. *Journal of Educational Research, 100*(4), 243-253
ABSTRACT: Simultaneous renewal in teacher education is based on the notion that improvement at 1 level requires improvement at all levels and that all stakeholders are responsible for such improvement. The authors discuss the creation and impact of a mathematics team as a vehicle for simultaneous renewal by using the team model for simultaneous renewal for improved teacher-education courses, student achievement in an elementary school, and curriculum changes in K-16 mathematics. Participation in the mathematics team created awareness and respect for the teachers, mathematicians, and mathematics educators.

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.
ABSTRACT: Teachers' work with four National Science Foundation-funded curricula in the Missouri Middle-School Mathematics Project has disclosed 10 critical implementation elements: administrative support, opportunities for study, curriculum sampling, daily planning, interaction with experts, collaboration with colleagues, incorporation of new assessments, student adjustment time, and planning for transition.

Brucker, Elizabeth L. (2009). Journey into a Standards-Based Mathematics Classroom. *Mathematics Teaching in the Middle School, 14*(5), 300-310.

Cai, J. & Moyer J. C. (2006). *A conceptual framework for studying curricular effects on students' learning: Conceptualization and design in the LieCal Project*. Poster presented at the 2006 annual meeting of the International Group of Psychology of Mathematics Education, Prague, Czech Republic: Charles University in Prague.

Cai, J. & Nie, B. (2007). Problem solving in Chinese mathematics education: research and practice. *ZDM Mathematics Education. 39*, 459–473

ABSTRACT: This paper is an attempt to paint a picture of problem solving in Chinese mathematics education, where problem solving has been viewed both as an instructional goal and as an instructional approach. In discussing problem-solving research from four perspectives, it is found that the research in China has been much more content and experience-based than cognitive and empirical-based. We also describe several problem-solving activities in the Chinese classroom, including ''one problem multiple solutions,'' ''multiple problems one solution,'' and ''one problem multiple changes.'' Unfortunately, there are no empirical investigations that document the actual effectiveness and reasons for the effectiveness of those problemsolving activities. Nevertheless, these problem-solving activities should be useful references for helping students make sense of mathematics.

Capraro, M. M., Kulm, G., & Capraro, R. M. (2005). Middle grades: Misconceptions in statistical thinking. *School Science and Mathematics, 105*, 165-174.

ABSTRACT: A sample of 134 sixth-grade students who were using the *Connected Mathematics* Project (CMP) curriculum were administered an open-ended item entitled, Vet Club (Balanced Assessment, 200). This paper explores the role of misconceptions and naïve conceptions in the acquisition of statistical thinking for middle grades students. Students exhibited misconceptions and naïve conceptions regarding representating data data graphically, interpreting the meaning of typicality, and plotting 0 above the *x*-axis.

Choppin, J. (2006, November). *Design rationale: Role of Curriculua in providing opportunities for teachers to develop complex practices.* Paper presented at the 28th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Mèrida, Mèxico.

ABSTRACT: This study analyzes the potential of two similar tasks to generate dialogic classroom interactions. Although both tasks were similar in context and outcome, one affords teachers' actions to elicit and build from diverse student explanations. This would require greater teacher expertise – both mathematically and pedagogically – and an articulation of conditions when more potentially dialogical tasks should be implemented.

Choppin, J. (2006, November). *Studying a curriculum implementation using a communities of practice perspective*. Paper presented at the 28th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, Mèrida, Mèxico.

ABSTRACT: The publication of the 1989 NCTM Standards (NCTM, 1989) marked the launch of extensive efforts to reform mathematics teaching and learning. These efforts have included the development and publication of curricula which implicate constructivist instructional practices. Implementing reform curricula in a way that changes core teaching practices has proven to be a difficult endeavor (Spillane & Zeuli, 1999), especially so in urban settings, which are typically stressed in terms of teacher turnover, lack of material resources, and funding for professional development.

A number of researchers have noted the importance – if not necessity – of professional community in facilitating and sustaining teacher change towards constructivist-based pedagogy (Cobb, McClain, Lamberg, & Dean, 2003; Secada & Adajian, 1997; Stein, Silver, & Smith, 1998). In this study I use Wenger's (1998) three dimensions of community of practice (CoP) to analyze the extent to which core learning principles exist within the professional communities in my study. I focus on the learning principles of collaboration, reflection, recognition, and autonomy, which have been identified as characteristics of effective learning in communities of practice (Gee, 2003; Schon, 1983; Secada & Adajian, 1997; Wenger, 1998). This study describes characteristics of CoP's in an urban school system implementing the Connected Mathematics Project (CMP) (Lappan, Fey, Fitzgerald, Friel & Phillips, 1998) curriculum.

DeBoer, G., Morris, K., Roseman, J.E., Wilson, L., Capraro, M.M., Capraro, R. et al. (2004). *Research Issues in the Improvement of Mathematics Teaching and Learning through Professional Development*. Paper presented at the American Educational Research Association (AERA), San Dieago, CA.

Ding, M., Li, X., Piccolo, D. & Kulm, G. (2007). Teacher Interventions in Cooperative Learning Math Classes. *The Journal of Educational Research, 100*(3), 162-175.
ABSTRACT: The authors examined the extent to which teacher interventions focused on students' mathematical thinking in naturalistic cooperative-learning mathematics classroom settings. The authors also observed 6 videotapes about the same teaching content using similar curriculum from 2 states. They created 2 instruments for coding the quality of teacher intervention length, choice and frequency, and intervention. The results show the differences of teacher interventions to improve students' cognitive performance. The authors explained how to balance peer resource and students' independent thinking and how to use peer resource to improve students' thinking. Finally, the authors suggest detailed techniques to address students' thinking, such as identify, diversify, and deepen their thinking.

Ellis, A. (2007). A taxonomy for categorizing generalizations: Generalizing actions and reflection generalizations. *Journal of the Learning Sciences, 16*(2), 221-262
ABSTRACT: This article presents a cohesive, empirically grounded categorization system differentiating the types of generalizations students constructed when reasoning mathematically. The generalization taxonomy developed out of an empirical study conducted during a 3-week teaching experiment and a series of individual interviews. Qualitative analysis of data from teaching sessions with 7 seventh-graders and individual interviews with 7 eighth-graders resulted in a taxonomy that distinguishes between students' activity as they generalize, or generalizing actions, and students' final statements of generalization, or reflection generalizations. The three major generalizing action categories that emerged from analysis are (a) relating, in which one forms an association between two or more problems or objects, (b) searching, in which one repeats an action to locate an element of similarity, and (c) extending, in which one expands a pattern or relation into a more general structure. Reflection generalizations took the form of identifications or statements, definitions, and the influence of prior ideas or strategies. By locating generalization within the learner's viewpoint, the taxonomy moves beyond casting it as an activity at which students either fail or Succeed to allow researchers to identify what students see as general, and how they engage in the act of generalizing.

Ellis, A. B. (2007). Connections between generalizing and justifying: Students reasoning with linear relationships. *Journal for Research in Mathematics Education, 38*(3), 194–229.
ABSTRACT: Research investigating algebra students' abilities to generalize and justify suggests that they experience difficulty in creating and using appropriate generalizations and proofs. Although the field has documented students' errors, less is known about what students do understand to be general and convincing. This study examines the ways in which seven middle school students generalized and justified while exploring linear functions. Students' generalizations and proof schemes were identified and categorized in order to establish connections between types of generalizations and types of justifications. These connections led to the identification of four mechanisms for change that supported students' engagement in increasingly sophisticated forms of algebraic reasoning: (a) iterative action/reflection cycles, (b) mathematical focus, (c), generalizations that promote deductive reasoning, and (d) influence of deductive reasoning on generalizing.

Ellis, A. (2007). The influence of reasoning with emergent quantities on students' generalizations. *Cognition and Instruction, 25*(4): 439-478

ABSTRACT: This paper reports the mathematical generalizations of two groups of algebra students, one which focused primarily on quantitative relationships, and one which focused primarily on number patterns disconnected from quantities. Results indicate that instruction encouraging a focus on number patterns supported generalizations about patterns, procedures, and rules, while instruction encouraging a focus on quantities supported generalizations about relationships, connections between situations, and dynamic phenomena, such as the nature of constant speed. An examination of the similarities and differences in students' generalizations revealed that the type of quantitative reasoning in which students engaged ultimately proved more important in influencing their generalizing than a mere focus on quantities versus numbers. In order to develop powerful, global generalizations about relationships, students had to construct ratios as emergent quantities relating two initial quantities. The role of emergent-ratio quantities is discussed as it relates to pedagogical practices that can support students' abilities to correctly generalize.

Gutstein, E. (2006). "The Real World As We Have Seen It": Latino/a Parents' Voices On Teaching Mathematics For Social Justice. *Mathematical Thinking and Learning, 8*(3), 331-358.

ABSTRACT: This article describes the views of Latino/a parents who supported social justice mathematics curriculum for their children in a 7th-grade Chicago public school classroom in which I was the teacher. The parents viewed dealing with and resisting oppression as necessary parts of their lives; they also saw mathematics as integral and important. Because (mathematics) education should prepare one for life - and injustice, resistance, and mathematics were all interconnected parts of life - an education made sense if it prepared children to be aware of and respond to injustices that they faced as members of marginalized communities. Such education may be unusual, but it was congruent with the parents' core values and worth standing up for.

Hallagan, J.E. (2004). *A teacher's model of students' algebraix thinking about equivalent expressions*. Paper presented at the 28th Conference of the International Group of the Psychology of Mathematics Education, Bergen, Norway.

Halat, E. (2006). Sex-related differences in the acquisition of the Van Hiele levels and motivation in learning Geometry. *Asia Pacific Education Review*, *7*(2), 173-183.

ABSTRACT: The purpose of this study was to examine the acquisition of the van Hiele levels and motivation of sixth-grade students engaged in instruction using van Hiele theory-based mathematics curricula. There were 150 sixth-grade students, 66 boys and 84 girls, involved in the study. The researcher employed a multiple-choice geometry test to find out students' reasoning stages and a questionnaire to detect students' motivation in regards to the instruction. These instruments were administered to the students before and after a five-week period of instruction. The paired-samples t-test, the independent-samples t-test, and ANCOVA with $\alpha = .05$ were used to analyze the quantitative data. The study demonstrated that there was no statistically significant difference as in motivation between boys and girls, and that no significant difference was detected in the acquisition of the levels between boys and girls. In other words, gender was not a factor in learning geometry

Harris, K., Marcus, R., McLaren, K., & Fey, J. (2001). Curriculum materials supporting problem-based teaching. *Journal of School Science and Mathematics*, *101*(6), 310-318.

Hartmann, C. (2004). Using Teacher Portfolios to Enrich the Methods Course Experiences of Prospective Mathematics Teachers. *School Science and Mathematics, 104(8),* 392-407.

Heck, D.J., Banilower, E.R., Weiss, I.R., & Rosenberg, SL. (2008). Studying the effects of professional development: The case of the NSF's local systemic change

through teacher enhancement initiative. *Journal for Research in Mathematics Education*, *39*(2), 113-152.
ABSTRACT: Enacting the vision of NCTM's Principles and Standards for School Mathematics depends on effective teacher professional development. This 7-year study of 48 projects in the National Science Foundation's Local Systemic Change Through Teacher Enhancement Initiative investigates the relationship between professional development and teachers' attitudes, preparedness, and classroom practices in mathematics. These programs included many features considered to characterize effective professional development: content focus, extensive and sustained duration, and connection to practice and to influences on teachers' practice. Results provide evidence of positive impact on teacher-reported attitudes toward, preparedness for, and practice of Standards-based teaching, despite the fact that many teachers did not participate in professional development to the extent intended. Teachers' perception of their principals' support for Standards-based mathematics instruction was also positively related to these outcomes.

Herbel-Eisenmann, B. (2004). An examination of textbook “voice”: How might discursive choice undermine some of the goals of the reform? In D. McDougall & J. Ross (Eds.), *Proc. 26th of the North American Group for the Psychology of Mathematics Education* (Vol. 2, pp. 862-870). Toronto, Canada: PME-NA.

Herbel-Eisenmann, B. (2007). From intended curriculum to written curriculum: Examining the "voice" of a mathematics textbook. *Journal for Research in Mathematics Education*, *38*(4), 344-369
ABSTRACT: In this article, I used a discourse analytic framework to examine the "voice" of a middle school mathematics unit. I attended to the text's voice, which helped to illuminate the construction of the roles of the authors and readers and the expected relationships between them. The discursive framework I used focused my attention on particular language forms. The aim of the analysis was to see whether the authors of the unit achieved the ideological goal (i.e., the intended curriculum) put forth by the NCTM's Standards (1991) to shift the locus of authority away from the teacher and the textbook and toward student mathematical reasoning and justification. The findings indicate that achieving this goal is more difficult than the authors of the Standards documents may have realized and that there may be a mismatch between this goal and conventional textbook forms.

Hill, H.C. (2007). Mathematical knowledge of middle school teachers: Implications for the No Child Left Behind Policy Initiative. *Educational Evaluation and Policy Analysis, 29*(2), 95-114
ABSTRACT: This article explores middle school teachers' mathematical knowledge for teaching and the relationship between such knowledge and teachers' subject matter preparation, certification type, teaching experience, and their students' poverty status. The author administered multiple-choice measures to a nationally representative sample of teachers and found that those with more mathematical course work, a subject-specific certification, and high school teaching experience tended to possess higher levels of teaching-specific mathematical knowledge. However teachers with strong mathematical knowledge for teaching are, like those with full credentials and preparation, distributed unequally across the population of U.S. students. Specifically, more affluent students are more likely to encounter more knowledgeable teachers. The author discusses the implications of this for current U.S. policies aimed at improving teacher quality.

Hunter, M.A. (2006). Opportunities for environmental science and engineering outreach through K-12 mathematics programs. *Environmental Engineering Science, 23*(3), 461-471.
ABSTRACT: Programs to improve mathematics education provide an opportunity to educate K-12 students about environmental science and engineering. Many professional organizations as well as the National Science Foundation have developed activities for middle school and high school teachers that can be utilized by higher education faculty when participating in such programs. A hands-on workshop, provided a discussion of environmental and civil engineering as a career for young women whom

participated in a girls mathematics day called "Y2M, Yes to Mathematics" hosted at a local community college. Another project involving 10 school districts on Long Island, provided the opportunity to incorporate environmental science and engineering outreach to middle school students. The project goal is to increase the time students spend on mathematics in mathematics, science, and technology classes using suitable pedagogy and curricula. The first year of the 5-year program involved organizing and training of district teams, then developing a district plan for increasing the math content across the curriculum. The second year involved training of additional middle school teachers and piloting exemplary materials. The second year of this program has been completed and progress towards meeting the expected goals and benchmarks such as improved performance on the NY state Mathematics assessment and increased use of mathematics in the science classroom has occurred. Incorporation of mathematics into the science curricula can occur through environmental science or engineering activities. The program should, in turn, significantly improve the students' understanding of mathematics and increase their interest in environmental science and engineering.

Huntley, Mary Ann. (2008). A Framework for Analyzing Differences Across Mathematics Curricula. *NCSM Journal, 10*(2), 10-27.

Izsak, A. (2000). Inscribing the winch: Mechanisms by which students develop knowledge structures for representing the physical world with algebra. *Journal of the Learning Sciences, 9*(1), 31-74

ABSTRACT: I propose and test an account of mechanisms by which students develop knowledge structures for modeling the physical world with algebra. The account begins to bridge the gap between current mathematics curricula, in which modeling activities play an important role, and theoretical accounts of how students learn to model, which lag behind. After describing the larger study, in which I observed 12 pairs of 8th-grade students introduce and refine algebraic representations of a physical device called a winch, I then focus on 1 pair that generated an unconventional yet sound equation. Because the prevailing genetic accounts of knowledge structures in mathematics education, cognitive science, and information-processing psychology do not explain key characteristics of the data, I begin to construct a new developmental account that does. To do so, I use forms, a class of schemata that combine patterns of algebra symbols with patterns of experience in the physical world, and 2 mechanisms, notation variation and mapping variation. I then use forms and the 2 mechanisms to analyze how the selected pair of students introduced and refined initial, faulty algebraic representations of the winch into an unconventional yet sound equation.

Izsak, A. (2004). Students' coordination of knowledge when learning to model physical situations. *Cognition and Instruction, 22*(1), 81-128

ABSTRACT: In this article, I present a study in which 12 pairs of 8th-grade students solved problems about a physical device with algebra. The device, called a winch, instantiates motions that can be modeled by pairs of simultaneous linear functions. The following question motivated the study: How can students generate algebraic models without direct instruction from more experienced others? The first main result of the study is that students have and can use criteria for judging when I algebraic expression is better than another. Thus, students can use criteria to regulate their problem-solving activity. The second main result is that constructing knowledge for modeling with algebra can require students to coordinate criteria for algebraic representations with several other types of knowledge that I also identify in the article. These results contribute to research on students' algebraic modeling, cognitive processes and knowledge structures for using mathematical representations, and the development of mathematical knowledge.

Izsak, A. (2004). 'We want a statement that is always true': Criteria for good algebraic representations and the development of modeling knowledge. (vol 34, pg 191, 2003). *Journal for Research in Mathematics Education, 35*(2), 152-152.

ABSTRACT: Presents a case study in which two 8th grade students developed knowledge for modeling a physical device called a winch. Demonstrates that students have and can use criteria for evaluating

algebraic representations. Explains how students can develop modeling knowledge by coordinating criteria with knowledge for generating and using algebraic representations.

Izsak, A. (2005). "You have to count the squares": Applying knowledge in pieces to learning rectangular area. *Journal of the Learning Sciences*, *14*(3), 361-403.
ABSTRACT: This article extends and strengthens the knowledge in pieces perspective (diSessa, 1988, 1993) by applying core components to analyze how 5th-grade students with computational knowledge of whole-number multiplication and connections between multiplication and discrete arrays constructed understandings of area and ways of using representations to solve area problems. The results complement past research by demonstrating that important components of the knowledge in pieces perspective are not tied to physics, more advanced mathematics, or the teaming of older students. Furthermore, the study elaborates the perspective in a particular context by proposing knowledge for selecting attributes, using representations, and evaluating representations as analytic categories useful for highlighting some coordination and refinement processes that can arise when students learn to use external representations to solve problems. The results suggest, among other things, that explicitly identifying similarities and differences between students' past experiences using representations to solve problems and demands of new tasks can be central to successful instructional design.

Izsak, A. (2008). Mathematical knowledge for teaching fraction multiplication. *Cognition and Instruction, 26*(1), 95-143
ABSTRACT: The present study contrasts mathematical knowledge that two sixth-grade teachers apparently used when teaching fraction multiplication with the Connected Mathematics Project materials. The analysis concentrated on those tasks from the materials that use drawings to represent fractions as length or area quantities. Examining the two teachers' explanations and responses to their students' reasoning over extended sequences of lessons led to a theoretical frame that emphasizes relationships between teachers' unit structures and pedagogical purposes for using drawings. In particular, the present study builds on the distinction made in past research between reasoning with two and with three levels of quantitative units and demonstrates that reasoning with three levels of units is necessary but insufficient if teachers are to use students' reasoning with units as the basis for constructing generalized numeric methods for fraction arithmetic. Teachers need also to assemble three-level unit structures with flexibility supported by drawn versions of the distributive property.

Jansen, A. (2006). Seventh Graders' Motivations for Participating in two Discussion-Oriented Mathematics Classrooms. *Elementary School Journal, 106*, 409–428.
ABSTRACT: In this study I examined the self-reported motivational beliefs and goals supporting the participation of 15 seventh graders in whole-class discussions in 2 discussion-oriented Connected Mathematics Project classrooms. Through this qualitative investigation using semistructured interviews, I inductively identified and described the students' motivational beliefs and goals and relations among them. Results demonstrated beliefs that constrained students' participation and ones that supported their participation. Students with constraining beliefs were more likely to participate to meet goals of helping their classmates or behaving appropriately, whereas students with beliefs supporting participation were more likely to participate to demonstrate their competence and complete their work. Results illustrated how the experiences of middle school students in discussion-oriented mathematics classrooms involve navigating social relationships as much as participating in opportunities to learn mathematics.

Jansen, A. (2008). An investigation of relationships between seventh-grade students' beliefs and their participation during mathematics discussions in two classrooms. *Mathematical Thinking and Learning*, *10*(1), 68-100.
ABSTRACT: As mathematics teachers attempt to promote classroom discourse that emphasizes reasoning about mathematical concepts and supports students' development of mathematical autonomy, not all students will participate similarly. For the purposes of this research report, I examined how 15 seventh-grade students participated during whole-class discussions in two mathematics classrooms. Additionally, I interpreted the nature of students' participation in relation to their beliefs about participating in whole-class discussions, extending results reported previously (Jansen, 2006) about a wider range of students' beliefs

and goals in discussion-oriented mathematics classrooms. Students who believed mathematics discussions were threatening avoided talking about mathematics conceptually across both classrooms, yet these students participated by talking about mathematics procedurally. In addition, students' beliefs about appropriate behavior during mathematics class appeared to constrain whether they critiqued solutions of their classmates in both classrooms. Results suggest that coordinating analyses of students' beliefs and participation, particularly focusing on students who participate outside of typical interaction patterns in a classroom, can provide insights for engaging more students in mathematics classroom discussions.

Johanning, D. I. (2008). Learning to Use Fractions: Examining Middle School Students' Emerging Fraction Literacy, *Journal for Research in Mathematics*, *39*(3), 281-310.

ABSTRACT: This article describes 1 prevalent practice that a group of 6th- and 7th-grade students engaged in when they used fractions in the context of area and perimeter, decimal operations, similarity, and ratios and proportions. The study's results revealed that students did not simply take the concepts and skills learned in formal fractions units and use them in these other mathematical content areas. Their understanding of how to use fractions was tied to their understanding of situations in which they could be used.

Kaput, J., & Thompson, P. (1994). Technology in Mathematics Education Research - The 1st 25 Years in the JRME. *Journal for Research in Mathematics*, 25 (6), 676-684

Keller, B.A., Martin, W.G., & Hart, E.W. (2001). Illuminating NCTM's Principles and Standards for School Mathematics. *School Science and Mathematics*, *101*(6), 292-304.

ABSTRACT: Describes electronic resources designed to illuminate the National Council of Teachers of Mathematics' (NCTM) "Principles and Standards for School Mathematics". Provides a vehicle for further discussion of the vision put forth in the Standards.

Knuth, E. J., Alibali, M. W., McNeil, N. M., Weinberg, A., & Stephens, A. C. (2005). Middle school students' understanding of core algebraic concepts: Equivalence & variable. *ZDM*, *37*(1), 68-76.

ABSTRACT: Algebra is a focal point of reform efforts in mathematics education, with many mathematics educators advocating that algebriac reasoning should be integrated at all grade levels K-12. Recent research has begun to investigate algebra reform in the context of elementary school (grades K-5) mathematics, focusing in particular on the development of algebraic reasoning. Yet, to date, little research has focused on the development of algebraic reasoning in middle school (grades 6–8). This article focuses on moiddle school students' understanding of two core algebraic ideas—equivalence and variable—and the relationship of their understanding to performance on problems that require use of these two ideas. The data suggest that students' understanding of these core ideas influences their success in solving problems, the strategies they use in their solution processes, and the justifications they provide for their solutions. Implications for instruction and curricular design are discussed.

Kramarski, B., & Mevarech, Z.R. (2003). Enhancing mathematical reasoning in the classroom: The effects of cooperative learning and metacognitive training. *American Educational Research Journal*, *40*(1), 281-310.

ABSTRACT: The purpose of this study was to investigate the effects of four instructional methods on students' mathematical reasoning and metacognitive knowledge. The participants were 384 eighth-grade students. The instructional methods were cooperative learning combined with metacognitive training (COOP+META), individualized learning combined with metacognitive training (IND+META), cooperative learning without metacognitive training (COOP), and individualized learning without metacognitive training (IND). Results showed that the COOP+META group significantly outperformed the IND+META group, which in turn significantly outperformed the COOP and IND groups on graph

interpretation and various aspects of mathematical explanations. Furthermore, the metacognitive groups (COOP+META and IND+META) outperformed their counterparts (COOP and IND) on graph construction (transfer tasks) and metacognitive knowledge. This article presents theoretical and practical implications of the findings.

Kulm, G., Wilson, L.D., Kitchen, R. (2005). Alignment of Content and Effectiveness of Mathematics Assessment Items. *Educational Assessment*, *10*(4), 333 – 356.

ABSTRACT: Alignment has taken on increased importance given the current high-stakes nature of assessment. To make well-informed decisions about student learning on the basis of test results, assessment items need to be well aligned with standards. Project 2061 of the American Association for the Advancement of Science (AAAS) has developed a procedure for analyzing the content and quality of assessment items. The authors of this study used this alignment procedure to closely examine 2 mathematics assessment items. Student work on these 2 items was analyzed to determine whether the conclusions reached through the use of the alignment procedure could be validated. It was found that the Project 2061 alignment procedure was effective in providing a tool for in-depth analysis of the mathematical content of the item and a set of standards and in identifying 1 particular content standard that was most closely aligned with the standard. Through analyzing student work samples and student interviews, it was also found that students' thinking may not correspond to the standard identified as best aligned with the learning goals of the item. This finding highlights the potential usefulness of analyzing student work to clarify any additional deficiencies of an assessment item not revealed by an alignment procedure.

Lappan, G., & Ferrini-Mundy, J. (1993). Knowing and doing mathematics – a new vision for middle grades students. *Elementary School Journal, 93*(5), 625-639.

ABSTRACT: Research provides characteristics of effective programs for schools that want to restructure their programs to better meet the needs of students in the middle grades. Direction in revising both the curriculum and instruction in mathematics classrooms is provided by the National Council of Teachers of Mathematics in its two documents Curriculum and Evaluation Standards for School Mathematics and the Professional Standards for Teaching Mathematics. In this article we discuss mathematical tasks, classroom environments, and means of assessment that might encourage rich mathematical growth for middle grades students. Proposed changes in the mathematics content and processes emphasized in the middle grades are outlined. Shifts in the culture of the mathematics classroom that support students' development of mathematical power are described, and two problems that involve the mathematics content and processes we advocate are provided. Finally, we acknowledge the complexity of implementing such changes in tasks, environment, and assessment and point to the need for transformative research and structural shifts.

Lloyd, G. M., & Behm, S. L. (2005). Preservice elementary teachers' analysis of mathematics instructional materials. *Action in Teacher Education*, *26*(4), 48-62.

Lloyd, G.M. (2008). Curriculum use while learning to teach: One student teacher's appropriation of mathematics curriculum materials. *Journal for Research in Mathematics Education*, *39*(1), 63-94.

ABSTRACT: This article describes one student teacher's interactions with mathematics curriculum materials during her internship in a kindergarten classroom. Anne used curriculum materials from two distinct programs and taught lessons multiple times to different groups of children. Although she used each curriculum in distinct ways, her curriculum use was adaptive in both cases. Anne's specific ways of reading, evaluating, and adapting the curriculum materials contrast with previous results about beginning teachers' curriculum use. Several key factors appeared to contribute to Anne's particular ways of using the curriculum materials: features of her student-teaching placement, her personal resources and background, and characteristics of the materials. Directions for future research about student teachers' and other teachers' curriculum use are suggested in accord with these factors.

Maccini, P., & Gagnon, J. (2002). Perceptions and application of NCTM standards by special and general education teachers. *Exceptional Children*, 68 (3), 325-344
ABSTRACT: This study determined teachers' perceptions related to application of and barriers to implementation of the National Council of Teachers of Mathematics (NCTM) Standards with students labeled learning disabled (LD) and emotionally disturbed (ED). A stratified random sample of 129 secondary general education math and special education teachers responded to a mail survey. A majority of special education teachers indicated they had not beard of the NCTM Standards. Respondents reported teaching mostly basic skills/general math to secondary students with LD and ED, versus higher-level math, such as algebra and geometry. Teachers identified lack of adequate materials as a considerable barrier to successful implementation of activities based on the Standards. Implications for practice and future research are also provided.

McNeil, N., Grandau, L., Knuth, E., Alibali, M., Stephens, A., Hattikudur, S., & Krill, D. (2006). Middle-school students' understanding of the equal sign: The books they read can't help. *Cognition and Instruction*, 24 (3), 367-385
ABSTRACT: This study examined how 4 middle school textbook series (2 skills-based, 2 Standards-based) present equal signs. Equal signs were often presented in standard operations equals answer contexts (e.g., 3 + 4 = 7) and were rarely presented in nonstandard operations on both sides contexts (e.g., 3 + 4 = 5 + 2). They were, however, presented in other nonstandard contexts (e.g., 7 = 7). Two follow-up experiments showed that students' interpretations of the equal sign depend on the context. The other nonstandard contexts were better than the operations equals answer context at eliciting a relational understanding of the equal sign, but the operations on both sides context was best. Results suggest that textbooks rarely present equal signs in contexts most likely to elicit a relational interpretation-an interpretation critical to success in algebra.

Mendez, E., Sherin, M., & Louis, D. (2007). Multiple perspectives on the development of an eighth-grade mathematical discourse community. *Elementary School Journal*, 108 (1), 41-61
ABSTRACT: In this article we examine the development, over 1 year, of mathematical discourse communities in 2 eighth-grade mathematics classes in a suburban public middle school. The curriculum topics included probability, functions, graphing, data analysis, and pre-algebra. The 50 students were heterogeneously placed; most were from upper-middle-class families. Data included videotaped classroom observations, field notes, and teacher reflections. We explored both the students' growing competencies with mathematical discourse and changes in how the teacher attended to students' ideas. We present the teacher's impressions of the developing discourse community, and we applied 2 research-based lenses, robust mathematical discussion to assess the strength of student discourse, and professional vision for classroom discourse to analyze the ways in which the teacher paid attention to, and reflected on, ideas students raised during discussion. Applying multiple perspectives highlighted the complex nature of developing a discourse community and the challenges facing the teacher as he worked to orchestrate constructive dialogue for learning mathematics and to become aware of what students were learning in this context. We also provide an analytic tool, the robust mathematical discussion framework, that will be useful for teachers, teacher educators, And researchers to evaluate the evolving nature of classroom discourse.

Nathan, M.J., & Kim, S. (2007). Pattern Generalization with Graphs and Words: A Cross-Sectional and Longitudinal Analysis of Middle School Students' Representational Fluency. *Mathematical Thinking and Learning*, *9*(3), 193-219.
ABSTRACT: Cross-sectional and longitudinal data from students as they advance through the middle school years (grades 6-8) reveal insights into the development of students' pattern generalization abilities. As expected, students show a preference for lower-level tasks such as reading the data, over more distant predictions and generation of abstractions. Performance data also indicate a verbal advantage that shows greater success when working with words than graphs, a replication of earlier findings comparing words to symbolic equations. Surprisingly, students show a marked advantage with patterns presented in a

continuous format (line graphs and verbal rules) as compared to those presented as collections of discrete instances (point-wise graphs and lists of exemplars). Student pattern-generalization performance also was higher when words and graphs were combined. Analyses of student performance patterns and strategy use contribute to an emerging developmental model of representational fluency. The model contributes to research on the development of representational fluency and can inform instructional practices and curriculum design in the area of algebraic development. Results also underscore the impact that perceptual aspects of representations have on students' reasoning, as suggested by an Embodied Cognition view.

Patrick, H., Turner, J., Meyer, D., & Midgley, C. (2003). How teachers establish psychological environments during the first days of school: Associations with avoidance in mathematics. *Teachers College Record*, 105 (8), 1521-1558

ABSTRACT: Observations of the first days of school in eight sixth-grade classrooms identified three different classroom environments. In supportive environments teachers expressed enthusiasm for learning, were respectful, used humor, and voiced expectations that all students would learn. In ambiguous environments teachers were inconsistent in their support and focus on learning and exercised contradictory forms of management. In nonsupportive environments teachers emphasized extrinsic reasons for learning, forewarned that learning would be difficult and that students might cheat or misbehave, and exercised authoritarian control. Teachers' patterns of motivational and organizational discourse during math classes near the end of the year were consistent with the messages they expressed at the beginning of the year. When student reports of avoidance behaviors in math from fall and spring were compared with the qualitative analyses of these environments, students in supportive classrooms reported engaging in significantly less avoidance behavior than students in ambiguous or nonsupportive environments.

Phillips, E. (1998), Developing a coherent and focused K-12 algebra curriculum. In National Research Council (Ed.), The nature and role of algebra in the K-14 curriculum: Proceedings of a national symposium, (pp. 27-29). Washington, D.C.: National Academy Press.

Post, T.R., Harwell, M.R., Davis, J.D., Maeda, Y., Cutler, A., Andersen, E, et al. (2008). Standards-based mathematics curricula and middle-grades students' performance on standardized achievement tests. *Journal for Research in Mathematics Education*, *39*(2), 184-212.

ABSTRACT: Approximately 1400 middle-grades students who had used either the Connected Mathematics Project (CMP) or the MATHThematics (STEM or MT) program for at least 3 years were assessed on two widely used tests, the Stanford Achievement Test, Ninth Edition (Stanford 9) and the New Standards Reference Exam in Mathematics (NSRE). Hierarchical Linear Modeling (HLM) was used to analyze subtest results following methods described by Raudenbush and Bryk (2002). When Standards-based students' achievement patterns are analyzed, traditional topics were learned. Students' achievement levels on the Open Ended and Problem Solving subtests were greater than those on the Procedures subtest. This finding is consistent with results documented in many of the studies reported in Senk and Thompson (2003), and other sources.

Reys, R., Reys, B., Lapan, R., Holliday, G., & Wasman, D. (2003). Assessing the impact of standards-based middle grades mathematics curriculum materials on student achievement. *Journal for Research in Mathematics Education, 34*(1), 74-95.

ABSTRACT: This study compared the mathematics achievement of eighth graders in the first three school districts in Missouri to adopt NSF-funded Standards-based middle grades mathematics curriculum

materials (MATH Thematics or Connected Mathematics Project) with students who had similar prior mathematics achievement and family income levels from other districts. Achievement was measured using the mathematics portion of the Missouri Assessment Program (MAP) administered to all 8th graders in the state annually beginning in the spring of 1997. Significant differences in achievement were identified between students using Standards-based curriculum materials for at least 2 years and students from comparison districts using other curriculum materials. All of the significant differences reflected higher achievement of students using Standards-based materials. Students in each of the three districts using Standards-based materials scored higher in two content areas (data analysis and algebra), and these differences were significant.

Ridgway, J., Zawojewski, J., and Hoover, M. (2000) Problematising evidence-based policy and practice. *Evaluation and Research in Education*, *14*(3&4), 181-192.

ABSTRACT: Evidence-based policy and practice (EBPP) is widely advocated, and for good reason. Here, some challenges to EBPP are identified, illustrated by a large-scale evaluation of a major curriculum development project. Problems include: changes in educational goals, which necessitate the development of new measures of attainment; different time lines over which different patterns of result emerge; the challenge of defining a complex treatment, such as a new curriculum; and the variability of effect size in different classrooms. Several approaches are offered as responses to these challenges. The paper argues that much of the work on EBPP has focused on practice rather than on policy. Evidence-based policy will require detailed work on descriptions of systems and on systems change; more significantly, it will require the development of a new field of endeavor, associated with macro-systemic change, that is to say, the study of systems undergoing radical change.

Riordan, J., Noyce, P. (2001). The impact of two standards-based mathematics curricula on student achievement in Massachusetts. *Journal for Research in Mathematics, 32*(4), 368-398

ABSTRACT: Since the passage of the Education Reform Act in 1993, Massachusetts, has developed curriculum frameworks and a new statewide testing system. As school districts align curriculum and teaching practices with the frameworks, standards-based mathematics programs are beginning to replace more traditional curricula. This paper presents a quasi-experimental study using matched comparison groups to investigate the impact of one elementary and one middle school standards-based mathematics program in Massachusetts on student achievement. The study compares statewide standardized test scores of fourth-grade students using Everyday Mathematics and eighth-grade students using Connected Mathematics to test scores of demographically similar students using a mix of traditional curricula. Results indicate that students in schools using either of these standards-based programs as their primary mathematics curriculum performed significantly better on the 1999 statewide mathematics test than did students in traditional programs attending matched comparison schools. With minor exceptions, differences in favor of the standards-based program, remained consistent across mathematical strands, question types, and student sub-populations.

Rittle-Johnson, B., & Koedinger, K. (2005). Designing knowledge scaffolds to support mathematical problem solving. *Cognition and Instruction, 23*(3), 313-349 2005

ABSTRACT: We present a methodology for designing better learning environments. In Phase 1, 6th-grade students'(n = 223) prior knowledge was assessed using a difficulty factors assessment (DFA). The assessment revealed that scaffolds designed to elicit contextual, conceptual, or procedural knowledge each improved students' ability to add and subtract fractions. Analyses of errors and strategies along with cognitive modeling suggested potential mechanisms underlying these effects. In Phase 2, we designed an intervention based on scaffolding this prior knowledge and implemented the computer-based lessons in mathematics classes. In Phase 3, we used the DFA and supporting analyses to assess student learning from the intervention. The posttest results suggest that scaffolding conceptual, contextual, and procedural knowledge are promising tools for improving student learning.

Sherin, B. (2001). How students understand physics equations. *Cognition and Instruction, 19* (4), 479-541

ABSTRACT: What does it mean to understand a physics equation? The use of formal expressions in physics is not just a matter of the rigorous and routinized application of principles, followed by the formal manipulation of expressions to obtain an answer. Rather, successful students learn to understand what equations say in a fundamental sense; they have a feel for expressions, and this guides their work. More specifically, students learn to understand physics equations in terms of a vocabulary of elements that I call symbolic forms, Each symbolic form associates a simple conceptual schema with a pattern of symbols in an equation. This hypothesis has implications for how we should understand what must be taught and learned in physics classrooms. From the point of view of improving instruction, it is absolutely critical to acknowledge that physics expertise involves this more flexible and generative understanding of equations,and Our instruction should be geared toward helping students to acquire this understanding, The work described here is based on an analysis of a corpus of videotapes in which university students solve physics problems.

Sherin, M. G. (2002). A balancing act: Developing a Discourse Community in a Mathematical Classroom. *Journal of Mathematics Teacher Education, 5*, 205-233.

ABSTRACT: This article examines the pedagogical tensions involved in trying to use students' ideas as the basis for class discussion while also ensuring that discussion is productive mathematically. The data for this study of the teaching of one middle-school teacher come from observations and videotapes of instruction across a school year as well as interviews with the participating teacher. Specifically, the article describes the teacher's attempts to support a student-centered *process* of mathematical discourse and, at the same time, facilitate discussions of significant mathematical *content*. This tension in teaching was not easily resolved; throughout the school year the teacher shifted his emphasis between maintaining the process and the content of the classroom discourse. Nevertheless, at times, the teacher balanced these competing goals by using a ``filtering approach'' to classroom discourse. First multiple ideas are solicited from students to facilitate the process of student-centered mathematical discourse. Students are encouraged to elaborate their thinking, and to compare and evaluate their ideas with those that have already been suggested. Then, to bring the content to the fore, the teacher filters the ideas, focusing students' attention on a subset of the mathematical ideas that have been raised. Finally, the teacher encourages student-centered discourse about these ideas, thus maintaining a balance between process and content.

Slavin, R., Lake, C., & Groff, C. (2007). *Effective programs in middle and high school mathematics: A best-evidence synthesis.* United States Department of Education.

ABSTRACT: This article reviews research on the achievement outcomes of mathematics programs for middle and high schools. Study inclusion requirements included use of a randomized or matched control group, a study duration of at least twelve weeks, and equality at pretest. There were 100 qualifying studies, 26 of which used random assignment to treatments. Effect sizes were very small (median ES=+0.07 in 38 studies) for mathematics curricula, larger (median ES=+0.16 in 39 studies) for computer-assisted instruction, and largest (median ES=+0.21 in 23 studies) for instructional process programs, especially cooperative learning (median ES=+0.32 in 8 studies). Consistent with an earlier review of elementary programs, this article concludes that programs that affect daily teaching practices and student interactions have larger impacts on achievement measures than those emphasizing textbooks or technology alone.

Smith, J., & Star, J. (2007). Expanding the notion of impact of K-12 Standards-based mathematics and reform calculus programs. *Journal for Research in Mathematics Education, 38*(1), 3-34

ABSTRACT: Research on the impact of Standards-based, K-12 mathematics programs (i.e., written curricula and associated teaching practices) and of reform calculus programs has focused primarily on student achievement and secondarily, and rather ineffectively, on student attitudes. This research has shown that reform programs have competed well with traditional programs in terms of student achievement. Results for attitude change have been much less conclusive because of conceptual and methodological

problems. We critically review this literature to argue for broader conceptions of impact that target new dimensions of program effect and examine interactions between dimensions. We also briefly present the conceptualization, design, and broad results of one study, the Mathematical Transitions Project (MTP), which expanded the range of impact along those lines. The MTP results reveal substantial diversity in students' experience within and between research sites, different patterns of experience between high school and university students, and surprising relationships between achievement and attitude for some students.

Spielman, L. J. & Lloyd, G. M. (2004). The impact of enacted mathematics curriculum models on prospective elementary teachers' course perceptions and beliefs. *School Science and Mathematics, 104*(1), 32-44.

Star, J.R., & Hoffmann, A.J. (2002). Assessing students' conceptions of reform mathematics. In Mewborn, D., Sztajn, P., White, D., Wiegel, H., Bryant, R., & Nooney, K. (Eds.), Proceedings of the twenty-fourth annual meeting of the North American chapter of the International Group for the Psychology of Mathematics Education (pp. 1729-1732). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

ABSTRACT: As the use of NSF-sponsored, reform-oriented mathematics curricula has become more prevalent across the US, an increasing number of researchers are attempting to study the "impact" of reform. In particular, mathematics educators are interested in determining whether reforms are having the desired effects on students, particularly with respect to the learning of mathematical content and the improvement of attitudes about mathematics. In this effort, researchers have used a variety of methods, and have looked at a variety of variables, in order to assess the impact of reform. In many cases, such research assesses reform by looking closely at students' scores on tests or their strategies for solving certain kinds of problems. For example, Riordan & Noyce (2001) assessed reform's impact by comparing students' scores on standardized achievement tests. Other researchers have used structured interviews, classroom observations, and more interpretive or ethnographic methods to assess the impact of reform (e.g., Boaler,1997). Both of these methodologies are useful in assessing the impact that reform mathematics curricula are having on students. An alternative evaluation of the impact of reform that has not been as widely used is through the use of survey instruments. Surveys have been widely and reliably used to assess students' motivation (Pintrich, Smith, Garcia, & McKeachie, 1993), beliefs and attitudes (Kenney & Silver, 1997), and interest (Köller, Baumert, & Schnabel, 2001). We propose to add to this literature by using a survey to study the impact of reform on students' conceptions of mathematics.

Star, J. R., Smith III, J.P., & Hoffmann, A. J. (2004). *Students' perceptions of difference between traditional and Standards-based mathematics curricula*. Paper presented at the 2004 Research Presession of the annual meeting of the National Council of Teacher of Mathematics, Philadelphia, PA.

Star, J. R., & Hoffmann, A. J. (2005). Assessing the Impact of Standards-based Curricula: Investigating Students' Epistemological Conceptions of Mathematics. *The Mathematics Educator*, *15*(2), 25-34

ABSTRACT: Since the advent of the NCTM *Standards* (1989), mathematics educators have been faced with the challenge of assessing the impact of *Standards*-based (or "reform") curricula. Research on the impact of *Standards*-based curricula has predominantly focused on student achievement; here we consider an alternative: Students' epistemological conceptions of mathematics. 297 participants were administered a Likert-scale survey instrument, the Conceptions of Mathematics Inventory. Of these, 163 had not experienced *Standards*-based curricula, while the rest had used a *Standards*-based curriculum for over three years. Our results indicate that students at the *Standards*-based site expressed more sophisticated epistemological conceptions of mathematics than those of the students from the non-*Standards*-based site.

We interpret this result to suggest that implementation of *Standards*-based curricula may be having an effect on students' epistemological conceptions of mathematics.

Star, J.R., Smith, J.P., & Jansen, A. (2008). What students notice as different between reform and traditional mathematics programs. *Journal for Research in Mathematics Education*, *39*(1), 9-32.
ABSTRACT: Research on the impact of Standards-based mathematics and reform calculus curricula has largely focused on changes in achievement and attitudes, generally ignoring how students experience these new programs. This study was designed to address that deficit. As part of a larger effort to characterize students' transitions into and out of reform programs, we analyzed how 93 high school and college students perceived Standards-based and reform calculus programs as different from traditional ones. Results show considerable diversity across and even within sites. Nearly all students reported differences, but high-impact differences, like Content, were not always related to curriculum type (reform or traditional). Students' perceptions aligned moderately well with those of reform curriculum authors, e.g., concerning Typical Problems. These results show that students' responses to reform programs can be quite diverse and only partially aligned with adults' views.

Stylianides, G.J. (2007). Investigating the Guidance Offered to Teachers in Curriculum Materials: The Case of Proof in Mathematics. *International Journal of Science and Mathematics Education*, *6*(1), 191 -215.

Tarr, J.E., Reys, R.E., Reys, B.J., Chavez, O., Shih, J., & Osterlind, S.J. (In press, expected May 2008). The impact of middle grades mathematics curricula on student achievement and the classroom learning environment. *Journal for Research in Mathematics Education*, *39*(3), xx-xxx.

Turner, J., Midgley, C., Meyer, D., Gheen, M., Anderman, E., Kang, Y., & Patrick, H. (2002). The classroom environment and students' reports of avoidance strategies in mathematics: A multimethod study. *Journal of Educational Psychology, 94* (1), 88-106
ABSTRACT: The relation between the learning environment (e.g., students' perceptions of the classroom goal structure and teachers' instructional discourse) and students' reported use of avoidance strategies (self-handicapping, avoidance of help seeking) and preference to avoid novelty in mathematics was examined. Quantitative analyses indicated that students' reports of avoidance behaviors varied significantly among classrooms. A perceived emphasis on mastery goals in the classroom was positively related to lower reports of avoidance. Qualitative analyses revealed that teachers in high-mastery/low-avoidance and low-mastery/high-avoidance classrooms used distinctively different patterns of instructional and motivational discourse. High incidence of motivational support was uniquely characteristic of high-mastery/low-avoidance classrooms, suggesting that mastery goals may include an affective component. Implications of the results for both theory and practice are discussed.

Turner, J., & Meyer, D. (2004). A classroom perspective on the principle of moderate challenge in mathematics. *Journal of Educational Research, 97*(6), 311-318
ABSTRACT: The authors reviewed the research on challenge as a motivator, with a view toward application in mathematics classrooms. The authors conclude that traditional motivational research, with its focus on individual differences and decontextualized tasks, is not readily applicable to classrooms. They argue that a combination of challenging instruction and positive affective support is necessary for promoting motivation in mathematics classrooms. The authors describe the kinds of classroom contexts that are likely to support challenge seeking and learning in mathematics and illustrate an example of a teacher who used challenge effectively in her 7th-grade mathematics classes. Finally, the authors suggest that a focus on creating contexts that support challenge seeking offers a powerful application of this motivational tool for all learners.

Turner, J., & Patrick, H. (2004). Motivational influences on student participation in classroom learning activities. *Teachers College Record, 106*(9), 1759-1785
ABSTRACT: This study examined how one type of student work habit-classroom participation-is related to a combination of both student factors (math achievement, personal achievement goals, perceptions of classroom goal structures, and teacher support) and features of the classroom context (teachers' instructional practices, average perceptions of classroom goal structures). We focused on the participation of two students in mathematics class during both sixth and seventh grades. Differential teacher expectations, calling patterns, and instructional and motivational support and nonsupport interacted with beliefs and behaviors of both students, and those interactions were associated with different patterns of participation each year. Results suggest that student participation is malleable rather than stable and emphasize the potential of teacher practices to both support and undermine the development of student work habits.

Wasserman, Laurie. (2008). A Marriage Made in Math Class. *Teacher Magazine, 2*(1).