ARTICLES IN RESEARCH JOURNALS AND RESEARCH REPORTS ON CMP


American Association for the Advancement of Science: Project 2061 (2000). Middle grades mathematics textbooks: A benchmarks-based evaluation. Evaluation report prepared by the American Association for the Advancement of Science.


ABSTRACT: 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.


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.


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.


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.


**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.


**ABSTRACT:** Contextual problems involving rational numbers and proportional reasoning were presented to seventh grade students with different curricular experiences. There is strong evidence that students in reform curricula, who are encouraged to construct their own conceptual and procedural knowledge of proportionality through collaborative problem solving activities, perform better than students with more traditional, teacher-directed instructional experiences. Seventh grade students, especially those who study the new curricula, are capable of developing their own repertoire of sense-making tools to help them to produce creative solutions and explanations. This is demonstrated through analysis of solution strategies applied by students to a variety of rate problems.


**ABSTRACT:** Discussions about school mathematics often address the importance of reasoning and proving for building students' understanding of mathematics. However, there is little research examining how teachers enact tasks designed to engage students in justifying and proving in the classroom. This article presents results of a study investigating the processes and outcomes of implementing proof-related tasks in the classroom. Data collection consisted of observations of 7 middle school classrooms during implementation of proof-related tasks-tasks providing opportunities for students to produce generalizations, conjectures, or proofs-in the Connected Mathematics Project (CMP) curriculum by teachers experienced in using the materials. The findings suggest that students' experiences with such tasks are insufficient for developing an understanding of what constitutes valid mathematical justification.


**ABSTRACT:** In this study, we used problem posing as a measure of the effect of middle-school curriculum on students' learning in high school. Students who had used a standards-based curriculum in middle school performed equally well or better in high school than students who had used more traditional curricula. The findings from this study not only show evidence of strengths one might expect of students who used the standards-based reform curriculum but also bolster the feasibility and validity of problem posing as a measure of curriculum effect on student learning. In addition, the findings of this study demonstrate the usefulness of employing a qualitative rubric to assess different characteristics of students' responses to the posing tasks. Instructional and methodological implications of this study, as well as future directions for research, are discussed.


**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 problem solving activities. Nevertheless, these problem-solving activities should be useful references for helping students make sense of mathematics.

**ABSTRACT:** This paper discusses the approaches to teaching linear equation solving that are embedded in a Standards-based mathematics curriculum (CMP) and in a traditional mathematics curriculum (Glencoe Mathematics) in the United States. Overall, the CMP curriculum takes a functional approach to teach equation solving, while Glencoe Mathematics takes a structural approach to teach equation solving. The functional approach emphasizes the important ideas of change and variation in situations and contexts. It also emphasizes the representation of relationships between variables. The structural approach, on the other hand, requires students to work abstractly with symbols, and follow procedures in a systematic way. The CMP curriculum may be regarded as a curriculum with a pedagogy that emphasizes predominantly the procedural aspects of equation solving, while Glencoe Mathematics may be regarded as a curriculum with a pedagogy that emphasizes predominantly the conceptual aspects of equation solving. The two curricula may serve as concrete examples of functional and structural approaches, respectively, to the teaching of algebra in general and equation solving in particular.


**ABSTRACT:** Evaluated the Connected Mathematics Project (CMP), a middle school reform mathematics curriculum used in Louisiana's Lafayette parish. Analysis of Iowa Test of Basic Skills and Louisiana Education Assessment Program mathematics data indicated that CMP schools significantly outperformed non-CMP schools. Surveys of teachers and students showed that both groups believed the program was helping students become better problem solvers.


**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 representing data graphically, interpreting the meaning of typicality, and plotting 0 above the x-axis.


**ABSTRACT:** The set of papers presented in this issue comprise a multiple-case study which attends to instructional resources—teacher knowledge and curriculum materials—to understand how they individually and jointly contribute to instructional quality. We approach this inquiry by comparing lessons taught by teachers with differing mathematical knowledge for teaching who were using either the same or different editions of a US Standards-based curriculum. This introductory paper situates the work reported in the next four case-study papers by outlining the analytic framework guiding the exploration and detailing the methods for addressing the research questions.


**ABSTRACT:** This paper examines the contribution of mathematical knowledge for teaching (MKT) and curriculum materials to the implementation of lessons on integer subtraction. In particular, it investigates the instruction of three teachers with differing MKT levels using two editions of the same set of curriculum materials that provided different levels of support. This variation in MKT level and curriculum support facilitated exploring the distinct and joint contribution of MKT and the curriculum materials to instructional quality. The analyses suggest that MKT relates positively to teachers' use of representations, provision of explanations, precision in language and notation, and ability to capitalize on student contributions and move the mathematics along in a goal-directed manner. Curriculum materials set the stage for attending to the meaning of integer subtraction and appeared to support teachers' use of representations, provision of explanations, and precision in language and notation. More critically, the findings suggest that less educative curriculum materials, coupled with low levels of MKT, can lead to problematic instruction. In contrast, educative materials can help low-MKT teachers provide adequate instruction, while higher MKT levels seem to enable teachers to compensate for curriculum limitations.

**ABSTRACT:** This study characterizes the teacher learning that stems from successive enactments of innovative curriculum materials. This study conceptualizes and documents the formation of curriculum-context knowledge (CCK) in three experienced users of a Standards-based mathematics curriculum. I define CCK as the knowledge of how a particular set of curriculum materials functions to engage students in a particular context. The notion of CCK provides insight into the development of curricular knowledge and how it relates to other forms of knowledge that are relevant to the practice of teaching, such as content knowledge and pedagogical content knowledge. I used a combination of video-stimulated and semistructured interviews to examine the ways the teachers adapted the task representations in the units over time and what these adaptations signaled in terms of teacher learning. Each teacher made noticeable adaptations over the course of three or four enactments that demonstrated learning. Each of the teachers developed a greater understanding of the resources in the respective units as a result of repeated enactments, although there was some important variation between the teachers. The learning evidenced by the teachers in relation to the units demonstrated their intricate knowledge of the curriculum and the way it engaged their students. Furthermore, this learning informed their instructional practices and was intertwined with their discussion of content and how best to teach it. The results point to the larger need to account for the knowledge necessary to use Standards-based curricula and to relate the development and existence of well-elaborated knowledge components to evaluations of curricula.


**ABSTRACT:** This study investigates how teacher attention to student thinking informs adaptations of challenging tasks. Five teachers who had implemented challenging mathematics curriculum materials for three or more years were videotaped enacting instructional sequences and were subsequently interviewed about those enactments. The results indicate that the two teachers who attended closely to student thinking developed conjectures about how that thinking developed across instructional sequences and used those conjectures to inform their adaptations. These teachers connected their conjectures to the details of student strategies, leading to adaptations that enhanced task complexity and students’ opportunity to engage with mathematical concepts. By contrast, the three teachers who evaluated students’ thinking primarily as right or wrong regularly adapted tasks in ways that were poorly informed by their observations and that reduced the complexity of the tasks. The results suggest that forming communities of inquiry around the use of challenging curriculum materials is important for providing opportunities for students to learn with understanding.


**ABSTRACT:** This study explores the extent to which a teacher elicited students’ mathematical reasoning through the use of challenging tasks and the role her knowledge played in doing so. I characterised the teacher’s knowledge in terms of a local theory of instruction, a form of pedagogical content knowledge that involves an empirically tested set of conjectures situated within a mathematical domain. Video data were collected and analysed and used to stimulate the teacher’s reflection on her enactments of an instructional sequence. The teacher, chosen for how she consistently elicited student reasoning, showed evidence of possessing a local theory in that she articulated the ways student thinking developed over time, the processes by which that thinking developed, and the resources that facilitated the development of student thinking. Her knowledge informed how she revised and enacted challenging tasks in ways that elicited and refined student thinking around integer addition and subtraction. Furthermore, her knowledge and practices emphasised the progressive formalisation of students’ ideas as a key learning process. A key implication of this study is that teachers are able to develop robust knowledge from enacting challenging tasks, knowledge that organises how they elicit and refine student reasoning from those tasks.


**ABSTRACT:** This study focused on the use of curriculum materials for three teachers who had enacted instructional sequences from the materials on multiple occasions. The study investigated how the teachers drew on the materials, what they understood about the curriculum resources, and how they connected their use of the materials to their observations of student thinking. There were similarities across the teachers, particularly with respect to their goals and how they read and followed recommendations in the teacher resource materials. There were differences in how their task revisions were in response to what they observed about student thinking. The teacher who most intensively observed student thinking made connections between her interpretations of students’ strategies and her use of the curriculum resources, allowing her to design learned adaptations. Learned adaptations required both an understanding of the design rationale and empirically developed knowledge of how that rationale played out in practice. The empirically developed knowledge could not be
totally anticipated by the designers, in part because it developed within a particular context by a teacher with particular characteristics. The case of the teacher who developed learned adaptations showed how these complementary forms of knowledge helped her to use the curriculum resources in ways that enhanced students’ opportunities for sense making. Furthermore, her adaptations were intended to facilitate success not only at the task level, but also across instructional sequences as well. This study also shows how professional vision is not limited to informing only in-the-moment instructional decisions, but also to the use of curriculum materials.

Cobb, P., & Jackson, K. (2012). Analyzing educational policies: A learning design perspective. The Journal of the Learning Sciences, 21(4), 487-521. ABSTRACT: In this article, we describe and illustrate an analytical perspective in which educational policies are viewed as designs for supporting learning. This learning design perspective is useful when designing policies, when adapting policies to particular school and district settings during implementation, and when revising policies after implementation to make them more effective. Analyzed from this perspective, a policy comprises the goals for the learning of members of the target group, the supports for their learning, and an often implicit rationale for why these supports might be effective. We clarify that this perspective on policies has broad generality. In addition, we illustrate that personnel at all levels of the US education system both formulate policies designed to influence others’ practices, and are practitioners targeted by others’ policies. The standard image of a single policy traveling down through an education system with more or less fidelity is therefore displaced by that of people at multiple levels of a system reorganizing their practices in school and district settings shaped by others’ policymaking efforts.


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.

ABSTRACT: The purpose of this study was to compare the acquisition of the van Hiele levels of sixth-grade students engaged in instruction using a reform-based curriculum with sixth-grade students engaged in instruction using a traditional curriculum. There were 273 sixth-grade mathematics students, 123 in the control group and 150 in the treatment group, involved in the study. The researcher administered a multiple-choice geometry test to the students before and after a five-week of instruction. The test was designed to detect students’ reasoning stages in geometry. The independent-samples t-test, the paired-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.


ABSTRACT: The aim of this study was to compare the acquisition of the van Hiele levels of sixth-grade students engaged in instruction using a reform-based curriculum with sixth-grade students engaged in instruction using a traditional curriculum. There were 273 sixth-grade mathematics students, 123 in the control group and 150 in the treatment group, involved in the study. The researcher administered a multiple-choice geometry test to the students before and after a five-week of instruction. The test was designed to detect students’ reasoning stages in geometry. The independent-samples t-test, the paired-samples t-test, and ANCOVA with \( \alpha = .05 \) were used to analyze the data. The study demonstrated that
although both types of instructions had positive impacts on the students’ progress, there was no statistical significant difference detected in the acquisition of the levels between the groups.


**ABSTRACT:** Traditionally, mathematics has been considered easy for English language learners (ELLs) due to the belief that math is a “universal language.” At the same time, reform-oriented mathematics curricula, designed to promote mathematical discourse, are increasingly being adopted by schools serving large numbers of ELLs. CMP, the Connected Math Project, is one such reform-oriented curriculum. Taking a community-of-practice approach, this article compares how three 6th grade mathematics teachers in a Spanish/English community utilized language to draw ELLs into content and classroom participation. Teacher use of standard language fell into 2 categories: (a) modeling and (b) eliciting student practice. In the teacher's class that regularly elicited language, ELLs were successful on academic assessments; whereas students in the other 2 classes were not. Results suggest that CMP facilitates ELLs' learning and that a focus on mathematical language and elicitation benefits the development of mathematical discourse and content knowledge.


**ABSTRACT:** The vision for school mathematics described by the National Council of Teachers of Mathematics (NCTM) suggests a need for new approaches to the teaching and learning of mathematics, as well as new curriculum materials to support such change. This article discusses implications of the NCTM standards for mathematics curriculum and instruction and provides three examples of lessons from problem-based curricula for various grade levels. These examples illustrate how the teaching of important mathematics through student exploration of interesting problems might unfold, and they highlight the differences between a problem-based approach and more traditional approaches. Considerations for teaching through a problem-based approach are raised, as well as reflections on the potential impact on student learning.


**ABSTRACT:** This paper illustrates ways to employ teacher portfolios to improve the quality of methods course experiences for prospective mathematics teachers. Based upon research conducted in an undergraduate teacher preparation program, this case study describes how the author used teacher portfolios to mentor prospective teachers in new ways. The case describes the author's experiences through a case study of his assessment of and response to one prospective teacher's portfolio. This portfolio illustrated themes that were present in other teachers' portfolios, but did so in ways that highlighted strategies for change to the methods course. Through the lens of this teacher's portfolio the author identified specific ways that the prospective teacher's beliefs were impacting her teaching practice, a result that enabled him to better help all of the teachers in the methods course reflect on their teaching. By providing a detailed account of the feedback process that led to this result, this paper illustrates how mathematics teacher educators can use prospective teachers' portfolios to enrich the quality of their methods courses.


**ABSTRACT:** Middle-school students are expected to understand key components of graphs, such as slope and y-intercept. However, constructing graphs is a skill that has received relatively little research attention. This study examined students' construction of graphs of linear functions, focusing specifically on the relative difficulties of graphing slope and y-intercept. Sixth-graders’ responses prior to formal instruction in graphing reveal their intuitions about slope and y-intercept. Sixth- and seventh- and eighth-graders’ performance indicates how instruction shapes understanding. Students' performance in graphing slope and y-intercept from verbally presented linear functions was assessed both for graphs with quantitative features and graphs with qualitative features. Students had more difficulty graphing y-intercept than slope, particularly in graphs with qualitative features. Errors also differed between contexts. The findings suggest that it would be valuable for additional instructional time to be devoted to y-intercept and to qualitative contexts.


**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.


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.


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.


ABSTRACT: This paper draws on four case studies to perform a cross-case analysis investigating the unique and joint contribution of mathematical knowledge for teaching (MKT) and curriculum materials to instructional quality. As expected, it was found that both MKT and curriculum materials matter for instruction. The contribution of MKT was more prevalent in the richness of the mathematical language employed during instruction, the explanations offered, the avoidance of errors, and teachers' capacity to highlight key mathematical ideas and use them to weave the lesson activities. By virtue of being ambitious, the curriculum materials set the stage for engaging students in mathematical thinking and reasoning; at the same time, they amplified the demands for enactment, especially for the low-MKT teachers. The analysis also helped develop three tentative hypotheses regarding the joint contribution of MKT and the curriculum materials: when supportive and when followed closely, curriculum materials can lead to high-quality instruction, even for low-MKT teachers; in contrast, when unsupportive, they can lead to problematic instruction, particularly for low-MKT teachers; high-MKT teachers, on the other hand, might be able to compensate for some of the limitations of the curriculum materials and offer high-quality instruction. This paper discusses the policy implications of these findings and points to open issues warranting further investigation.


ABSTRACT: This paper documents the ways mathematical knowledge for teaching (MKT) and curriculum materials appear to contribute to the enactment of a 7th grade Connected Mathematics Project lesson on comparing ratios. Two teachers with widely differing MKT scores are compared teaching this lesson. The comparison of the teachers' lesson enactments suggests that MKT appears to contribute to the mathematical richness of the lesson, teacher ability to capitalize on student ideas, and capacity to emphasize and link key mathematical ideas; yet the relationship of MKT to whether and how students participated in mathematical reasoning was more equivocal. Curriculum materials seemed to contribute to instructional quality, in that the novel tasks contained in the curriculum laid the groundwork for in-depth student problem-solving experiences; they also prevented the low-MKT teacher from making a mathematical error. At the
same time, these ambitious materials influenced enactment because of the difficulties they caused teachers: the lesson's tasks needed to be 'repaired' to enable students to engage with the main mathematical ideas, and off-track student responses to these tasks required remediation. Only the higher-MKT teacher was successfully able to meet the challenge, a finding suggestive of the confluence of MKT and the curriculum materials in informing instructional quality.


ABSTRACT: The authors focused on 1 middle-grades mathematics teacher's identity and her efforts to implement standards-based instructional practices. As professionals, teachers participate in multiple professional communities and must negotiate and manage conflicting agendas. The authors analyze how the contexts of these communities influence the teacher's identity and thus her teaching of mathematics.


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.


ABSTRACT: The "Connected Mathematics Project" ("CMP") is a mathematics curriculum designed for students in grades 6-8. Each grade level of the curriculum is a full-year program and covers numbers, algebra, geometry/measurement, probability, and statistics. The curriculum uses an investigative approach, and students utilize interactive problems and everyday situations to learn math concepts. The What Works Clearinghouse (WWC) reviewed 79 studies of "CMP." No studies of "CMP" meet WWC evidence standards, and one study meets WWC evidence standards with reservations. The one study included more than 12,000 students from grades 6-8 in Texas. Based on this study, the WWC considers the extent of evidence for "CMP" to be small for math achievement. "CMP" was found to have no discernible effects on math achievement. Appended to this report are: (1) Study characteristics: Schneider, 2000 (quasi-experimental design); (2) Outcome measure for the math achievement domain; (3) Summary of study findings included in the rating for the math achievement domain; (4) Summary of cohort findings for the math achievement domain; (5) "CMP" rating for the math achievement domain; and (6) Extent of evidence by domain. (Contains 9 notes.) [The following study is reviewed in this intervention report: Schneider, C. L. (2000). "Connected Mathematics and the Texas Assessment of Academic Skills" (Doctoral dissertation, University of Texas at Austin, 2000). Dissertation Abstracts International, 62*(02), 503A. (UMI No. 3004373). For previous WWC intervention reports on the "Connected Mathematics Project," see ED499297 (2007) and ED485389 (2004).]


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.

9
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.


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.


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 an 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.


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.


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.

ABSTRACT: We present a case study of teaching and learning fraction addition on number lines in one sixth-grade classroom that used the Connected Mathematics Project Bits and Pieces II materials. Our main research questions were (1) What were the primary cognitive structures through which the teacher and students interpreted the lessons? and (2) Were the teacher's and her students' interpretations similar or different, and why? The data afforded particularly detailed analyses of cognitive structures used by the teacher and one student to interpret fractions and their representation on number lines.


ABSTRACT: This article specifies how the setup, or introduction, of cognitively demanding tasks is a crucial phase of middle-grades mathematics instruction. The authors report on an empirical study of 165 middle-grades mathematics teachers' instruction that focused on how they introduced tasks and the relationship between how they introduced tasks and the nature of students' opportunities to learn mathematics in the concluding whole-class discussion.


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.


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.


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.


ABSTRACT: Research has shown that prediction has the potential to promote the teaching and learning of mathematics
because it can be used to enhance students' thinking and reasoning at all grade levels in various topics. This article addresses the effectiveness of using prediction on students' understanding and reasoning of mathematical concepts in a middle school algebra context. In the treatment classroom, prediction questions were utilized at the launch of each algebra lesson, and in the control classroom such questions were not used. Both classrooms were taught by the same teacher and used the same curriculum. After completing each of the linear and exponential units, the two classrooms were compared in terms of their mathematical understanding and reasoning through unit assessments. Overall, the treatment classroom outperformed the control classroom on the unit assessments. This result supports that prediction is a valid construct with respect to enhanced conceptual understanding and mathematical reasoning.

ABSTRACT: In this article, we describe how using prediction during instruction can create learning opportunities to enhance the understanding and doing of mathematics. In doing so, we characterize the nature of the predictions students made and the levels of sophistication in students' reasoning within a middle school algebra context. In this study, when linear and exponential functions were taught, prediction questions were posed at the launch of the lessons to reflect the mathematical ideas of each lesson. Students responded in writing along with supportive reasoning individually and then discussed their predictions and rationale. A total of 395 prediction responses were coded using a dual system: sophistication of reasoning, and the mechanism students appeared to utilize to formulate their prediction response. The results indicate that using prediction provoked students to connect among mathematical ideas that they learned. It was apparent that students also visualized mathematical ideas in the problem or the possible results of the problem. These results suggest that using prediction in fact provides learning opportunities for students to engage in mathematical sense making and reasoning, which promotes students' understanding of the mathematics that they learn.

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.


ABSTRACT: As an exploratory investigation, this study aims to analyze non-textual elements in some Korean and US mathematics textbooks using a conceptual framework whose components include accuracy, connectivity, contextuality, and conciseness. By analyzing three US textbooks and three Korean ones, the study not only shows patterns in the use of non-textual elements in mathematics textbooks in different contexts but also provides insights into how to assess the quality of these elements in mathematics textbooks, which I hope will contribute to the provision of more meaningful and productive learning opportunities to school children. Overall, the results from this study show that there is significant difference across topics and textbooks, which implies different opportunities to learn through non-textual elements. This study makes a unique contribution to the conceptualization of non-textual elements in mathematics education and has implications for textbook analysis and curriculum development.

ABSTRACT: Algebra is a focal point of reform efforts in mathematics education, with many mathematics educators advocating that algebraic 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 middle 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.


**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.


**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.


**ABSTRACT:** This study addresses the nexus of two critical challenges for today's mathematics teacher. On the one hand, teaching for understanding for all students is the goal of most mathematics teachers. However, many teachers also must acknowledge and address the requirement that students do well on high stakes tests. This study analyzed data on 6th grade students' performance and achievement after a year-long implementation of Connected Mathematics (CMP). Texas Assessment of Academic Skills (TASS) data were analyzed, comparing students' achievement from 5th to 6th grade. The variables of at-risk, socio-economic status, and ethnicity were analyzed to determine the nature and practical importance of adopting CMP. The results indicated that the overall gain from using CMP materials over the previous year's mathematics achievement was four points (p less than 0.01). The at-risk students demonstrated a mean 10-point gain (p less than 0.01) while the non-at-risk students demonstrated a mean 2-point gain.


**ABSTRACT:** The publication of the National Council of Teachers of Mathematics initial Standards (1999) has acted as a catalyst to begin reforming the way mathematics is taught in the USA. However, the literature regarding reform movements suggests that changing our educational systems requires overcoming many barriers and is thus difficult to achieve. Reform in mathematics education, like reform movements in other areas of education, has thus been slow to take hold. One structure that has been shown to support educational reform, particularly instructional reform, has been teacher community. This paper discusses a professional development intervention that attempted to start a professional community among a group of secondary mathematics teachers through in-service work on mathematical problem solving and technology. The results of this study suggest that the use of mathematical content explorations in professional development settings provides a means to help mathematics teachers build professional communities. Together, these two
components—mathematical content explorations and teacher community—provided these secondary mathematics teachers with a strong foundation for engaging in the reform of their mathematics classes.


ABSTRACT: Time issues raised by sixth- and seventh-grade teachers involved in field testing an NSF-sponsored investigation-centered mathematics curriculum (the Connected Mathematics Project--CMP) for middle-grades students were examined in this study. Questions investigated included the following: How much scheduled time is actually available for mathematics instruction in elementary and middle schools and how is it configured? How do project teachers and students spend their time in class? What factors influence CMP teachers’ pacing through this new curriculum? Findings indicate that teaching in the spirit of the current mathematics education reform movement may be highly dependent upon flexibility in class scheduling. Innovations in teaching mathematics (e.g., increased group work, writing, extended projects, and alternative forms of assessment) seem to require additional time, and new ways of thinking about using class time.


ABSTRACT: The National Council of Teachers of Mathematics has released guidelines on educational reform in the development of mathematical curriculum, teaching methods and assessment. Some teachers were able to adapt to change without much problems, while others exercised a more cautious disposition to change. Reactions to teaching recommendations were conditioned by course content, instruction method, environmental factors and teacher's desire for a problem-free school day.


ABSTRACT. Reform in mathematics education has been stimulated and propelled by the publication of standards documents by the National Council of Teachers of Mathematics. This article examines the vision of teacher decision making that is portrayed in NCTM Professional Teaching Standards: choosing worthwhile mathematical tasks, orchestrating and monitoring classroom discourse, creating an environment for learning, and analyzing one's practice. The philosophical orientation and the set of commitments to teaching and learning on which the standards are based include stances on equity, curriculum, teaching, and learning. These stances are summarized under the following headings: inclusiveness, depth over coverage, teaching for understanding, active engagement of students, curriculum investigations, applications, and connections.


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ABSTRACT. During 46 lessons in Euclidean geometry, sixth-grade students (ages 11, 12) were initiated in the mathematical practice of inquiry. Teachers supported inquiry by soliciting student questions and orienting students to related mathematical habits-of-mind such as generalizing, developing relations, and seeking invariants in light of change, to sustain investigations of their questions. When earlier and later phases of instruction were compared, student questions reflected an increasing disposition to seek generalization and to explore mathematical relations, forms of thinking valued by the discipline. Less prevalent were questions directed toward search for invariants in light of change. But when they were posed, questions about change tended to be oriented toward generalizing and establishing relations among mathematical objects and properties. As instruction proceeded, students developed an aesthetic that emphasized the value
of questions oriented toward the collective pursuit of knowledge. Post-instructional interviews revealed that students experienced the forms of inquiry and investigation cultivated in the classroom as self-expressive.


ABSTRACT: This paper compares lessons on linear equations from the same curriculum materials taught by two teachers of different levels of mathematical knowledge for teaching (MKT). The analysis indicates that the mathematical quality of instruction in these two classrooms appears to be a function of differences in MKT. Although the two teachers were teaching from the same curriculum materials, the teacher with higher MKT had more complete and concise ways to describe key concepts, had multiple ways to represent ideas about linear equations, could move nimbly among different mathematical expressions of linear relationships, and gave students a larger role in articulating the mathematical ideas of the lesson. However, curriculum materials seem to have moderated what would otherwise have been larger disparities in the quality of instruction between the two teachers. The lower-MKT teacher made minor mathematical errors, stayed on topic, and defined concepts in reasonably accurate ways when he followed the curriculum materials closely.


ABSTRACT: The prevalence of prediction in grade-level expectations in mathematics curriculum standards signifies the importance of the role prediction plays in the teaching and learning of mathematics. In this article, we discuss benefits of using prediction in mathematics classrooms: (1) students' prediction can reveal their conceptions, (2) prediction plays an important role in reasoning and (3) prediction fosters mathematical learning. To support research on prediction in the context of mathematics education, we present three perspectives on prediction: (1) prediction as a mental act highlights the cognitive aspect and the conceptual basis of one's prediction, (2) prediction as a mathematical activity highlights the spectrum of prediction tasks that are common in mathematics curricula and (3) prediction as a socio-epistemological practice highlights the construction of mathematical knowledge in classrooms. Each perspective supports the claim that prediction when used effectively can foster mathematical learning. Considerations for supporting the use of prediction in mathematics classrooms are offered.


ABSTRACT: This article explores the practice of engaging prospective elementary teachers in the analysis of lessons from different textbooks. A rationale for such engagement, based on particular teacher education goals, is provided. The article focuses on a specific lesson analysis assignment given to prospective elementary teachers in which portions of mathematics textbooks were compared and contrasted. Examination of 23 preservice teachers' analysis of two textbook lessons (one fairly traditional and one more reform oriented) revealed that, with very few exceptions, the preservice teachers searched the textbook lessons for familiar, mainly traditional instructional components. The teachers' preference for traditional lesson components appeared to contribute to a tendency to make considerable misinterpretations of the two textbook lessons. These tendencies, including ways that the teachers attempted to justify differences between the two lessons, offer important insights into prospective elementary teachers' conceptions of the role of textbooks in the teaching and learning process. In addition, these findings suggest the necessity of involving prospective teachers more extensively in the analysis of textbooks, curriculum materials, and other instruction resources so that richer, more useful conceptions may develop.


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.

ABSTRACT: As a researcher-teacher, I examined 7th-graders' experiences with a problem-centered curriculum and pedagogy, focusing on SES differences in students' reactions to learning mathematics through problem solving. Although higher SES students tended to display confidence and solve problems with an eye toward the intended mathematical ideas, the lower SES students preferred more external direction and sometimes approached problems in a way that caused them to miss their intended mathematical points. An examination of sociological literature revealed ways in which these patterns in the data could be related to more than individual differences in temperament or achievement among the children. I suggest that class cultural differences could relate to students' approaches to learning mathematics through solving open, contextualized problems.


ABSTRACT: Examined how a curriculum development project, aligned with current mathematics education reforms, affected 18 students in socially diverse mathematics classroom. Found that students of lower socioeconomic status preferred direct teacher intervention as opposed to open discussions among classmates. Higher socioeconomic status students displayed more comfort with abstract mathematical concepts. Findings suggest that discussion-intensive classrooms align more with middle-class cultures.


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 heard 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.


ABSTRACT: This study examines the effects of Connected Mathematics Project 2 (CMP2) on grade 6 student mathematics achievement and engagement using a cluster randomized controlled trial (RCT) design. It responds to a need to improve mathematics learning in the Mid-Atlantic Region (Delaware, Maryland, New Jersey, Pennsylvania, and Washington, DC). Findings reveal that the type of instructional activity taking place in intervention schools differed from that in control schools, and the activity observed in intervention schools was the type expected when implementing CMP2. Sixty-four percent of intervention teachers reported implementing the curriculum at a level consistent with the publishers' recommendations on the number of units completed per school year (six), and 68 percent of them reported implementing the curriculum consistent with the recommended amount of class time per week. But CMP2 did not have a statistically significant effect on grade 6 mathematics achievement as measured by the TerraNova, which answered the primary research question. Indeed, grade 6 mathematics students in schools using CMP2 performed no better or worse on a standardized mathematics test than did their peers in schools not using it. The results for the secondary research question were similar. There was no statistically significant difference between groups in PTV, and the small effect size is unlikely meaningful. These results were insensitive to alternative model specifications. The lack of statistically significant effects is consistent with prior research on CMP2 rated in the 2010 WWC review as meeting standards "with reservations" (Schneider 2000) and the Eddy et al. (2008) RCT. The intent-to-treat analytical approach used in this study, which analyzes participants based on how they are randomly assigned, yielded unbiased estimates of program effectiveness as implemented. To estimate the effect of CMP2 under typical conditions, teachers were provided all the typical materials and PD that a normal school adopting CMP2 would have. However, while CMP2 use was tracked, the study team did not ensure a particular amount or quality of CMP2 instruction. So, the curriculum impact reflects the effect of a school being assigned to use CMP2 as opposed to continuation of their regular curriculum, not necessarily of actually using CMP2. The results apply to the implementation of the CMP2 curriculum, after typical PD, in schools with grade 6 students. Use of a volunteer sample limits the findings to the schools, teachers, and students that participated in the study in the Mid-Atlantic region. The conclusions drawn in this study about the effects of CMP2 on student math achievement are limited to student math achievement as measured by the TerraNova, and do not generalize to any other standardized test.

**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.


**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.


**ABSTRACT:** In this article, we discuss differences between the mathematics instruction of CMP and non-CMP teachers in the LieCal project. There are three aspects of instruction that 200 6th grade urban classroom observations showed were strongly and differently related to the type of curriculum that teachers were using. These three aspects relate to the teachers' use of (1) group and individual work, (2) written narratives and worked-out examples, and (3) conceptually- and procedurally-focused instruction.


**ABSTRACT:** The purpose of the study reported in this article is to examine the impact of curriculum on instruction. Over a three-year period, we observed 579 algebra-related lessons in grades 6-8. Approximately half the lessons were taught in schools that had adopted a Standards-based mathematics curriculum called the Connected Mathematics Program (CMP), and the remainder of the lessons were taught in schools that used more traditional curricula (non-CMP). We found many significant differences between the CMP and non-CMP lessons. The CMP lessons, emphasized the conceptual aspects of instruction to a greater extent than the non-CMP lessons and the non-CMP lessons emphasized the procedural aspects of instruction to a greater extent than the CMP lessons. About twice as many CMP lessons as non-CMP lessons were structured to use group work as a method of instruction. During lessons, non-CMP students worked individually on homework about three times as often as CMP students. When it came to test usage, CMP teachers were more likely than non-CMP teachers to work problems from the text and to follow lessons as laid out in the text. However, non-CMP
students and teachers were more likely than CMP students and teachers to review examples or find formulas in the text. Surprisingly, only small proportions of the CMP lessons utilized calculators (16%) or manipulatives (11%).


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.


ABSTRACT: Although the question of whether written curricula are implemented according to the intentions of curriculum developers has already spurred much research, current methods for documenting curricular implementation seem to be missing a critical piece: the mathematics. To add a mathematical perspective to the discussion of the admittedly controversial and conceptually complex issue of "fidelity of curricular implementation," this study proposes a method for investigating fidelity that deals with the question of mathematical equivalence of written curricula and their enactments in the classroom. The method rests on the assumption that the curricula, both written and enacted, can be treated as discourses, and that one of the ways to judge their mathematical equivalence is to compare the mathematical objects around which these discourses evolve. As an illustration for how the method works, I analyzed a part of the written Connected Mathematics Project (CMP) curriculum and its enactment in a sixth grade classroom learning about fractions. This analysis showed that the written and enacted versions of the central mathematical objects of the two curricula, rational numbers, differed in almost every aspect: in their ontology, in the relative prominence of their realizations (i.e., symbols, icons and concrete objects) and in the importance attributed to their different properties. These differences may have an impact on the nature of students' mathematical competence.


ABSTRACT: This study analyzed teachers’ intentions for and reflections on their use of Standards-based [Connected Mathematics Program (CMP)] textbooks and traditional (non-CMP) mathematics textbooks to guide instruction. In this investigation of the interplay between textbooks and instruction, we focused on learning goals, instructional tasks, teachers’ anticipation of students’ difficulties, and their perceptions of students’ achievement of learning goals. All of these are aspects of teachers’ intentions and reflections that have proved fruitful in comparing the roles of the CMP and non-CMP mathematics textbooks in our Longitudinal Investigation of the Effect of Curriculum on Algebra Learning project. Whereas the cognitive level of the teachers’ intended learning goals appeared generally to reflect the emphases of their respective textbooks, we found that the CMP teachers’ intended learning goals were not as well aligned with the CMP textbooks as the non-CMP teachers’ learning goals were aligned with their non-CMP textbooks. The CMP and non-CMP teachers’ implementations of the lessons seemed to reduce the degree of difference between the cognitive levels of their intended goals. Even so, we found that significantly more CMP lessons than non-CMP lessons were implemented at a high level of cognitive demand. Although the non-CMP teachers’ intended learning goals were better aligned with their textbook’s learning goals, we found that the CMP teachers were more likely than the non-CMP teachers to follow the guidance of their textbooks in designing and selecting instructional tasks for a lesson. Future research should consider
other aspects of teachers’ intentions and reflections that may shed a broader light on the role of textbooks and curriculum materials in teachers’ crafting of instructional experiences for their students.


ABSTRACT: Analyzing the important features of different curricula is critical to understand their effects on students’ learning of algebra. Since the concept of variable is fundamental in algebra, this article compares the intended treatments of variable in an NSF-funded standards-based middle school curriculum (CMP) and a more traditionally based curriculum (Glencoe Mathematics). We found that CMP introduces variables as quantities that change or vary, and then it uses them to represent relationships. Glencoe Mathematics, on the other hand, treats variables predominantly as placeholders or unknowns, and then it uses them primarily to represent unknowns in equations. We found strong connections among variables, equation solving, and linear functions in CMP. Glencoe Mathematics, in contrast, emphasizes less on the connections between variables and functions or between algebraic equations and functions, but it does have a strong emphasis on the relation between variables and equation solving.


ABSTRACT: This paper examines professional development workshops focused on Connected Math, a particular curriculum utilized or being considered by the middle-school mathematics teachers involved in the study. The hope was that as teachers better understood the curriculum used in their classrooms, i.e., Connected Math, they would simultaneously deepen their own understanding of the corresponding mathematics content. By focusing on the curriculum materials and the student thought process, teachers would be better able to recognize and examine common student misunderstandings of mathematical content and develop pedagogically sound practices, thus improving their own pedagogical content knowledge. Pre- and post-mathematics content knowledge assessments indicated that engaging middle-school teachers in the curriculum materials using pedagogy that can be used with their middle-school students not only solidified teachers’ familiarity with such strategies, but also contributed to their understanding of the mathematics content.


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.


ABSTRACT: Approximately 1,400 middle-grades students who had used either the Connected Mathematics Project (CMP) or the MATH Thematics (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.


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.


ABSTRACT: Problem-solving-oriented mathematics curricula are viewed as important vehicles to help achieve K-12 mathematics education reform goals. Although mathematics curriculum projects are currently underway to develop such materials, little is known about how teachers actually use problem-solving oriented curricula in their classrooms. This article profiles a middle-school mathematics teacher and examines her use of two problems from a pilot version of a sixth-grade unit developed by a mathematics curriculum project. The teacher's use of the two problems reveals that although problem-solving-oriented curricula can be used to yield rich opportunities for problem solving and making mathematical connections, such materials can also provide sites for student confusion and uncertainty. Examination of this variance suggests that further attention should be devoted to learning about teachers' use of problem-solving oriented...
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.


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.


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.


ABSTRACT: Connection mathematics ability will be greatly needed by students, especially to solve the problems that need the relation between mathematical concepts with other concepts in mathematics and other disciplines or in everyday life. To get that mathematics ability, in this research used Connected Mathematics Project (CMP) model based on Presentation Media. CMP model based on presentation media was a student-centered learning model that involved student more; student not only did the problem but also sought the solution actively that enabled student to explore the relation of mathematical concept in real life. This research was a quasi experiment research with the student of 7th grade of Junior High School of Ujungjaya 2 of Sumedang district, Indonesia as the research sample. After the learning in the experiment class was conducted, the data description by using instrument of pre-test and post-test were collected to find out the student’s ability of mathematical connection, as well as observation sheet to find out the activity and condition of student during mathematical learning. The result of the research showed that the student’s mathematical connection ability by using Connected Mathematics Project (CMP) model based on presentation media was better than the conventional one. Besides, student’s activity in the learning process by using Connected Mathematics Project (CMP) based on presentation media was really positive and they became very active.

Implementation Pilot. Report submitted to the National Science Foundation as part of the Connecting Teaching, Learning, and Assessment Project.


**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.


**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.


**ABSTRACT:** This article reviews research on the achievement outcomes of mathematics programs for middle and high schools. Study inclusion requirements include use of a randomized or matched control group, a study duration of at least 12 weeks, and equality at pretest. There were 100 qualifying studies, 26 of which used random assignment to treatments. Effect sizes were very small for mathematics curricula and for computer-assisted instruction. Positive effects were found for two cooperative learning programs. Outcomes were similar for disadvantaged and nondisadvantaged students and for students of different ethnicities. Consistent with an earlier review of elementary programs, this article concludes that programs that affect daily teaching practices and student interactions have more promise than those emphasizing textbooks or technology alone.


**ABSTRACT:** This paper investigates the contribution of mathematical knowledge for teaching (MKT) and curriculum materials to the mathematical quality of instruction by comparing the enactment of a fractions problem taught by two teachers with differing MKT. It was found that MKT seem to support teachers’ precise use of mathematical language and to prevent errors; the curriculum materials provided a rich representational context for mathematical work. However, teachers’ orientations toward mathematics and mathematics teaching and their goals for student learning also seemed to contribute to their use of curriculum materials to engage students with rich mathematics and to support students’ participation in the development of the mathematics. Although orientations and goals made it more likely for a teacher to use multiple representations and elicit multiple solution methods, MKT was needed to productively use these elements in instruction. Based on this analysis, it is argued that there are aspects of developing orientations and goals that are related to MKT.

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.


ABSTRACT: This paper communicates the impact of prospective teachers' learning of mathematics using novel curriculum materials in an innovative classroom setting. Two sections of a mathematics content course for prospective elementary teachers used different text materials and instructional approaches. The primary mathematical authorities were the textbook sections and the prospective teachers in the curriculum materials section. After one semester, teachers in the curriculum materials section (n=34) placed significantly more importance on classroom group work and discussions, less on instructor lecture and explanation, and less on textbooks having practice problems, examples, and explanations. They valued student exploration over practice. In the textbook section (n=19), there was little change in the teachers' beliefs, in which practice was valued over exploration. These results highlight the positive impact of experiences with innovative curriculum materials on prospective elementary teachers' beliefs about mathematics instruction.


ABSTRACT: This study is a validity study of the National Assessment of Educational Progress (NAEP), intended to test the adequacy of NAEP for detecting and monitoring the effects of mathematics education reform. The current study design was intended to support a comparison of the relative effectiveness of three different types of large-scale assessments—Balanced Assessment in Mathematics (BAM), NAEP, and state assessments—for measuring the learning gains of students participating in a well-implemented reform mathematics curriculum. To provide a context for assessing student learning where the authors could be reasonably certain of observing substantial learning gains in mathematics over the course of a school year, they selected National Science Foundation's (NSF's) Connected Mathematics Project (CMP). Although the authors had initially hypothesized that BAM, being more closely aligned with the reform curriculum, would reveal larger gains than NAEP, they found that both assessments were equally sensitive to the gains of their sample of students in CMP classrooms, and NAEP appeared better able to detect gains in the algebra classrooms. This was true even though the BAM test required twice as much time to administer as the NAEP test. Three appendices are included: (1) Sample NAEP Items; (2) Sample BAM Task; and (3) Analyses Using Booklet Percent Correct Metric. (Contains 21 tables, 1 figure, and 8 footnotes.) [This report is based on work that was jointly supported by NCSER contract ED-01-CO-0026-005 and the National Science Foundation (grant 454755).]


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.
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.


ABSTRACT: Despite widespread agreement that proof should be central to all students' mathematical experiences, many students demonstrate poor ability with it. The curriculum can play an important role in enhancing students' proof capabilities: teachers' decisions about what to implement in their classrooms, and how to implement it, are mediated through the curriculum materials they use. Yet, little research has focused on how proof is promoted in mathematics curriculum materials and, more specifically, on the guidance that curriculum materials offer to teachers to enact the proof opportunities designed in the curriculum. This paper presents an analytic approach that can be used in the examination of the guidance curriculum materials offer to teachers to implement in their classrooms the proof opportunities designed in the curriculum. Also, it presents findings obtained from application of this approach to an analysis of a popular US reform-based mathematics curriculum. Implications for curriculum design and research are discussed.


ABSTRACT: Despite widespread agreement that the activity of reasoning-and-proving should be central to all students' mathematical experiences, many students face serious difficulties with this activity. Mathematics textbooks can play an important role in students' opportunities to engage in reasoning-and-proving: research suggests that many decisions that teachers make about what tasks to implement in their classrooms and when and how to implement them are mediated by the textbooks they use. Yet, little is known about how reasoning-and-proving is promoted in school mathematics textbooks. In this article, I present an analytic/methodological approach for the examination of the opportunities designed in mathematics textbooks for students to engage in reasoning-and-proving. In addition, I exemplify the utility of the approach in an examination of a strategically selected American mathematics textbook series. I use the findings from this examination as a context to discuss issues of textbook design in the domain of reasoning-and-proving that pertain to any textbook series.


ABSTRACT: We examine student achievement of 2833 students in 10 middle schools in relation to the implementation of textbooks developed with funding from the National Science Foundation (NSF) or publisher-developed textbooks. Using hierarchical linear modeling (HLM), curriculum type was not a significant predictor of student achievement on the Balanced Assessment in Mathematics (BAM) or TerraNova Survey (TNS) after controlling for student-level variables. However, the Standards-Based Learning Environment (SBLE) moderated the effect of curriculum type. Students were positively impacted on the BAM by NSF-funded curricula when coupled with either Moderate or High levels of SBLE. There was no statistically significant impact of NSF-funded curricula on students in classrooms with a Low level of SBLE, and the relationship between publisher-developed textbooks and SBLE was not statistically significant. Moreover, there was no significant impact of either curriculum type when coupled with varying levels of SBLE on the TNS as the dependent measure.

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.


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.


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.


ABSTRACT: An important component of the National Council of Teachers of Mathematics Standards is the equity principle: All students should have access to a coherent, challenging mathematics curriculum. Many in the mathematics reform community have maintained that this principle can be achieved through one well-designed curriculum. However, the extant research on equity—which focuses on either ethnic diversity or academic achievement—suggests that this principle is illusive. The current study compares the effectiveness of two curricula in teaching a range of math concepts to 53 (28 male; 25 female) middle school students at risk for special education services in math. The yearlong.
quasi-experimental study involved achievement and attitudinal measures. Results indicated that students in the intervention group who used materials designed according to instructional principles described in the special education literature achieved higher academic outcomes (p < .05, p < .001) and had more positive attitudes toward math (p < .001) than did students in the comparison group.


**ABSTRACT:** The authors analyzed mathematics achievement data from a longitudinally matched student cohort from a large southwestern U.S. school district to investigate school context and practice effects on the academic performance and growth of middle school students. Investigation of the degree to which aspects of the school environment related to mathematics achievement outcomes revealed 2 distinct patterns. School context, as measured by student and school demographic characteristics, related closely to mathematics performance levels but had little relationship with mathematics growth rates. The opposite was true for aspects of school practice. Teacher educational attainment and the mathematics curricula delivered to students were not related to student performance levels but were moderately associated with mathematics growth rates. These results suggest that the effect of some policy-relevant school variables may be difficult to identify when student achievement is studied at a single point in time. However, investigation of school impacts on student achievement may be facilitated when an analytic strategy that takes into account the time-dependent and cumulative nature of schooling is adopted.

**CONFERENCE PRESENTATIONS AND PROCEEDINGS**


**ABSTRACT:** Contemporary constructivist views of mathematical learning have encouraged curriculum developers to devise instructional materials that help students build their own understanding and procedures for doing rational number computations, solving proportions, and applying those skills to real and whimsical problems. The Connected Mathematics Project (CMP) curriculum supports construction of rational number knowledge by presenting students with a series of units based on contextual problems that require proportional reasoning and computation. The goal of this study was to describe the character and effectiveness of proportional reasoning by students with different curricular experiences as they face problems in which ratio and proportion ideas are appropriate and useful. Performance task papers and follow-up interviews with selected students from the study indicated that, in addition to a greater frequency of correct answers and reasoning compared with control group students, CMP students appeared to have developed greater ability to articulate their thinking. Students from CMP classes had a generally broader and more flexible repertoire of strategies available for problem solving. The results suggest that problem-based curriculum and instruction can be effective in helping students construct effective personal understanding and skill in one of the core strands of middle grade mathematics.


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.


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.


ABSTRACT: Does a middle school mathematics curriculum that is redesigned using principles based in cognitive research improve student outcomes? To test whether research can be effectively translated into practice, the Connected Mathematics Project 2 (CMP2) curriculum was revised according to four principles 1) integrating visual with verbal information, 2) prompting for self-explanation of correct and incorrect worked examples, 3) spacing learning over time, and 4) using formative assessment. This study of 6th grade and 8th grade mathematics education addresses the research question: “Do students who are exposed to specific redesigned CMP2 curriculum modules (treatment) exhibit greater improvements in mathematics performance in the module-specific content area than their counterparts exposed to the regular CMP2 curriculum (control)?” Preliminary analyses show statistically significant effects of the redesigned CMP2 units in three of the four curricular units in this study.


ABSTRACT: The purpose of this paper is to describe a study we are conducting on the improvement of mathematics teaching and learning at the middle school level through professional development and to discuss some of the research issues that we have encountered in conducting the study. The paper will lay out the various rationales for our initial design and for the adjustments that we made along the way. We are nearing the end of year two of a five-year study, so this is very much a work in progress. The study is not large in terms of the number of teachers involved (approximately 50
teachers and 1,000 students per year in the early stages of the study), but it is a complex study involving many interconnected elements. In Part I we lay out the design of the study, and in Part II we discuss some of the issues that we are facing as we progress through our work.


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, Roedan & 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 (Koller, 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.


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