This supplement contains the annual listing of research in mathematics education for 1994. Chapter 1, "Dissertation Research Reported in 1994" (Michael L. Bumbaugh & Sigrid Wagner), lists 251 dissertations abstracted in Dissertation Abstracts International during 1994 along with an index of dissertations by institution. Chapter 2, "Research Articles Published in 1994" (Gale A. Watson & Michelle K. Reed), lists 185 journal articles published in 1994 and includes a list of journals searched. Journal articles focusing on the interpretation and implications of research are included in this chapter. Chapter 3, "Research Papers and Monographs Produced in 1994" (Michelle K. Reed & Gale A. Watson), lists 57 papers and monographs abstracted for the ERIC database by the end of March 1995. Entries in each chapter contain annotations, major and minor category codes, and grade level codes. An index by major category codes is provided at the end. (MKR)
RESEARCH ON MATHEMATICS EDUCATION

REPORTED IN 1994

Supplement to the July 1995 JRME

edited by

Sigrid Wagner

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

and

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- A rationale for development of the document, including identification of target audience and the needs served.
- A vita and a writing sample.

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Dedication

This volume is dedicated to Marilyn N. Suydam, Professor Emerita at The Ohio State University, who for nearly 25 years compiled the annual listing of research that eventually became the July issue of JRME. Carefully hand searching journals and dissertation abstracts, and composing concise and informative annotations for every report of research on mathematics education, Dr. Suydam was solely responsible, year after year, for the single most popular feature ever to appear in JRME. With sincere appreciation for her longtime labor of love, as well as other numerous and outstanding contributions to the mathematics education profession she served so long and so well, we gratefully dedicate this volume to Marilyn Suydam.
PREFACE

This annual listing of research in mathematics education was prepared by the ERIC Clearinghouse for Science, Mathematics, and Environmental Education (ERIC/CSMEE), at the request of the JRME Editorial Board, and is the last such research listing to be included in a JRME subscription at the current subscription price. From this point forward, the July issue of JRME, which used to contain the research listing, will be of the same format as other issues of the journal.

As much as mathematics educators have valued the research listing in the past, with electronic databases becoming increasingly (but not uniformly) accessible, it is not clear in what format(s) future listings would be most useful. Though ERIC/CSMEE has the capacity to produce the listing, it is not even clear the extent to which a single annotated listing of mathematics education research is still valued by our profession. Thus, we earnestly solicit feedback from you, our reader, using either the enclosed postcard or the e-mail address given below.

If response is favorable, ERIC/CSMEE anticipates producing the hard copy version of the listing for the next three years, to be included with a JRME subscription at minimal additional cost. At the same time, an electronic version will be available through the ERIC/CSMEE gopher and world wide web sites. At the end of three years, we will once again solicit feedback from JRME subscribers.

Because space limitations in this separate supplement are not as severe as in the July issue of the journal, some modest additions have been made to the listing. Annotations have been lengthened, MAJOR and MINOR codes have been added to each entry, and all entries have been indexed by MAJOR codes. Research papers and monographs dated 1994 and abstracted for the ERIC database by the end of March 1995, as well as journal articles focusing on the interpretation and implications of research, have been included. An index of dissertations by institution is also provided.

If the hard copy form of the listing is continued for the next three years, it is anticipated that future July supplements may include other features useful to JRME readers, such as the information that is currently compiled in the NCTM Research Advisory Committee’s annual Highlights publication and Internet sources of mathematics education materials.

We hope you find this July supplement useful, and again, we sincerely solicit your comments and recommendations. You may contact ERIC/CSMEE via the enclosed postcard or by e-mail: erlcse@osu.edu. We welcome your suggestions.
# Key to Codes

The following topic codes have been used to indicate the major and minor emphases of each dissertation, journal article, and paper in this listing. Each entry has been assigned a minimum of one and a maximum of three major codes and any number of minor codes. The combined topic index at the end of the volume reflects only major codes, with entries listed in 18 clusters of related topics.

The grade level of each study is indicated in parentheses at the end of the list of codes. Please note that studies related to preservice or inservice teacher education are so indicated by the appropriate topic codes (PsRv, IsRv). The level designated on teacher education studies refers to the grade level(s) at which the intern or teacher participants teach.

## Topic Codes

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/S</td>
<td>Addition, subtraction</td>
</tr>
<tr>
<td>ACH</td>
<td>Achievement</td>
</tr>
<tr>
<td>AdvM</td>
<td>Post-calculus mathematics</td>
</tr>
<tr>
<td>AFF</td>
<td>Affect</td>
</tr>
<tr>
<td>ALG</td>
<td>Algebra, pre-algebra</td>
</tr>
<tr>
<td>ANX</td>
<td>Anxiety (student's)</td>
</tr>
<tr>
<td>ARTH</td>
<td>Arithmetic</td>
</tr>
<tr>
<td>ASSM</td>
<td>Assessment, evaluation</td>
</tr>
<tr>
<td>ATT</td>
<td>Attitudes (student's)</td>
</tr>
<tr>
<td>BLF</td>
<td>Beliefs (student's)</td>
</tr>
<tr>
<td>CAI</td>
<td>Computer-assisted instruction</td>
</tr>
<tr>
<td>Calc</td>
<td>Calculators (general)</td>
</tr>
<tr>
<td>CALS</td>
<td>Calculus</td>
</tr>
<tr>
<td>CC</td>
<td>Cross-cultural</td>
</tr>
<tr>
<td>CII</td>
<td>Computer-integrated instruction</td>
</tr>
<tr>
<td>Comp</td>
<td>Computers (general)</td>
</tr>
<tr>
<td>CURR</td>
<td>Curriculum, programs</td>
</tr>
<tr>
<td>D/R</td>
<td>Diagnosis, remediation</td>
</tr>
<tr>
<td>Deaf</td>
<td>Hearing impaired</td>
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<tr>
<td>Dcm</td>
<td>Decimals</td>
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<tr>
<td>DevM</td>
<td>Developmental mathematics, remedial mathematics</td>
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<tr>
<td>DscM</td>
<td>Discrete mathematics</td>
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<tr>
<td>Eqv</td>
<td>Equivalence, proportions</td>
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<tr>
<td>EST</td>
<td>Estimation</td>
</tr>
<tr>
<td>ETIN</td>
<td>Ethnic, racial, cultural factors</td>
</tr>
<tr>
<td>frac</td>
<td>Fractions, ratios</td>
</tr>
<tr>
<td>GCAL</td>
<td>Graphing calculators</td>
</tr>
<tr>
<td>GEND</td>
<td>Gender differences</td>
</tr>
<tr>
<td>GEOM</td>
<td>Geometry</td>
</tr>
<tr>
<td>GIFT</td>
<td>Gifted</td>
</tr>
<tr>
<td>GrpG</td>
<td>Grouping for instruction, cooperative learning</td>
</tr>
<tr>
<td>IC</td>
<td>Integrated curriculum</td>
</tr>
<tr>
<td>IMPL</td>
<td>Implications of research, interpretations of research</td>
</tr>
<tr>
<td>INT</td>
<td>Integers</td>
</tr>
<tr>
<td>IsRv</td>
<td>Inservice teacher education, professional development</td>
</tr>
<tr>
<td>Knw</td>
<td>Knowledge (student's)</td>
</tr>
<tr>
<td>LANG</td>
<td>Language, psycholinguistics</td>
</tr>
<tr>
<td>LD</td>
<td>Learning disabled</td>
</tr>
<tr>
<td>LRNG</td>
<td>Learning, learning theories, cognitive development</td>
</tr>
<tr>
<td>LRNR</td>
<td>Learners (characteristics of)</td>
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<tr>
<td>LSAs</td>
<td>Large-scale assessments, SAT, NAEP, SIMS, TIMSS, CSMS</td>
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<tr>
<td>MID</td>
<td>Multiplication, division</td>
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<tr>
<td>Manp</td>
<td>Manipulatives</td>
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<td>MATL</td>
<td>Materials (texts, other resources)</td>
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<tr>
<td>MEAS</td>
<td>Measurement</td>
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<td>MTGC</td>
<td>Metacognition, reflection</td>
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<tr>
<td>NSNS</td>
<td>Number sense</td>
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<tr>
<td>ORAL</td>
<td>Oral communication, classroom discourse</td>
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<tr>
<td>PCT</td>
<td>Percents</td>
</tr>
<tr>
<td>Pers</td>
<td>Personality</td>
</tr>
<tr>
<td>PLAN</td>
<td>Planning, decision making</td>
</tr>
<tr>
<td>PLcV</td>
<td>Place value, numeration</td>
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<tr>
<td>PRF</td>
<td>Proof, justification</td>
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### Topic Codes (cont.)

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<tr>
<td>PROB</td>
<td>Probability</td>
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<tr>
<td>PS</td>
<td>Problem solving, reasoning</td>
</tr>
<tr>
<td>PSRV</td>
<td>Preservice teacher education</td>
</tr>
<tr>
<td>REP</td>
<td>Representations, modelling</td>
</tr>
<tr>
<td>REVW</td>
<td>Reviews of research</td>
</tr>
<tr>
<td>RSCH</td>
<td>Research issues, methods</td>
</tr>
<tr>
<td>SOC</td>
<td>Social factors, parents, context</td>
</tr>
<tr>
<td>SOFT</td>
<td>Software, programming</td>
</tr>
<tr>
<td>STAT</td>
<td>Statistics</td>
</tr>
<tr>
<td>STYL</td>
<td>Learning style, cognitive style</td>
</tr>
<tr>
<td>TANX</td>
<td>Anxiety (teacher's)</td>
</tr>
<tr>
<td>TATT</td>
<td>Attitudes (teacher's)</td>
</tr>
<tr>
<td>TBLF</td>
<td>Beliefs (teacher's)</td>
</tr>
<tr>
<td>TCHG</td>
<td>Teaching (role, style, methods)</td>
</tr>
<tr>
<td>TCHR</td>
<td>Teachers (characteristics of)</td>
</tr>
<tr>
<td>TECH</td>
<td>Technology (general)</td>
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<tr>
<td>TKNW</td>
<td>Content knowledge (teacher's), pedagogical knowledge</td>
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<tr>
<td>VIS</td>
<td>Spatial visualization</td>
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<tr>
<td>WRIT</td>
<td>Writing, journals</td>
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### Level Codes

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<tr>
<td>EC</td>
<td>Early childhood, K-4</td>
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<td>MS</td>
<td>Middle grades, 5-8</td>
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<td>HS</td>
<td>High school, 9-12</td>
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<td>EL</td>
<td>Elementary, K-2</td>
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<tr>
<td>SE</td>
<td>Secondary, 5-12</td>
</tr>
<tr>
<td>K-12</td>
<td>All school levels</td>
</tr>
<tr>
<td>PS</td>
<td>Postsecondary, 13-</td>
</tr>
<tr>
<td>ALL</td>
<td>All levels</td>
</tr>
</tbody>
</table>

11
Dissertation Research Reported in 1994

Michael L. Bumbaugh, Ohio State University
Sigrid Wagner, Ohio State University

This section lists 251 dissertations in mathematics education research that were abstracted in Dissertation Abstracts International during 1994. Each entry is coded (see Key to Codes) with 1-3 Major and any number of Minor topic codes, as well as the grade level (in parentheses). All entries are indexed by Major codes at the end of this volume. Please note that studies related to preservice or in-service teacher education are so indicated by the appropriate topic codes (Psrv, Isrv). The level designated on teacher education studies refers to the grade level(s) at which the intern or teacher participants teach. An index of dissertations by institution is included at the end of this section.


Five case studies provide data on teachers' conceptual congruence with framework ideas, perceptions of curriculum development processes, behavior during restructuring, and targeted student outcomes.


Results showed the importance of interdisciplinary planning, classroom observations, student interviews, appropriate assessment instruments, and sensitivity to teaching styles in interdisciplinary teaching.

Almstrum, Vicki Lynn. (1994, December). Limitations in the understanding of mathematical logic by novice computer science students (The University of Texas at Austin, 1994). DAI, 55A, 1496. [AAC 9428445]

Novice computer science students experienced more difficulty with concepts involving mathematical logic than they did with other concepts in computer science.


Teaching roles assumed by (n=2) Brigham Young University math instructors reflected previous experience, and success in teaching was not related to role. Instructors used role-related questions (9 types identified) as an important teaching technique.


Interviews with (n=9) teachers and their students indicate that ability to do math does not change with age, ability to learn basic math depends mainly on motivation and having a good teacher, and good teachers stress active learning and higher order thinking skills.

DIR, AFF (Ps)

Dynamic assessment interviews with (n=20) children in each of grades 2, 4, and 6 suggested that instruction should link concrete understanding to semi-abstract and then to symbolic understanding, and that ability and cognitive style were major factors in performance.

PcV, Rep, A/S, Manp, Styl (EL)


One group of algebra neophytes was taught visual and propositional rules using ordinary algebraic notation; another group, a syntactic tree notation. In ordinary notation, visual rules were significantly easier to recognize and somewhat more difficult to constrain. Alg, Rep (Se)


Teacher involvement in planning, the needs of language minority students, availability of bilingual teachers, and use of cooperative learning groups were critical in the successful implementation of a new science and mathematics program.

IC, TchG, Ettn, GrpG, Lang (EL)


Training Ethiopian teachers (n=22) in probing techniques produced more student responses per lesson than in control classes (n=12), but there were no significant differences in student (n=2674) achievement between the two groups. Isrv, TchG, Achi, Oral (HS)


Two error correction procedures significantly improved the short-term recall of multiplication facts for 10 second-grade students tutored by 10 gifted sixth-grade students, but no differential effects on achievement were found between the two procedures. DrvM, M/D (EC)


Across (n=202) students, females had higher course averages than males; attendance, study groups, and math lab software improved performance; and successful teaching methods used calculators, manipulatives, and programmed instructional materials.

DevM, TchG, Achi, Gnd, Soc (Ps)


Students (n=27) in a guided discovery approach to developmental mathematics had higher achievement, less anxiety, and were more confident in their mathematical ability than students (n=53) in traditional classes.

DevM, TchG, Achi, Anx (Ps)

Data from (n=124) sixth graders showed significant differences in attitude by gender, by achievement level, and for the race by achievement interaction. *ATT, ACH, ETHN, GEND (MS)*


Data on (n=1494) students in grades 3, 5, 8, and 11 suggest a surface understanding of language is insufficient for mathematics achievement; an understanding of relationships is needed. Females showed higher math aptitude in grades 3 and 5; males, higher achievement in grade 11. *ACH, LANG, ASSM, GEND, LD (K-12)*


Five learning disabled students could solve a variety of word problems; major barriers were procedures learned without understanding. Students were capable of sharing their strategies, justifying their thinking, and helping each other understand. *LD, PS, ARTH, Oral (EC)*


Students’ concept images of functions were dominated by an equation/numerical relationship. Animation exercises helped students think of functions as independent variables and graphs as dependent variables. *CALS, REP, SOFT (HS)*


Teachers (n=150) participating in the Texas Mathematics Staff Development Program were surveyed to determine the relationship between the number of training sessions attended and improvements in teaching, with grade level as covariate. *ISRV, TCHG (EL)*


Good predictors of outcomes for traditional students in three remedial math courses were high school GPA, marital status, employment status, and financial aid status; good predictors for nontraditional students were feelings about school, self, and math. *ACH, DEV M, AFF, SOC (Ps)*


Three coordinated studies investigated the effects of (1) wording of the problem, (2) students’ verbal fluency, and (3) instructional techniques on the ability of (n=70,527,511) students in grades 3-8 to solve word problems and perform simple computations. *ARTH, PS, LANG, TCHG (MS)*
College algebra and precalculus students differed significantly in the number of knowledge nodes possessed related to proportions. Fewer algebra, but more precalculus students than expected possessed the equivalent-ratio and proportion knowledge nodes.

This study examined the effect of task specific multiple-embedded metaphors on math task self-efficacy in (n=68) undergraduate students attending math classes. Interaction effects across gender and treatments were evaluated.

Preservice teachers (n=17) with extensive and integrated knowledge of functions and those with previous experience teaching mathematics were more successful transforming their content knowledge into appropriate forms.

Preservice elementary teachers (n=52) who did not engage in data collection activities scored higher on the posttest and on all 36 individual test items than students who engaged in data collection.

Students (n=542) in grades 3, 4, and 5 who used journals daily (1) perceived that they had a greater opportunity to learn and that their teachers were more effective but (2) did not differ in achievement or attitude from the control group.

Bull, Michael Porter. (1994, January). Exploring the effects on mathematics achievement of eighth-grade students that are taught problem-solving through a four-step method that addresses the perceptual strengths of each student (University of South Carolina, 1993). DAI, 54A, 2497. [AAC 9400198]
Students (n=511) who were taught problem solving through “Magic Math” improved significantly more in mathematics than students taught through more traditional methods.

Special sections of calculus for students who enter college without any previous exposure to calculus did not lead to improved performance and the “calculus gap” widened for those in the special sections.

Writing was an effective means of teaching students (n=371) to solve problems. Writing activities enabled students to verbalize their thought processes and helped them develop a systematic approach to problem solving. PS, WRIT (MS)


Students (n=76) did better with student-based feedback (directed at the student’s errors) than with domain-based feedback (reteaching the correct procedure without regard for the student’s specific mistakes). DIR, SOFT, A/S (EC)


A program based on the use of concrete manipulatives helped students understand the concept of variable. Sixth and seventh graders in England scored higher than those in Iowa, but eighth graders performed similarly in both locales. ALG, MANP, ATT, CC (MS)


Questionnaire responses of (n=60) students in grades K-3 showed only minor differences by gender. Middle school data showed that educational software is often not used as intended and should be integrated into the curriculum. GEN, SOFT, Ill (EL)

Caniglia, Joanne Carmel. (1994, December). The transformation and enactment of teachers’ content, pedagogical, and personal practical knowledge: Four case studies of expert secondary mathematics teachers (Kent State University, 1994). DAI, 55A, 1497. [AAC 9428886]

Enactment of teachers’ knowledge should include strong representations and rich connections; integration of content, pedagogical, and practical knowledge; and openness to new resources. TKNW, TCHG, REP (HS)

Capps, Jesse Louis. (1994, October). The effects of pure E strategies and of pure C strategies, the number of moves and the student's relevant knowledge on learning a researcher designed algebraic concept (North Carolina State University, 1994). DAI, 55A, 896. [AAC 9425453]

Relevant knowledge, number of moves and type of teaching strategy (C or E) were significant factors in determining concept attainment scores of (n=289) Algebra II students. ALG, TCHG, Acc (HS)

Carter, Janye Pearl Witherspoon. (1994, May). Personal factors influencing the decision of black students to participate in optional mathematics courses (Auburn University, 1993). DAI, 54A, 4020. [AAC 9411402]

Mother’s encouragement, and father’s and mother’s help were found to be significant predictors of participation in nonrequired mathematics courses for (n=117) seventh graders. Hours of television was a predictor for (n=147) eleventh graders and beyond. ETHN, Soc (K-12)

Sixth grade students were introduced to the use of letters in mathematical problems using a bag of marbles to stand for an unknown value. Students in the experimental group improved significantly more than a control group, but did not understand letters as specific unknowns. 

**Algebra, Arithmetic, Manipulation (MS)**


Four case studies suggest 14 factors affecting success in college algebra grouped into 5 categories: environment, motivation, climate, ability, and opportunity. **Affiliation, Sociology, Algebra (PS)**


Three students utilized a variety of schemas to help them solve problems. Some representations were numerical, some were graphical, and some were algebraic in form. Situational knowledge appeared to amplify their ability to reason mathematically. **Algebra, PS, Research (PS)**

Chakalisa, Paul Algebra. (1994, June). Relationships of student gender, teacher experience and setting to student's achievement and attitudes toward mathematics in Botswana community junior secondary schools (Ohio University, 1994). *DAI, 54A*, 4340. [AAC 9416021]

Students (n=800) in 40 junior secondary schools in Botswana showed significant differences in achievement based on setting, gender, and teacher experience; differences in confidence based on gender, attitudes toward success, math as a male domain, and teacher's attitude. **Achievement, Gender, Teacher, Affiliation (SE)**

Chalardkid, Paphai. (1994, September). Test development of mathematics subject matter knowledge levels of division of rational numbers for Thai preservice elementary teachers (Oregon State University, 1993). *DAI, 55A*, 535. [AAC 9422153]

A 42-item instrument was developed and administered to (n=272) preservice elementary teachers at eight teachers' colleges in eight provinces in northern Thailand. Item difficulty was used to select the 32 items in the final instrument. **Assessment, Frac, Preservice, Knowledge (EL)**


Mastery learning strategies promoted learning outcomes in mathematics for nondisabled children, for learning disabled children, and to a lesser extent, for educable mentally retarded children. **LD, Teaching (EC)**


Individual interviews with (n=64) students in grades K and 2 showed that cognitive processes for solving addition problems in children with hearing impairment are qualitatively similar to, but quantitatively different from, those in children with normal hearing. **Deaf, Learning, Affiliation (EC)**


This study explores the thinking of a gifted learning disabled secondary student and concludes that the student is a highly self-motivated learner only in situations where the curriculum or learning activities match his special interests. **Gifted, Learning, Affiliation, Learning (SE)**

Individual interviews with (n=336) students showed that multiplicative thinking appears early and develops slowly. Introduction of multiplication in second grade is appropriate but should not be taught only as repeated addition.

LRNG, MID (El)


Three case studies document a remarkable transition from a transmission to constructivist approach to teaching. Difficulties were experienced in changing patterns of communication, new roles for teacher and students, and different approaches to planning.

ISRV, TCHG, ORAL, PLAN (MS)


Recommendations include: (1) trying different kinds of CAL, (2) considering students’ learning style preferences, and (3) emphasizing applied mathematics.

CAI, ACH, STYL (HS)


A survey of (n=266) Algebra II teachers indicated lack of resources and effective software are major deterrents to computer use, graphing calculators are used much more than computers, and teachers with at least 10 years’ experience are more likely to use computers.

TCHG, TECH, ALG (HS)

Costa, Sara Waite. (1994, October). Adolescents’ understanding of percent problems (Clark University, 1994). DAI, 55A, 896. [AAC 9424696]

On a written test of 20 problems, seventh graders (n=20) solved fewer problems than Algebra II students (n=20). Interviews suggested four patterns of conceptual and procedural knowledge.

LRNG, PCT, EQV (Se)


American Sign Language signed through the air or in print, as modes of presenting word problems, produced more correct answers among (n=23) deaf youths than English, either signed through the air or in print.

DEAF, LANG, PS, WRIT (Ps)


Remediated at-risk students (n=40) performed as well as nonremedial students (n=48) in a first college-level math class. Females outperformed males and older students outperformed younger students.

ACH, D/R, GEND, LRNR (Ps)

Dallaway, Richard Zak. (1994, Fall). Dynamics of arithmetic: A connectionist view of arithmetic skills (University of Sussex, 1994). DAI, 55C, 1017. [NOT AVAILABLE]

Two models are presented—one of memory for multiplication facts and one of children’s errors in multicolumn multiplication—both of which are built from connectionist components and useful for modeling procedural skills in arithmetic.

LRNG, MID (EC, Ps)
Dapples, Birdeena Crandall. (1994, October). Teacher-student interactions in SIMMS and non-SIMMS mathematics classrooms (Montana State University, 1994). DAI, 55A, 934. [AAC 9423043]

Four teachers trained in the constructivist methodology of the Systemic Initiative for Montana Mathematics and Science showed more student-centered interactions in SIMMS classrooms, but the majority of classroom interactions were still teacher-centered.

_ISRV, TCHG, IC, ORAL (IIS)_


Three teachers believed the main reason for teaching problem solving was to develop students' critical thinking skills, but the problems they presented were routine textbook problems designed to reinforce skills.

_PS, TBLF (MS)_


Stated beliefs were that teachers provide students with opportunities to construct meaning for themselves while beliefs-in-practice suggested that direct instruction is an effective way to teach. Planning was more influenced by the syllabus than by student knowledge.

_TBLF, PLAN (IIS)_


Data on (n=42) teachers showed that a year-long in-service program on teaching mathematics to LEP students had a positive effect on confidence, but at no stage did students in their classes outperform students in control classes.

_ACH, ISRV, TANX, LANG (MS)_


There were no gender differences in either anxiety or achievement, but there was a reduction in anxiety from the beginning of the precalculus course to the end.

_CALS, GCAL, ACH, ANX, GEN (Ps)_


Journal writing produced no significant differences in student (n=113) achievement, but may contribute to an increased understanding of mathematical concepts for students and to a better understanding of students' difficulties for teachers.

_WRIT (MS)_


This study compared the performance of third- and fourth-grade students with and without mild learning/behavior disabilities when using the computerized program "Math Concepts and Skills." Some significant differences in gains were found.

_CAI, LD, ACH, D/R (EC)_

Dorgan, Karen. (1994, June). Teachers' orientations toward teaching, learning, and mathematics: Three teachers' decisions concerning the implementation of a revised elementary mathematics curriculum (University of Virginia, 1994). DAI, 54A, 4342. [AAC 9415594]
While enacting a revised curriculum intended to reflect the NCTM Standards, the teachers maintained fairly traditional teaching styles. Problem solving and application of technology appeared as "add-ons" to the usual instructional program. **CURR, TCHG, PLAN, TBLF (MS)**


An 11-year longitudinal study found few gender differences in achievement except on the SAT in eleventh grade, but temperament measured in first grade was strongly related to achievement throughout the study. **GEND, PERS, ACH (K-12)**


This study compared a Tell Plus Show and Tell Plus Write error correction strategy on the math performance of (n=5) high school students with learning problems. No functional effect in favor of either treatment was found. Students preferred Tell Plus Write. **D/R, LD, M/D (HS)**


A survey of (n=126) public school teachers in primary (K-2), elementary (3-5), middle school (6-8), and high school (9-12) showed that significant differences in awareness of assessment practices exist among the four levels. **ASST, TKNw (K-12)**


Three classes of prospective elementary teachers explored the four-color problem, probability, Hamiltonian circuits, series, and tessellations using HyperCard. All three classes significantly improved their perception of math, and one showed a decline in mathematics anxiety. **SOFT, PHSV, TANX, TATT (EL)**


Performance of tenth-grade students on a test of mathematical problem solving and communication (three open-ended tasks with no clear method of solution) suggest limited student experience with open-ended questions. **ASST, PS, WRIT (HS)**


Innovative text materials both enabled and inhibited change in teachers' practices; changes that occurred were due to a reflective process; peer interaction and administrative support were important during implementation. **CURR, ISRV, TBLF (SE)**

A technologically enhanced environment did positively affect students’ (n=10) ability to construct an appropriate concept image of the derivative, distinguish between graphs of functions and derivatives, and perform symbolic differentiation.

**GCAL, SOFT, CHI, CALS, LANG (Ps)**


Surveys (n=137) showed significant changes in beliefs about mathematics among students earning an A or B in the course. Interviews (n=9) revealed increased confidence in mathematical abilities and an increased likelihood of using innovative instructional approaches.

**CURR, PSYV, TBLF (El)**


Principals’ beliefs about mathematics and mathematics teaching and teachers’ perceptions of those beliefs were not significantly different. Student mathematics achievement did not differ significantly according to the congruence of beliefs and perceptions.

**TBLF, ACH (MS)**


Chinese language and mathematics teachers used periodic examinations to assess knowledge, comprehension, and application, with little attention to higher order thinking levels. They used oral questioning and performance assessments to measure higher level thinking skills.

**ASSM (MS)**


First graders’ solutions for EQUALIZE and WON’T GET problems were found to be significantly higher than for the COMPARE problems. The EQUALIZE problems were most frequently solved by using an ADD-ON strategy, and the WON’T GET problems by a MATCH strategy.

**LANG, PS, REP (EC)**


Students (n=8) worked on two derivative tasks: traditional (algebraic reasoning) and nontraditional (graphical reasoning). Traditional task results showed several clear patterns. The initial interpretation of the nontraditional task had the greatest influence on performance.

**AFF, BLF, KNW, CALS (Ps)**


Nine classes were assigned to pre-algorithmic or post-algorithmic treatments or to the control group. Both treatment groups estimated significantly better than the control group, but the difference was not significant six weeks later.

**EST, TCHG, FLAC (MS)**


Case studies of eighth-grade students indicated a direct relationship between degree of field-independence/dependence and success with problem solving for those students with extreme measures of cognitive style.
Michael L. Bumbaugh and Sigrid Wagner

Foutz, Paul Frederick. (1994, March). The effects of a mathematics laboratory course on achievement for beginning algebra students at a public community college (The University of Texas at Austin, 1993). *DAI, 54A*, 3359. [AAC 9400886]

An additional two hours per week in a math lab produced no significant differences in achievement.

Frant, Janete Bolite. (1994, October). Educational computer technology in Brazil: The diffusion and implementation of an educational innovation (New York University, 1994). *DAI, 55A*, 938. [AAC 9422993]

This case study traces the history of the implementation process, describes educational computer technology usage in 1993, recounts the federal initiatives taken to implement computers in the public school system, and analyzes the diffusion process.


Weekly computer lab work in four sections of a traditional college calculus course produced little change in attitudes and anxiety, and no significant change in achievement. Lab students performed as well as students who received additional homework.


Observations of four classrooms revealed that teachers and students use mathematics register, or language, to drive, direct, and support their own activity as well as the activity of others; to query and respond to queries; and to provide information.


Data from (n=68) students in grades 4 and 5 suggest that working with a same-status partner may be more cognitively beneficial than working with a partner of higher status when access to more advanced problem understanding is guaranteed.

Gerhard, Nancy Elizabeth Holmgreen. (1994, February). Learning style time preferences among middle school mathematics students (The University of Texas at Austin, 1993). *DAI, 54A*, 2931. [AAC 9400890]

Middle school students preferred afternoon for learning in general, and mathematics in particular. However, there were no differences in achievement between students whose class schedules and preferred times for mathematics instruction were congruent versus dissonant.

Gibbs, Linda Louise. (1994, December). Analysis of developmental mathematics programs in Texas community colleges which are successful with black and Hispanic students (The University of Texas at Austin, 1994). *DAI, 55A*, 1457. [AAC 9428521]

Eight colleges whose developmental math programs are successful with minority students place high value on basic skills and offer the program through the math department. Assessment and placement of students are crucial, and instruction is lecture-based with math lab support.

Data on \( n=269 \) twelfth-grade students showed that there is no MBTI type that correlates highly with mathematics achievement, but introverts had significantly higher math GPAs than extraverts.

ACH, PERS (HS)

Gittinger, Dennis Joseph. (1994, December). Cooperative learning and computer-assisted instruction: A comparison of student achievement in arithmetic and algebra in the college developmental algebra class (The University of Texas at Austin, 1994). *DAI, 55A*, 1497. [AAC 9428525]

Results suggest that cooperative learning is a more powerful technique than computer-assisted instruction, especially for females and minorities.

CAI, GRPG, DEV M, ETHN, GEND (PS)


Posttest scores were related to group membership but not to gender; the Afrocentric group had pretest scores below those of the other two groups but achieved significant gains during the study. Mathematics anxiety was related more to gender than group membership.

ETHN, SOC, ANX, GEND (MS)


Analysis of three popular high school text series revealed more similarities than differences. Textbook problem-solving activities do not stimulate analysis or develop an attitude of inquiry.

MATL, PS (HS)


Forty students were classified as traditionalists, incrementalists, or innovators. After 60 hours of instruction, the latter two groups had changed their views about problem solving from application of rules to a process of creation and construction of knowledge.

MTCG, TCHG, BLF, PS (PS)


None of the three teacher variables—area of certification, years of teaching experience, and teacher educational level—had a significant relationship with mathematics achievement in the middle schools \( n=110 \) of South Carolina.

ACH, TCHR (MS)

Greico, Linda Fletcher. (1994, March). The effectiveness of coupling a general format with a conceptual schema upon college algebra students' ability to solve mathematical word problems (University of South Florida, 1993). *DAI, 54A*, 3360. [AAC 9404900]

Students \( n=55 \) who were given a format for solving specific kinds of problems did not perform significantly better than the control group except on a nonroutine problem. No significant gender differences were found, except that males outperformed females on the nonroutine problem.

PS, TCHG, ALG, GEND (PS)

Eighth-grade mathematics classes were evaluated for efficiency in mathematics instruction, using U.S. SIMS data. There were no differences in efficiency between classes in public and Catholic schools for the total sample or for the three achievement subgroups.

*Tchg, Ach, Soc (MS)*

Gurney, Penelope J. (1994, May). On the association between modes of mental representation and mathematics experience in pre-service education students (University of Ottawa, 1992). *DAI, 54A*, 4037. [AAC NN83852]

Results indicate that differences do exist between the mental representation modes preferred by individuals with no mathematics experience compared to those who have even a small level of experience in mathematics.

*Rep, Rev (K-12)*


A rule-based learning system, scSIFT—a Self-Improving Fractions Tutor—models what and how a human tutor might learn over the course of tutoring. scSIFT is based on a detailed study of a human tutor teaching fractions.

*LRng, Soft, Frac (EL)*


This study followed a mathematics teacher and her seventh-grade students throughout one school year as students selected and reflected on work and conferenced with the teacher. Test scores and attitudes of students who did and did not work with portfolios are contrasted.

*Assm (MS)*


Despite different orientations of the curricula, both teachers prioritized content coverage, emphasized methods for answering standard questions, and relied on teacher-focused pedagogy. Actions of the teacher, not the curriculum, determined students' perception of algebra.

*MATL, Alg, CC, Tchg (S)&)*


No significant differences between the mathematical achievement of Chapter 1, average achieving, and high achieving students (n=382) and learning style preferences were found.

*Ach, Styl (MS)*


Trade books containing mathematical concepts that were enhanced by adding explicit mathematical notation were significantly preferred over the original version. Symbolism encouraged rereading, made the mathematics more evident, and catalyzed discussion.

*Lang, Writ (EC)*
Analysis of Complex Analysis textbooks showed that the discourse is neither standardized, nor objectively neutral, but is permeated by conflicts between logical, heuristic, and rhetorical schemes. *LANG, WRIT, ADV (Ps)*

Harris, Marieta Wells. (1994, April). The effect of manipulatives on developing mathematics achievement and attitudes of seventh-grade students (Memphis State University, 1993). *DAI, 54A*, 3664. [AAC 9402982]  
Students in the experimental group believed that manipulatives helped them understand perimeter and area and apply formulas appropriately. Evidence did not support that students in all ability level groups show higher achievement as a result of using manipulatives. *MANP, ACH, ATT, MEAS (MS)*

Harrison, Allyson Grainger Elgie. (1993, August). A follow-up study of adults identified in childhood as having a learning disability either in reading or in arithmetic (Queen's University at Kingston, 1992). *DAI, 54A*, 462. [AAC NN76361]  
A 12-year follow-up of (n=51) adults suggests that learning disabilities produce a lifelong pattern of deficits. Findings have implications for remedial programs and emphasize the need to differentiate between different subgroups of learning disabilities. *LD, D/R (Ps)*

Data from (n=36) pairs of fifth-grade students showed that average/average achievement pairs attempted more resolutions per conflicting answer, achieved more consensus, and had greater gains in achievement than higher/lower pairs. *ACH, GRPG, PS, SOC (MS)*

Henry, Mary Janet. (1994, December). Hypermedia and the learning disabled student (West Virginia University, 1994). *DAI, 55A*, 1535. [AAC 9427964]  
Learning disabled students (n=18) and developmental math students (n=18) participated in high control or low control HyperCard tutorials. Results showed no significant difference between the high and low control groups. *DEV, LD, SOFT, ACH, ATT (Ps)*

Study concluded that Project SMART was effective in providing support and assistance to (n=38) rural teachers in their advancement of knowledge, skills, and attitudes and in their development as leaders in science and mathematics education. *ISR, TATT, TKNW (K-12)*

This study compared the performance of college students (n=35) who experienced concrete vs. computerized spatial visualization instruction. The concrete group gained significantly more, and males outscored females. *CAI, MANP, VIS, GEND (Ps)*

Hight, Orian Langley. (1994, April). The effects of math confidence/study skills instruction on the mathematics achievement, attitudes, and study skills behavior of remedial math college students (University of Maryland College Park, 1993). *DAI, 54A*, 3664. [AAC 9407642]
There was a statistically significant improvement in math self-concept in favor of the treatment group (n=19), but there was not a significant difference in achievement over the control group (n=23).

Hoosain, Emarnuddin. (1994, December). Teachers’ conceptions and beliefs about mathematical problem-solving relative to high-ability and low-ability students (The Ohio State University, 1994). *DAI, 55A*, 1461. [AAC 9427713]

Results showed teachers (n=130) made a distinction between high- and low-ability students with respect to Frustration/Motivation, Computational skills/General ability, Affect, and Enjoyment, but not with respect to Textbooks/Materials, Technology, and Applications.


Eighth-grade students (n=32) worked cooperatively in groups of four on two routine and two nonroutine tasks. Results suggest that a good group task needs to be nonroutine for everyone in the group, and group members must need each other in order to complete it.


Three middle school students spent 20 hours learning about linear functions in a dynamic computer environment. Generation of meaning, interpretation of symbols, formulation of algebraic representations, and connection of slope to rate of change were observed.

Hsu, Ay-Jivan. (1994, July). Hypertext as a tool for construction of knowledge: Examining a fifth grader’s learning process using a self-designed geometry stack on HyperCard (State University of New York at Buffalo, 1994). *DAI, 55A*, 42. [AAC 9412284]

The “knowledge and control of self” aspect of metacognition was addressed by incorporating documentation, buttons, and note pads at strategic points in the unit. Hypertext was judged versatile for facilitating teaching and learning congruent with the NCTM Standards.


Comparing textbooks (grades 1-12), homework, and time spent on mathematics instruction revealed that differences exist in the time spent on homework in the U.S. and China, and Chinese students received more instructional time on mathematics than American students.


No significant differences in mathematics performance were observed between second graders who received CAI aligned with the classroom curriculum and those who received CAI using an integrated learning system following a sequence suggested by the vendor.

Jenkins, Terry Lee. (1994, September). Enumeration strategies used by college students to solve combinatoric type problems (The University of Iowa, 1993). *DAI, 55A*, 499. [AAC 9421147]
Students (n=48) used four main strategies: listing, multiplying, generalizing, and diagramming. They tended to use listing to solve small-number problems and permutations; multiplying, to solve large-number problems and combinations.

**Jiang, Zhonghong. (1994, March).** Students' learning of introductory probability in a mathematical microworld (University of Georgia, 1993). *DAI, 54A*, 3360. [AAC 9404659]

Three eighth-grade students, using a mathematical microworld named CHANCE, demonstrated four modes of thinking: naive-intuitive, experimental-intuitive, initial-systematic, and operational-systematic.


Responses from (n=14) teachers who teach problem solving, integrate computer technology, and implement appropriate assessment methods recommend software that records student procedures so students can analyze their own thinking.

**Johnson, Laurence Franklin. (1994, February).** Relationship of performance in developmental mathematics to academic success in intermediate algebra (The University of Texas at Austin, 1993). *DAI, 54A*, 2931. [AAC 9400914]

Data on (n=824) community college students show that developmental course performance is a significant discriminator of college-level mathematics performance and persistence; five other major conclusions are discussed.

**Johnson, William Robinson. (1994, January).** Success indicators for the Applied Mathematics Program in Georgia (Georgia State University, 1993). *DAI, 54A*, 2498. [AAC 9335064]

Fourteen factors were examined to see if they were indicators of success in Applied Mathematics in 37 high schools in Georgia. Attitudes did not have a significant influence. Students with experienced teachers achieved more but did not make better grades.

**Kaldor, Wendy Ruth. (1994, June).** Relationships within and between operations in cognitive arithmetic (University of New South Wales, 1993). *DAI, 54B*, 6485. [NOT AVAILABLE]

Five experiments showed the strongest inter-operational associations between addition and subtraction and between multiplication and division. Further experiments examined intra-operational effects in arithmetic verification performance.

**Kasperek, Rebecca Finley. (1994, February).** Effects of integrated writing on attitude and algebra performance of high school students (The University of North Carolina at Greensboro, 1993). *DAI, 54A*, 2931. [AAC 9402483]

The experimental Algebra II group (n=34) achieved more on average than the control group (n=34). For the writing sample data, the experimental group performed higher on all chapter tests, suggesting that writing-to-learn mathematics can be a valuable instructional tool.

**Keim, Andrea Schumann. (1994, May).** Teachers' perception of South Carolina's mathematics curriculum framework draft (University Of South Carolina, 1993). *DAI, 54A*, 3977. [AAC 9410015]

Teachers' (n=12) perception of the framework’s vision was positive, but school structure and support conflict with the vision. Principals’ support was critical to teachers’ belief in the possibilities of the framework.

CAS sections of beginning calculus used MAPLE (n=2) and THEORIST (n=2). Comparison with control sections (n=2) showed virtually no differences. The manner of symbolic manipulation may not be a factor in students' development of symbol sense.

**Alg, Soft, CII, Cals (Ps)**


Both the hands-on group (n=17) and the on-screen group (n=18) made significant gains in geometry, classification, and arithmetic. Differences between the groups were not significant.

**Manp, Soft, Arth, Geom (EC)**


Piagetian tasks, especially seriation and transitivity, were better predictors of arithmetic achievement in first grade than the WISC-R vocabulary or block design tests for Korean kindergartners (30 males, 30 females). No systematic sex differences were found.

**Arth, Asmm, Lang, Gend (EC)**


Data from two Math Analysis classes provide no evidence that (1) sending specially designed study materials home to parents increases achievement or (2) there is a positive correlation between the amount of parental help with homework and student achievement.

**Ach, Soc, Cals (HS)**


This study addressed the question of the validity of the TASP test for predicting performance (n=4000) in college mathematics courses for students who require remediation as well as it does for students who do not require remediation.

**Assm, Devm, Ach (Ps)**


Mathematica used as a demonstration tool in two sections of differential equations did not improve achievement over two control sections. Computer attitudes changed significantly, but the classes did not attribute these changes to Mathematica.

**AdvM, Soft, Ach, Att, CII (Ps)**


For reasoning with computer-program-oriented complex logic, visual representations of the logic appeared more effective than verbal representations.

Data on (n=264) students showed significant correlations among metacognition, worry, and math achievement scores. Asian and African-American group scores were lower than those for Latino and White groups. Asian students worried more than the other three ethnic groups.

*ACH, ASSM, ANX, ETHN (Ps)*

Kunicki, Joseph Alexander. (1994, September). The effects of impertinence upon the validity of a process model of mathematics achievement and attitude (The Ohio State University, 1994). *DAI, 55A*, 499. [AAC 9420976]

The K-Index screening process partitioned a large-scale data set (LSAY) to eliminate non-random respondent error without compromising the demographic balance inherent in the original sample.

*ASSM, ACH, ATT (K-12)*


A case study of two high schools showed that existing organizational routines, faculty culture, and resources influenced the degree to which instructional computer activities were implemented.

*CII, CURR, SOC, TBLV (HS)*


Data from six intact classes showed that the "quizzes with teacher comments" group had significantly higher achievement scores than the "quizzes without teacher comments" or the "no quiz" groups, but there was no difference between the two homework groups.

*ACH, ASSM, WRIT, ETHN (HS)*


All four teachers were influenced, but to different degrees, by the research-based knowledge pertaining to the teaching and learning of place-value concepts and the theory of cognitive constructivism. Each classroom showed significant gains in place-value concepts.

*ISRV, LRNG, PLCV (EC)*


Data from three case study sites showed: (1) Parents and teachers experienced mutual empathy, (2) Parent understanding of math concepts increased through activities with their children, and (3) Technology caused teachers stress because they lacked the necessary skills.

*TCHG, TECH, SOC (EC)*


Students in the intervention group showed a significant decline in math anxiety and improvement in attitudes. There was no significant improvement in achievement.

*SOC, TCHG, ANX, ATT, GEN (HS)*

Students (n=196) from four urban middle schools participated in this investigation of the influence of student "voice" in a lesson. Average-achieving students stimulated significantly more positive teacher responses than high- or low-achieving students.


This study presents a computer model of the hypothesized processes that are required of a young student solving arithmetic word problems, including sentence-level reading and text integration. Results suggest new process-oriented measures of problem difficulty.


Most of the sixth-grade students (n=18) did not demonstrate a good development of number sense. The majority demonstrated a poor understanding of estimation using whole numbers and fractions.


A class of (n=14) second graders showed improvement on addition and subtraction facts after repeated practice and self-corrective feedback.


Two sections of Finite Mathematics that solved problems involving environmental issues demonstrated more interest and verbal interaction than two control sections.


Tenth-grade students (n=310) in Taiwan showed significant sex differences in geometry achievement and spatial ability favoring males. Both spatial ability and logical reasoning were positively correlated with geometry achievement.

Leiker, Virginia Carol. (1994, May). The relationship between an integrated learning system, reading and mathematics achievement, higher-order thinking skills and certain demographic variables: A study conducted in two school districts (Baylor University, 1993). DAI, 54A, 4067. [AAC 9411538]

Among third and fourth graders in two school districts the greatest amount of variance in higher order thinking skills was attributed to grade level; in mathematics and reading performance, to SES.

Results indicated no difference in the locus of control and mathematics attitude between anxious (n=10) and non-anxious (n=10) students. Parents of anxious students had higher expectations. Anxious students liked journals, and 70% were from non-traditional families.

**ANx, Att, Pers, Soc, Writ (MS)**


Among fifth-grade Taiwanese students (n=193) males had better attitudes toward mathematics than females. Combining the use of calculators and problem solving seems to be more effective than either strategy alone.

**Calc, PS, Att, Gend (MS)**


After 90 minutes of instruction for (n=140) ninth graders, an integrated visual/algorithmic approach to converting fractions to percents seemed to produce better retention than either visual or algorithmic approaches alone.

**Tchg, Frac, Pct (HS)**

Luce, Christlyn Zellars. (1994, August). The effects of the Family Math parental involvement program on students' cognitive and affective behaviors and parents' attitudes toward education (The University of Southern Mississippi, 1993). *DAI, 55A, 235.* [AAC 9417835]

Data on (n=92) fourth- and fifth-grade students and their parents showed that participation in the Family Math program contributed to improved attitudes, reduced anxiety, increased time parents worked with children, and more enjoyment of that time.

**Matl, Soc, ACH, ANx, ATT (El.)**


This study of (n=90) sixth-grade students in Taiwan showed no significant difference in problem solving or beliefs between the modified multimedia and traditional groups, and gender did not play a significant role in the mean scores on either instrument.

**Tchg, Tech, B1F, Gend, PS (MS)**


Responses to 112-116 questions by (n=481) seventh graders in six groups support the contention that teachers can formulate accurate judgments concerning how an individual will respond to a particular item based on limited samples of observed behavior.

**AsShm, Dlr, A/S, Frac (MS)**


Preservice teachers' (n=22) number sense and self-efficacy beliefs, but not attitudes toward teaching and learning mathematics, improved during a problem-centered elementary methods course.

**NSns, Prsv, TAtt, TBlF (El.)**

Four studies (n=196; 103; 209; 20) indicate that women math majors are positive about the value of mathematics and about themselves as mathematics learners but require frequent feedback on their performance. The importance of role models was noted.

Aff, Gen, Soc (Ps)


Data from (n=18) precalculus students showed: (1) Graphing technologies have a lasting impact on students even when their use is discouraged or prohibited; (2) Students do not become sophisticated users nor gain lasting enhancements of conceptual knowledge in only one semester.

Cals, GCal (Ps)


One-on-one teaching experiments with (n=9) rising geometry students suggest a direct relationship between vocabulary and van Hiele level; prior memorization interfered with new learning; and manipulatives were an invaluable teaching tool.

GrOm, Lang, Lrng, ManP (HS)

Mathews, Susann Miller. (1994, December). The effect of using as many variables as are needed to solve word problems on the problem-solving skills and attitudes of students in Algebra I (The Ohio State University, 1994). DAI, 55A, 1498. [AAC 9427751]

Four teachers each taught (a) an experimental and (b) a control section to solve two-variable word problems using (a) two explicit variables or (b) one explicit and one implicit variable. The experimental groups scored significantly higher on word problem tests.

Alg, Ps, Att, Curr (HS)


Four undergraduates and four teaching assistants involved in a remedial mathematics course expressed concerns about time, making personal and mathematical connections, and authority. The students wanted to know how learning mathematics would make a difference in their lives.

DevM, Tchg, Blf, TBlf (Ps)

Maxwell, Sheryl Anne. (1994, October). The needs of second career, secondary mathematics teachers: How well are they met by academic programs and inductive processes? (University of Virginia, 1994). DAI, 55A, 897. [AAC 9424462]

Case studies of five second career, secondary mathematics teachers show that specially designed programs, formal mentoring, and additional preparation in technology, exceptionality, and multicultural education are warranted for second career interns.

Curr, Prsv (Se)

Six fourth-grade teachers participated in professional development in the use of performance assessment; five did not. Concerns that performance tasks for assessment will detract from mathematics achievement on traditional standardized tests may be unwarranted.

**Assm, Isrv, Achi, Att (EC)**


Two teachers found metaphors for their roles to be useful constructs in reflecting on teaching and learning; they were profoundly influenced by the cultural myths of their school; and reframing and reflection were the foundation of personal learning and curricular change.

**Curr, Isrv, TbIF (HS)**


After 27 weeks using traditional instruction, Mathematics Their Way, or UCSMP materials, there were no significant differences on a test of problem solving and application across (n=250) second graders when pretest, age, and IQ were controlled.

**Matl, Manp, Ps (EC)**

McMann, Patricia Kovach. (1994, October). The effects of teaching practice review items and test-taking strategies on the ACT mathematics scores of second-year algebra students (Wayne State University, 1994). DAI, 55A, 897. [AAC 9423737]

Students (n=99) who were given spaced practice on sample ACT mathematics questions and test-taking strategies outscored students (n=97) in the control group. Gender and number of years of math were not significant factors.

**Ach, Curr, AlG, GenD (HS)**


Eighth graders (about 25% African-American) were grouped homogeneously (n=485) or heterogeneously (n=601) by ability. There was a significant difference in mathematics scores in favor of homogeneous grouping for whites but not for African-Americans.

**Ach, Grpg, Ethn (MS)**


Sixth graders wrote in journals and constructed questions about fractions individually and in groups. The questions revealed implicitly and explicitly more about their knowledge of fractions than their journal writing did.

**Writ, Frac, Ps (MS)**


Interviews with (n=32) students in grades 2, 5, 7, and high school geometry suggested 16 primary components to students' arguments. Second and fifth graders were most likely to draw pictures. High school students and 7th graders were more likely to use Intuitive Affirmation.

**Geom, Pbf (K-12)**

Millican, Beverly Robinson. (1994, October). The effects of writing-to-learn tasks on achievement and attitude in mathematics (University of North Texas, 1994). DAI, 55A, 897. [AAC 9424391]
Significant differences in fourth graders' achievement were found in favor of the writing-to-learn treatment (4 classes) and contrast (4 classes) groups as a whole, for females, and for low-achieving students. No differences in attitude toward mathematics were found.

ACH, WRT, ATT, GEND (EC)


Experts (n=29) in statistics education, participating in three iterations of a Delphi study, suggest that 49% of the statistics course should be data-based, 28% computer-based, 13% probability-based and 10% other approaches such as labs, projects, and case studies.

CURR, STAT, TCHG (Ps)


Teacher-trainees' (n=108) beliefs differed significantly from those of experienced teachers (n=107). Experienced teachers scored higher on self-measures of ability in mathematics, teacher efficacy, and personal efficacy for teaching mathematics.

TBLF, PSV, TCHR (El)

Moore, Sara Delano. (1994, November). Mathematical and verbal abilities as factors in mathematical problem-solving by talented students (University of Virginia, 1994). DAI, 55A, 1215. [AAC 9425758]

Students (n=53) of high verbal ability and (a) above average or (b) exceptional mathematical ability solved multistep problems. Exceptional math students were more likely to use diagrams, while above-average math students showed only computational work.

GIFT, PS, KNW (El)


One class each from (n=10) experienced instructors was analyzed to identify patterns of verbal communication. Results indicated a modest relationship between quality of verbal communication and student achievement.

ORAL, ACH, ALG (Ps)


Instruction in cubic units was augmented by journal writing and sharing in three experimental fifth-grade classes; instruction in fractions, in two experimental classes. There was a significant difference in achievement for students engaged in the experiment for a longer period of time.

ACH, WRT, AFF, FRAC, MEAS (MS)


Responses from (n=370) K-8 teachers suggest that practices consistent with the Standards were more likely in grades K-2 and Chapter 1 classrooms and less likely in grades 3-5 and multiple-grade classrooms. Teachers who were more aware of the Standards reported higher levels of consistency.

Third and seventh graders solved and later recalled six long and six short word problems. Performance on the problems was negatively related to the proportion of irrelevant inferences recalled from long problems.


Few teacher training colleges in Uganda, Nigeria, and Morocco prepare prospective teachers in statistics, and senior secondary school curricula do not include statistics.


Three case studies describe the implementation of portfolio assessment, mathematics projects, and contracting for grades. These new assessment methods are appropriately modified when teachers purposefully reflect on the effectiveness of the new method.


American and Soviet students each took both the AP Calculus exam and the Soviet entrance exam. The exams and corresponding course syllabi were compared to see if differences in exam results were attributable to curricular emphases.


This study describes the development and formative evaluation of a computer program designed to enhance, broaden, and amplify the informal counting skills of preschool children (n=6).


Survey responses by (n=109) elementary teachers, interviews of (n=10) teachers, and classroom observations of 12 different lessons suggest a positive impact of the math/science in-service education programs provided since the early 1980s.

Nichols, Joey Del. (1994, September). The effects of cooperative learning on student achievement and motivation in a high school geometry class (The University of Oklahoma, 1994). DAI, 55A, 460. [AAC 9422561]

Students (n=81) were randomly assigned to two treatment (STAD) and one control group. Treatment groups experienced higher achievement scores and increases in goal orientation, self-efficacy, intrinsic valuing, and reported uses of deep processing cognitive strategies.

Probability problem solutions of (n=30) undergraduate and (n=50) graduate students were coded according to the types of errors found. Text comprehension errors accounted for 15-23% of all errors and procedural difficulties accounted for 45% of the errors.

O’Neal, Judy Summers. (1994, January). Restructuring a mathematics program using the NCTM ‘Standards’ and outcome-based education (Georgia State University, 1993). DAI, 54A, 2499. [AAC 9335069]

Middle school (n=25) and high school (n=25) teachers participated in a 15-month, 3-phase project to redesign the 6-12 mathematics program. Issues were studied, a framework was constructed, and a model for prototypical instructional units was developed.


Eleven assertions related to problem solving, course applications, course integration, linguistic register, and student perceptions were used to enhance understanding of student difficulty in integrating knowledge between Algebra II and Chemistry.


Three students (n=26) took statistics tests under timed or untimed conditions. All students performed better under untimed conditions, but high-anxious students showed a greater increment in performance.


Because incoming students reported low to moderate math anxiety, a discrete math course designed to reduce math anxiety did not produce a significant effect.


Eleven students scored higher on unit tests when instruction included detailed, written systematic solutions of conic sections equations (circle, hyperbola) than when it did not (parabola, ellipse).


Students in the experimental group (n=39), who spent 18 weeks on concept development and then 6 weeks on procedures, had just as good skills and better understanding than students in the control group (n=54), who spent 24 weeks on traditional skills.


A case study of a second-grade teacher shows how she created a safe environment to foster constructivism. She forced students to think as problems were posed and encouraged them to verbalize their reflections, discuss their ideas, and agree or disagree.

Chinese students were faster at all mental addition tasks than U.S. students in the same, or higher, grades. Speed of mental rotation did not differ significantly, but Chinese students made remarkably more errors.


Same-age, trained tutors made a significant and positive difference in the mastery of pre-algebra concepts.


First semester results (n=348) indicated that AP Calculus students achieved highest, followed by non-AP Calculus students, and then high school Precalculus students. The effect of taking calculus in high school seemed to disappear by the end of second semester calculus.


Case studies of three preservice teachers showed that a teacher operating at van Hiele level n tended to describe concepts and choose activities at level n or n-1. The teacher’s beliefs about geometry also influenced the crafting of lessons.


High school students (n=171) solved four types of SAT problems and indicated the strategies they used. Certain strategies were found to be strongly associated with high scores, but the relationship between gender and strategy use remained unclear.


Analysis of 13 lessons in a second-grade classroom indicates that the linguistic activity of individual children and of the group influenced children’s conceptualization of ten. Conversely, children’s cognitive advances influenced the linguistic activity of individuals and of the group.


Survey data from (n=31) states indicate that 20 states are using one or more forms of alternative assessment—free response items, open-ended questions, performance tasks, or portfolios—at the state level.

Science students (n=960) experienced a CAI or non-CAI approach to a required math course. Achievement and attitude/interest scores of the CAI students were significantly higher than those of the non-CAI students.  

**CAI, ACH, AFF (Ps)**


Data on students (n=480) participating in a voluntary algebra placement system showed that ASSET Numerical Skills are valid predictors for Elementary Algebra, but ASSET Elementary Algebra scores are not valid predictors for Intermediate Algebra.  

**DEV, ALG, ASSM (Ps)**


The participating teacher's knowledge and beliefs about mathematics were influenced by her use of software and the problem-based curriculum. Evidence of the teacher's development was found in her planning, instruction, reflection, and assessment practices.  

**CURR, SOFT, IRSV (HS)**

Poppe, Pamela Elizabeth. (1994, June). Representations of function and the roles of the variable (Georgia State University, 1993). *DAI, 54A*, 4383. [AAC 9409911]

Two Algebra I classes participated in a teaching experiment that investigated students' use of variables when instruction utilized different representations of function. These students showed more improvement in generalizing patterns than four control classes.  

**ALG, REP, TCHG (HS)**


Results suggest that methods courses provide important experience in the use of manipulatives, technological aids, and cooperative learning, but preservice teachers (n=47) worry that they may have trouble implementing these methods themselves.  

**PRSV, ATT, TBLF, TKAw (K-12)**


"One best system" reform mandates tend to ignore the idiosyncratic needs of rural school districts, which may lack sufficient personnel and financial resources to implement reforms.  

**CURR, D/R, ASSM (K-12)**


A study of six teachers showed that prior school and teaching experiences were the primary influences on the teachers' beliefs, and the beliefs plus the behavior and ability of students were the key influences on the teachers' practices.  

**TBLF, TCHG (El.)**

Fourteen eighth graders at each of three estimation performance levels solved 10 numeric problems and 10 contextual problems. Students in the low and middle groups gave more acceptable responses for numeric problems; in the high group, for contextual problems.

Est (MS)


Fundamental to the discourse on gender differences is the notion of equal ability, but the goal of this research is not to force females to pursue mathematics to the same level as males, but to improve mathematics teaching and learning for all students.

Gend (ALL)


Six students could use recursive thinking informally, but mathematical induction on a formal level was achieved by only three. It was concluded that teaching that makes a connection between informal recursion and mathematical induction would be more successful.

Pre (Ps)


Responses of (n=23) high school students showed there are connections between the formal limit concept and (1) student beliefs about the validity of a mathematical technique and (2) student beliefs about the concept of limit.

Bel, Cal (HS)


A study of how two sixth-grade teachers used a problem-solving oriented unit on perimeter and area suggests that, while the curriculum can play a role in shaping mathematics teaching, the views, beliefs, and knowledge of teachers should also be addressed.

Cur, PS, Meas, Tbl, Tknw (MS)

Roberts, Frank Henry. (1994, December). The impact of the Saxon mathematics program on group achievement test scores (The University of Southern Mississippi, 1994). DAI, 55A, 1498. [AAC 9430198]

This study compared gains on the SAT of students in two rural Mississippi counties. On the Mathematics Computation subtest, gains were in favor of the non-Saxon group. Black girls in the Saxon group achieved higher mean gains than black girls in the control group.

Ach, Mat, Ethn, Gend (SE)


A sample of (n=597) students completed a variety of written instruments. Results suggest that statistics course anxiety encompasses several components and individualized interventions are necessary.

Assm, Stat, Anx, Att (Ps)

Fifth-grade students (n=82) worked on division-of-fractions word problems using Personalized Instruction strategies or not. Results indicated that success depends on school, class, and mathematics anxiety levels.


Case studies of two elementary teacher-leaders in the California Mathematics Project show outcomes achieved by the teacher-leaders were improvements in their clients’ teaching skills, commitment to reform of mathematics instruction, and sense of professionalism.


Data from (n=57) freshmen on possession and use of procedural knowledge, intrinsic and extrinsic goal orientation, and self-efficacy showed that only prior knowledge was significantly correlated to the use of procedural knowledge.


All of the fifth-grade groups that performed the best with an ILS as a supplement to traditional instruction were haptic groups. Three of the five groups that performed best with traditional instruction were visual learners; the other two were Hispanic learners.


Inventory data from (n=80) students indicated that the cognitive/relaxation group reported significantly lower scores on the Emotionality scale of the Test Anxiety Inventory. There were no differences among groups on the math computation test.

Shields, Sharon Marie. (1994, January). To what degree does the methodology used to develop a mathematical concept predict students’ mathematical success? (Texas A&M University, 1993). *DAI, 54A*, 2449. [AAC 9328803]

Comparing concept attainment instruction to traditional instruction with a sample of (n=203) middle school students, no statistically significant differences in achievement or attitude were found.


This four-year study examined the change process as ability grouping for reading and math was eliminated, one grade at a time. The change was successful because of the active participation of the teachers and the slow, deliberate implementation.
Simpson, Mary Lovenah. (1994, June). Let their eyes hear you: Teaching second-grade mathematics to hearing and hearing-impaired students using a student-centered approach (The University of Texas at Austin, 1993). DAI, 54A, 4383. [AAC 9413600]

The teacher used more visually oriented instruction and increased her direct communication with the hearing-impaired students. Manipulative materials facilitated understanding, and communication strategies encouraged exchange of ideas. **Deaf, Tchg, Mann, Oral (EC)**


Conceptual versus procedural instruction produced no significant differences in achievement or affect among (n=65) community college students. **DevM, Tchg, Acct, Aff (Ps)**


- CAI software based on five-structures, developed in the Netherlands, was successful in helping most students master the basic addition and subtraction tables. **CAI, Soft, AS (EC)**

Smith, Constance Flahive. (1994, August). The process of change in two mathematics teachers: A naturalistic study (The University of Rochester, 1994). DAI, 55A, 236. [AAC 9417282]

This study was part of a larger research project concerned with the introduction of active reading strategies into mathematics instruction. The dimensions along which two teachers made changes were identified and their lived theories of learning were explored. **Isrv (K-12)**


The goal initially was to understand the role of small group interactions and computers in the learning of mathematics, but developed into a search for ways to expand radical constructivist theory to allow social and individual perspectives to play complementary roles. **Lrng, Soc, Gnp (All)**

Smith, Maureen Ann. (1994, December). The influence of picture format and indefinite quantifiers on the ability of students with serious emotional disturbance to solve word problems (State University of New York at Buffalo, 1994). DAI, 55A, 1529. [AAC 9429862]

There were no significant differences in student (n=39) performance across test formats but there were between performance on items involving extraneous information and on those that did not. **Lang, Pers, AS, Pers (El.)**


The Geometric Supposer group (n=16) gained as much or more than the control group (n=23) on measures of spatial visualization, van Hiele level, and achievement, but not significantly more. A correlation of .45 was found between van Hiele level and achievement. **Grm, Soft, Ach, Lrng, Vis (Hs)**

Two groups of students received CAI on statistical concepts based on a three-stage model for transferring attributes from concrete to abstract settings. The model training improved factual retention but did not improve performance on routine and novel problems.

Snyder, Vaughn. (1994, October). Effects of cooperative learning upon student ability to communicate mathematically: An ethnographic study (Ohio University, 1994). DAI, 55A, 856. [AAC 9424633]

A continuum emerged related to student understanding of concepts and their ability to communicate their understanding mathematically. Teachers need to listen carefully to understand answers that vary from standard vocabulary and textbook explanations.

Sosa, Carmen Pacheco. (1994, September). The effects of text format and content on English as a Second Language students’ ability to solve math word problems (The University of Iowa, 1993). DAI, 55A, 492. [AAC 9421203]

Fifth-graders (647 white, 153 Hispanic) completed 18 multiple-choice word problems. Word length of the problems made no difference, but the presence of extraneous information significantly lowered scores, more for Hispanics than for whites.


Twelve sixth graders had developed a part-whole concept of fractions and one-half was a strong intuitive concept for all. Among the less proficient math students, a whole number interpretation of fraction symbols was common.


Teachers selected (n=42) pairs of students with learning disabilities for participation in the 20-week study. Results indicated that the CBM students performed better than their partners, whose instructional changes were not based on CBM data.


Individual interviews were conducted with (n=257) children, grades 2-5. In third grade, 72% showed transitivity and 61% showed unit iteration, implying that third grade is the appropriate grade level to begin teaching measurement of volume.


Programs for instructing 6- to 8-year-olds on place value concepts were written for the Archimedes microcomputer. A third of the children had difficulty interpreting the number line. Mental methods of calculation ranged from counting to methods based on place value.

Ninety seventh graders designed computer-assisted interactive video lessons on percent. Participants engaged in mathematical communications more frequently and exhibited increased metacognitive skills. Posttest scores on percent increased by 100%.

**PCT, TECH, MTCC, ORAL (MS)**


Both the U.S. and China urge students to take math every year in secondary school and acknowledge that different math topics need to be treated differently. Math curricula in the two countries differ in content coverage and emphasis on pedagogy.

**CC, CURR (SE)**


This study assessed the mathematical content knowledge and pedagogical skills of elementary teachers to determine if they are adequately prepared to teach mathematics based on NCTM recommendations. Findings indicate that the teachers are not adequately prepared to meet NCTM expectations. The current focus is an algorithmic approach with emphasis on numeration and computation. Lack of confidence in content areas beyond arithmetic contribute to the lack of preparedness of elementary teachers to implement innovative curricula.

**TKnw, Tchg, CURR (EL)**


Fourth-grade students (n=36) participated in socially assisted learning, cooperative learning, or control conditions. Socially assisted learners scored highest on quizzes and could focus on problem structure, monitor performance, and assume leadership roles.

**PS, SOC, GRPG, KNW, MTCC (EC)**


A constructivist approach to teaching increased discourse among African-American high school students and encouraged them to engage in mathematical tasks. Ninety-seven percent reported feeling more confident about their mathematical ability working in small groups.

**AFF, ETHN, Tchg, GRPG, ORAL (HS)**


This study evaluated the UCSMP Precalculus and Discrete Mathematics across nine schools. Students (n=141) scored substantially higher than SIMS students on SIMS items. Technology use varied widely. All teachers (n=9) would use the materials again.

**CALS, DscM, MATH, GCAL, PRF (HS)**

Todd, Thomas Lee. (1994, July). The effects of a computer management system upon the mathematical achievement of sixth-grade students (State University of New York at Buffalo, 1994). *DAI, 55A*, 44. [AAC 9414723]

The experimental group (n=150) had higher achievement scores in computations, concepts, and applications than the control group (n=150). Males had higher achievement scores, but females had higher achievement gains. Teachers’ attitudes improved significantly.

**ACH, COMP, GEND, TATT (MS)**

Data collected from (n=180) students across two universities was used to identify significant variables. The most important cognitive variable was GPA and the most important affective variable was attitude toward statistics. 

ACH, STAT, AFF (Ps)


The open approach to teaching improved students' (n=50) mathematical problem-solving performance and attitudes towards mathematics significantly in a positive way. Gender did not have a significant effect on problem-solving performance. PS,Tchg, ATT, GEND (HS)


Learning disabled (n=42) and regular students (n=42) were assigned to active interaction, drill and practice, or control conditions. Active interaction students scored highest and learning disabled students improved only in this condition. LD, Tchg, A/S (EC)


Case studies of four students and the instructor revealed that negotiated norms included collaboration, intellectual autonomy, and students devising their own methods, determining the viability of their solutions, and initiating the presentation of multiple solutions and ideas. PS, Soc (Ps)


Judgments of (n=80) mathematicians from around the world were used to validate the proposed model. Results indicated that the overall model and each of its three components was judged valid, comprehensive, and useful. REP (ALL)


Nine classes each used the graph exploration approach on one of two units. For the first unit (the indefinite integral), traditionally taught classes did significantly better on graphical problems. For the second unit (Fundamental Theorem of Calculus), there was no difference. Cals, GCAL, ACH (HS)


Seven of 14 classes participated in structured journal writing. Females achieved higher than males but exhibited a less positive attitude towards mathematics. When journal writing facilitated performance, males were helped more than females. 

ACH, ATT, WRIT, Alg, GEND (Ps)
Vidakovic, Draga. (1994, March). Cooperative learning: Differences between group and individual processes of construction of the concept of inverse function (Purdue University, 1993). *DAI, 54A, 3361.* [AAC 9403803]

Based on observations of five individual students and five groups of students, it was concluded that there was a difference between the individual and group processes involved in learning the concept of inverse function. Computer activities to assist the processes were developed.

**GRPG, LRNG, CALS, SOFT (Ps)**


A theoretical model of technology-aided mathematics education was developed and used to evaluate the IMSA program. Issues include learning benefits, role of industry, crucial factors, future events, and methods of dissemination.

**CURR, TECH (HS)**


Beginning with an analysis of the questions students ask, this study focuses on conflicts that arise in the classroom, reasons for these conflicts, how students feel these conflicts, events that prompt the conflicts, and how students' ways of knowing are communicated.

**BLF, ORAL, SOC (Al.)**


Parents in five elementary schools perceived similarities in the roles of education and mathematics in the implementation of technology. Unexpectedly, they also saw similarities in the roles of teachers and computers.

**TCHG, TECH, COMP, SOC (El.)**

Werner, Judy A. (1994, January). Teacher beliefs about calculator use as part of instruction and on tests and factors that influence those beliefs (University of South Carolina, 1993). *DAI, 54A, 2461.* [AAC 9400296]

Survey responses from teachers (n=44), grades 5-7, show that past experience, professional organizations, textbooks and materials, the school district, and others' beliefs influence their own beliefs about calculator usage in the classroom and on tests. **CALC, TBLF, SOC (MS)**


Six Korean-English bilingual students used different techniques according to their stage of bilingualism to solve mathematical word problems written in English. Results seem to support Vygotsky’s linguistic theory and the weak version of the Sapir-Whorf hypothesis.

**LANG, PS, ETIN, LRNG, WRIT (Al.)**


Two teachers assigned students three writings which were examined for length, syntactic maturity, and cognitive operations. Teachers thought the tasks helped students and gave the teachers more information about students' understanding of mathematics.

**WRIT, DevM (Ps)**

To encourage a less formal, more intuitive and creative approach to mathematics, the “connected mathematics” approach encourages explicit connections between mathematical ideas and other pieces of knowledge both mathematical and non-mathematical.

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Wilford, Paul Ward. (1994, February). Peer collaboration in the mathematics teachers network project: A qualitative study (Utah State University, 1993). DAI, 54A, 2976. [AAC 9402317] Schools with administrative support were most successful in implementing project activities. In-service activities by local teachers (n=10) promoted collaboration among teachers. Teacher concern for self-exposure was the major inhibitor.

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Williams, Janet D. (1994, July). Implementing the NCTM Standards for school mathematics: The effectiveness of site based teacher inservice at Winter Haven High School, Florida (University of Central Florida, 1993). DAI, 55A, 59. [AAC 9414224] Questionnaires, interviews, observations, and other data from (n=12) teachers suggested that the in-service was generally effective both in increasing the frequency of desired teaching techniques and in promoting positive attitudes about the NCTM Standards.

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Wilson, Linda Marie Dager. (1994, February). Assessment in a secondary mathematics classroom (The University of Wisconsin - Madison, 1993). DAI, 54A, 2935. [AAC 9322564] Only tests, quizzes, and exams were graded and therefore valued. Discrepancies between beliefs and practice were attributed to others’ expectations, the curriculum, the structure of the school, and working conditions.

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Wirnbish, Glenn Joseph, Jr. (1994, February). Identification and classification of attitudes of nonspecialist undergraduate mathematics students that might affect collegiate cooperative learning procedures (The University of Alabama, 1993). DAI, 54A, 2935. [AAC 9403320] This study examined student attitudes toward mathematics, mathematics teaching, and the use of cooperative learning interventions in a liberal arts mathematics classroom. No results are indicated in the abstract.

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Wolfe, Peggy Ann McDonald. (1994, April). The use of imagery to solve mathematical word problems by second-grade students (Oklahoma State University, 1993). DAI, 54A, 3674. [AAC 9407282] Students (n=24) solved word problems based on a traditional folktale. The pictures they drew were analyzed for spatial sense and problem solving. Those most capable of generating images were also best at problem solving and used their images in the solution process.

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Wu, Der-Bang. (1994, November). A study of the use of the van Hiele model in the teaching of non-Euclidean geometry to prospective elementary school teachers in Taiwan, the Republic of China (University of Northern Colorado, 1994). DAI, 55A, 1215. [AAC 9427458] The class taught using an approach based on the van Hiele learning model engaged in a higher level of geometric thinking and achieved significantly higher than the class taught by the lecture method.

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Suggestions from mathematics educators and teachers were used to develop objectives to be mastered in becoming computer literate. The operational definition of computer literacy put strong emphasis on integrating the computer into instruction. Comp, CII, TchG (Se)

Yoon, Gwan-Sik. (1994, May). The effects of instructional control, cognitive style, and prior knowledge on learning of selected CBI-taught arithmetic skills in a Korean elementary school (The Florida State University, 1993). DAI, 54A, 4069. [AAC 9410171]

Results on (n=166) second and third graders in Korea show that instructional control strategies interact with levels of prior knowledge and types of cognitive styles in their effect on mastery of multiplication facts. MID, CAI, Knw, StyL (EC)


Six intact classes of two teachers were randomly assigned to traditional instruction, student team learning, and enhanced cooperative learning. Teacher effects were significant, and for one teacher on the third test, cooperative methods were superior to traditional instruction. Grpg, ACh, Mtco (MS)


Seventh-grade students (n=129) who ranked high or low on looking-back ability were assigned to summary, completion, or control treatments. Statistically significant results showed that summaries and completions teach problem solvers of different abilities to look back. Ps, TchG, Knw (MS)
# Dissertations by Institution

**United States**

**American U.**
- Lee, R.E.

**Andrews U.**
- Cox

**Arizona State**
- Diaz S.; Kim, Y.S.

**Auburn U.**
- Carter, J.P.W.;
- Lee, D.B.; Parnell

**Baylor U.**
- Isbell; Leiker; Sanders

**Boston College**
- Halpern; Moynihan

**Brigham Young**
- Arnoldsen

**Cath. U. of America**
- Blagmon-Earl

**City U. of N. Y.**
- Moore, P.J.

**Clark U.**
- Costa

**Columbia U.**
- Akins; Burns; Klig;
- Mwerinde; Nayer;
- Newsome; Sun;
- O'Connell; Zaidi

**CorneU.**
- Smith, E.E.; Piliiero

**Drake U.**
- Chen; McKernan

**Florida State**
- Diaz O.; Follett;
- McGlamery; Olson;
- Trouw; Yoon

**Gallaudet U.**
- Glover

**Georgia State**
- Johnson, W.R.; Nash;
- O'Neal; Ottinger; Poppe;
- Thomas

**Hofstra U.**
- Taylor

**Indiana U.**
- Emenaker; Mau;
- Raymond

**Iowa State**
- Pierson; Sneller

**Kent State**
- Caniglia; Mikusa

**Lamar U.**
- Covell

**Louisiana State**
- Awrey; Reeves

**M. I. T.**
- Carter, R.C.; Wilensky

**Memphis State**
- Bassa; Harris; Lindberg;
- Liu

**Miami U. (Ohio)**
- Laison

**Michigan State**
- Rickard

**Montana State**
- Dapples; Fredenberg

**New York U.**
- Farin; Tournaki

**N. C. State**
- Capps

**Northern Arizona**
- Henry, R.J.

**Northern Illinois**
- Vohra

**Nova U.**
- Bartlett

**Ohio State**
- Chien; Drevo; Drury;
- Edwards; Hoosain;
- Kunicki; Kwak; Mathews;
- Smyser

**Ohio U.**
- Chakalisa; Nhlengetfwa;
- Snyder

**Oklahoma State**
- Hall; Wolfe

**Oregon State**
- Chalardkid

**Penn. State**
- Zubris

**Purdue U.**
- Perlwitz; Vidakovic

**Rutgers-N. Brunswick**
- Cerreto

**S. Ill.-Carbondale**
- Meeks; Tougaw

**Stanford U.**
- Hackett

**SUNY Albany**
- Schoeck

**SUNY Buffalo**
- Gonzalez G.; Ilsu;
- Smith, M.A.; Todd

**Syracuse U.**
- Mukunda

**Temple U.**
- Peterson

**Texas A&M**
- Allen; Majdalani; Mittag;
- Shields

**Texas Tech**
- Tunstall

**Texas Woman's**
- Bearden; Higginbotham

**Union Institute**
- Lai

**U. of Akron**
- Dipillo

**U. of Alabama**
- Clark, F.B. Dobbs;
- Massey; Strange; Wimbish

**U. of Arkansas**
- Caselman

**U. of Central Florida**
- Williams

**U. of Chicago**
- Thompson

**U. of Cincinnati**
- Dinkheller; Grogan

**U. of Connecticut**
- Dean

**U. of Denver**
- Ross

**U. of Georgia**
- Bennett, E.M.; Dresden;
- Estes; Hsieh; Jiang;
- Whang

**U. of Houston**
- Bennett, J.M.R.; King

**U. of Ill.-Chicago**
- Casteri
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<td>U. of S. Florida</td>
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<td>U. of S. Califomia</td>
<td>Ayala; Kosmicki; Lanich</td>
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<td>U. of S. Missouri</td>
<td>Brodley; Lee, M.J.; Luce; Roberts; Vaughn</td>
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<td>U. of Tennessee</td>
<td>Sprague; White</td>
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<td>U. of Texas–Aus.</td>
<td>Amstrum; Foutz; Gerhard; Gibbs; Gittinger; Owen; Johnson, L.F.; Paredes; Simpson; Sullivan; Tompkins</td>
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<td>Dorgan; Maxwell; Moore, S.D.; Perie</td>
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<td>Behrend; Gutstein; Hartig; Hopp; Martin; Richgels; Wilson</td>
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<td>Gooya; Menon</td>
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<td>U. of Toronto</td>
<td>Ayano; Clark, J.L.; Fullerton; Ilaines; Lato</td>
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<td>U. of N. S. W.</td>
<td>Kaldor; Phalavonk</td>
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RESEARCH ARTICLES PUBLISHED IN 1994

Gale A. Watson, Ohio State University
Michelle K. Reed, Ohio State University

This section lists 185 articles in mathematics education research that were published during 1994. Each entry is coded (see Key to Codes) with 1-3 major and any number of minor topic codes, as well as the grade level (in parentheses). All entries are indexed by major codes at the end of this volume. Please note that studies related to preservice or inservice teacher education are so indicated by the appropriate topic codes (Psrv, Isrv). The level designated on teacher education studies refers to the grade level(s) at which the intern or teacher participants teach. A list of the journals searched and the number of articles included from each is provided at the end of this section.


Subjects generated mental images before and after a problem was presented. Analysis showed that "imagery-after" helped overcome misleading or fixating tendencies that interfere with solutions; "imagery-before" enhance such tendencies. PS, VIS, ARTH, GEOM (HS, Ps)

Armstrong, Gerald; and others. (1994, December). Our experience with two reformed calculus programs. PRIMUS, 4(4), 301-311.

Gives a general description of reformed calculus efforts and describes experiences with two reformed calculus programs in contrast to traditional calculus. Compares these three programs using teaching evaluations and student journals. CALLS, TCHO, CII, CURR (Ps)


Reports on the use of technology to enhance the teaching of ordinary differential equations, gives examples of laboratory activities using cooperative learning, and discusses assessment of student learning. MacMath, TI-81 graphing calculators, and Maple were used in the course. AdvM, CII, GCAL, GRPG (Ps)


Discusses the use of multiple-choice test items to diagnose student misunderstandings. Properties of semi-dense items are discussed and illustrated with an example and by using a refined item digraph. ASSM, DIR, Eqv (K-12)


Describes the results of an international survey of (n=94) graduate programs that collected data about the training of researchers in mathematics education and established an information network about graduate programs in mathematics education. Isrv, Rsch (Ps)

Discusses the spatial aspects of Greeno's model of conceptual domains and applies the theory to the learning of geometry. Examines the relationship between mathematical and spatial thinking in light of Greeno's environmental/spatial view of learning. **GEOM, REP, VIS** (K-12)


Discusses ways that calculators and computer microworlds, such as Logo and Shape Makers, can be used as tools for exploration, problem solving, and empowerment in school mathematics. Includes suggestions for classroom activities. **CALC, COMP, IMP** (EL)


Focuses on the contribution of the Journal for Research in Mathematics Education to the view of learning and teaching elementary school mathematics embodied in current curricular recommendations for school mathematics. ** IMPL, RSCH, CURR, LRNG, TCCH** (EL)


Responses to Piagetian tasks revealed that a significant correlation exists between logical thinking structures and the ability to construct and interpret line graphs. **LRNG, REP, ALG** (K-12)


Examines the instrumentation used to assess both graphing abilities and the impact of microcomputer-based laboratories (MBL) on students' graphing abilities. Numerous disparities exist between the results of multiple-choice and free response instruments. **ASSM, REP, ALG, COMP** (HS)


Identified 423 cognitive student outcomes as perceived by (n=45) classroom teachers to be related to participation in a hands-on, integrated mathematics/science program called AIMS. Involvement in the research project contributed to teachers' professionalism. **IC, ISRV, LRNG** (EL)


College students were more likely to construct correct equations when symbolic knowledge was presented than when they only received a single relational statement (students/professors problem). Contextual constraints in problem solving are discussed. **LANG, PS, REP** (PS)

Discusses research issues deriving from different interpretations and responses to cultural conflicts in mathematics education and presents a possible research agenda.

**Ethn, Impl, Rsch (K-12)**


Two studies indicate that preservice teachers were more likely to incorporate into their teaching repertoire knowledge they acquired from an interactive multimedia system than from conventional methods.

**Prsv, Tech, TKNW, Tchg (El)**


Reports a case study exploring how two 16-year-olds were enabled to capitalize on the potential of errors to stimulate and support mathematical inquiry. Discusses variations within the strategy of using errors to enhance mathematics instruction.

**Dir, Tchg (HS)**


This study examined the relationship of (n=125) college women’s mathematical self-efficacy and interest in mathematics/science-based careers to the consideration of pursuing such careers. Interests was a significant predictor of career choice.

**Aff, GEND (Ps)**


Ten students from grades 7 and 8 solved five transformational geometry problems. Results indicated that some students showed a preference for holistic versus analytic processing and that use of analytic strategies was associated with success.

**Geom, PS, StyL (MS)**


A sample of (n=55) children in years 1, 2, and 3 in three schools in Brisbane showed a developmental sequence from use of objects, to use of counting, to mental calculations using knowledge of number facts and place value.

**AIS, Rep, PlCV (EC)**


Two lessons introducing probability taught by an expert and a non-expert 6th-grade teacher were analyzed for the quality of teaching. The expert teacher more consistently explicated the relationship between formal symbols and the given mathematical tasks.

**Tchg, Tchr, Prob (MS)**


An action research study of second-grade students’ group work indicates that when students were not given sample solutions for problems, they were more likely to use higher order thinking, take ownership of strategies, discuss solutions longer, and be more accepting of other views.

**Oral, PS, Tchg (EC)**


Metacognitive behaviors of subjects having high (n=2) and low (n=2) levels of experience were compared across four cognitive processes: orientation, organization, execution, and verification. High-experience subjects engaged in self-regulation and spent more time on orientation and organization.

Shares information on selected characteristics of Hispanic and Haitian students that may affect their mathematical learning and gives examples of classroom strategies that may be helpful in working with these students.

**ETHN, IMPL (MS)**


Reports, in French, an investigation of graphic representations in problem-solving tasks of the type in Spanish Mathematical Olympiads. The choice and interpretation of the first graphic representation played a decisive role in the discovery of the solution.

**PS, REP, Alg (Sc, Ps)**


Presents a case study of the interaction of cognitive and affective factors in one early childhood teacher education student's experiences of learning mathematics. Identifies issues of concern to both preservice teachers and teacher educators.

**Aфф, Lmр, Soc, Prsv (EC)**


High school students who studied worked examples while learning how to translate English expressions into algebraic equations outperformed the control group, made fewer errors and fewer types of errors, completed work more rapidly, and required less teacher assistance.

**Alg, Rep, D/R (HS)**


Presents data from a content analysis of mathematics textbooks for grades 1-8 showing that content areas were not evenly distributed throughout the texts and cautions that following a text in sequential order may cause students to miss important material.

**Curr, MatL (El)**


Content analysis of seven text series, grades 1-8, found that textbooks published after 1989 showed shifts of emphasis among content areas; changes in amount of content development, drill, word problems, and problem solving; and increased use of estimation and calculators.

**Curr, MatL (El)**


Reviews research related to computer functions that noncomputer media cannot easily duplicate in construction-oriented environments and evaluates their unique contributions to students' learning of geometry. Implications for software design are drawn.

**Geom, Revw, Soft (K-12)**

Investigated the continuous fraction concepts of (n=59) students, grades 4-6. Students were confident and accurate when performing sharing tasks, but were much less successful on continuous quantity tasks involving formal fraction language and symbol manipulation.


Discusses how issues related to mathematics teacher education are currently being addressed, what historical precepts have contributed to the present state of affairs, and what orientations can move teacher education forward as a legitimate field of disciplined inquiry.


Children who reproduced given rotations without the information provided by a rotating turtle used fewer trial-and-error problem-solving strategies and more higher level problem-solving strategies to compensate for lack of immediate feedback.


Tests of (n=107) 3rd- through 6th-graders' basic addition facts found that 34% of errors involved the addition of zero and 83% of the remaining errors involved at least one of the digits 7, 8, or 9 when the other addend was 4 or more.


Discusses the universality of mathematics and mathematics education, Western mathematics, social and educational change, mathematics education research, and the role of the Journal for Research in Mathematics Education.


Discusses needed improvements in teaching mathematics, considering students, human development, knowledge and learning, structure of schools and instructional programs, and mathematics. Also discusses the need for theories.


Activities of 12-year-old students solving problems of polygonal tilings suggests two categories of thinking processes: instantaneous perceptions of simple structures and discursive thinking reflected in drawing activities and arguments of proofs.


Analyzes three textbook series for meaningful learning experiences with fractions relative to modes of representation, pictorial models, qualitative reasoning, and students' informal knowledge of partitioning.

Research Articles Published in 1994

Describes observations, written samples, and interviews of (n=24) high school teachers learning concepts of group, subgroup, coset, normality, and quotient group in an abstract algebra course. Considers the role of errors from an action-process-schema perspective.

AdVM, Lnng, Isrv, TKnw (Ps)


Reports a project that involved experienced K-12 teachers in mathematical modeling, using variables and functions in an intuitive context, while investigating the appropriateness of spreadsheet solution methods across a broad range of grade levels. Rep, Soft, Isrv, PS (K-12)


Discusses results of research on graphing calculators in the following categories: (1) achievement studies, (2) conceptual understanding, (3) problem solving, (4) classroom dynamics, and (5) future research needed. GCal, Impl, ACh, Lnng, Oral, PS (SE, Ps)


Describes a course intended to develop students' abilities to read mathematics, express mathematical thoughts clearly, reason logically, and grasp the nature of proof. Students improved their algebraic procedural skills and attitudes towards mathematics.

Lang, PS, Att, Prf (Ps)


This article reviews the research on the development of children's understanding of the endlessness of numbers and of the infinite gap between a large finite set and an infinite set.

NSNs, Revw (El)


The focus of this study was the effect of wording on solving three types of difference problems by first graders. COMPARE problems were significantly harder than EQUALIZE and WON'T GET problems.

A/S, Lang (EC)


Addresses two questions: (1) How has gender and mathematics been treated in the JRME, and how does that record fit into the broader societal concern with gender and mathematics? (2) What kinds of studies should be published in the future to achieve equitable treatment?

Gend, Rsch, Soc (All)


Discusses research on helping students develop their mental managerial processes or metacognition, the role of a framework for problem-solving activities, the teacher as model or moderator, problem solving in small groups, and weaving writing into problem solving.

Impl, PS, Grpg, Mtcg, WrIt (Se)

The Recognizing and Recording Reform in Mathematics Education Project monitors the implementation of the NCTM Standards as well as a broad program of research and development. Discusses key issues in mathematics reform and describes the methodology of the project.

\[ \text{LSAs, CURR, ISRV, TCHG (K-12)} \]


Discusses research findings related to students' ability to make connections between analytical (symbolic) and graphical representations of functions in calculus. Describes graphing tasks and typical student interpretations. Implications for teaching are suggested.

\[ \text{CALS, IMPL, GCAL, REP (SE, Ps)} \]


This study examines the perceptions of three preservice teachers regarding the use of calculators as instructional tools and the influence of personal, background, and social factors affecting the use of calculators in the classroom.

\[ \text{CALL, PRSV, SOC, TCHR (K-12)} \]


Studied relationships between intended, implemented, and tested curricula of (n=84) classes of eighth-grade mathematics students based on SIMS data. The SIMS test for eighth graders was not representative of curriculum as defined by students' texts.

\[ \text{CURR, LSAs (MS)} \]


Results showed that children (n=354) in self-assessment classes showed significant improvement in scores on a purpose-built mathematics test over children (n=313) in a control group.

\[ \text{ACH, ASSM (EL)} \]


Studied fifth-grade (n=10) teachers' and (n=20) students' beliefs about mathematical problem solving, attributions for levels of performance, and beliefs about the teaching and learning of problem solving. Gives four general conclusions.

\[ \text{BLF, PS, TBLF (MS)} \]


Integrated assessment (Work projects, Progress activities, Self-regulating elements, and Observation) showed (n=4) teachers focused on local aims; general aims; and intentions, attitudes, and confidence as evidence of improved classroom environment.

\[ \text{ASSM, SOC, AFF (HS)} \]


Young children (5 & 6 yrs.) were asked to give different recipients the same total number of blocks, but the blocks were to be dealt out in different quantities to each recipient. The children did better when the total quantity was a multiple of the dealt number.

\[ \text{EQV, MID (EC)} \]

Structured interviews with high school students who scored at least 670 on the SAT-M showed female students were more likely than male students to use conventional solution strategies, which may explain why females outperform males on conventional problems.

*GEND, LSAs, PS, ACH (HS)*


The Professional Development Program, in which (n=80) mostly minority precalculus students attend workshops featuring small study groups, faculty leadership, challenging mathematical materials, and peer support networks, showed no overall effect on student performance.

*CALS, ETHN, Tchg, GRPG (Ps)*


A survey of (n=917) students of teachers trained in the Quantitative Literacy Project workshops found that students have mostly positive attitudes towards learning statistics, but fewer students felt it was useful to learn these topics.

*ATT, STAT, ISRV (K-12)*


Discusses the ethnomathematics movement, concepts related to ethnomathematics, ethnomathematics as a field of research that studies mathematics in its relationship to cultural and social life, and the beginning of ethnomathematical research in Mozambique.

*ETHN, RSCH, SOC (ALL)*


Discusses some results of the CSMS test which provides information for teachers on students’ levels of understanding in secondary school mathematics, including comparison with a Piagetian task, identification of misconceptions, and description of naive strategies.

*LRNG, LSAs, MEAS (SE)*


Analysis of think-aloud paired problem-solving protocols showed that although two year-11 students were successful in coordinating different, yet complementary roles, their metacognitive decision making was adversely affected by social interaction.

*MTCC, PS, SOC, GRPG (IIS)*


Presents an alternative to the research-development-diffusion model of mathematics education based on an integration of curriculum research and design embedded in educational development. Discusses characteristics and methods of developmental research.

*CURR, RSCH (K-12)*

Discusses duality between process and concept in mathematics, ambiguity of symbolic notation, flexibility in thought processes of successful students, and a qualitatively different kind of arithmetical thought in more able compared to less able elementary students. **Arth, Lrmg (El)**


Discusses four criteria essential for the development and use of appropriate systems for evaluating mathematics teaching: (1) make mathematics a priority, (2) consider teachers' beliefs, (3) use multiple data sources, and (4) make effective use of time. **Askm, Tchg, Tatt, Tblf (Sc)**


Studied invariance of ratio through (n=16) sixth graders' taste constancy. Results showed an absence of taste constancy and that children based their judgment of the relative strength of two samples from the same mixture on extraneous variables. **Eqy, Frac (Ms)**


Discusses the Third International Mathematics and Science Study including involvement of schools, international dimensions, content of tests, and value of TIMSS. **LSAs (K-12)**


Studied (n=87) elementary cooperating teachers' self-reported familiarity with, access to, and use of 11 common manipulative devices. Found limited use of manipulatives and a pattern of diminishing use through the grades. **Manp, Tchg, Att (El)**


Investigated (n=22) seventh-grade students' informal processes in solving first degree equations in one unknown prior to instruction. Results indicated a cognitive gap characterized as the students' inability to operate spontaneously with or on the unknown. **Alg, Arth, Lrmg (Ms)**


Questionnaire data from (n=117) mathematics teachers showed that teachers had a tendency to think only in terms of continuous functions, yet had little skill in constructing continuous functions. They scarcely considered discontinuous functions. **Caln, Tknw, Alg (HS, Ps)**


Provides the statistics and a brief analysis of the recent elementary and secondary science and math scores on the 1992 National Assessment of Educational Progress achievement test. **LSAs (K-12)**

Accounting students (n=114) were presented data in either a graphical or a tabular format. Males performed better than females and individuals receiving tabular format outperformed those receiving graphical format. 


Reviews the research on knowledge use in science and mathematics education and highlights approaches and strategies for dissemination.


This paper describes how girls interact within an electronic games environment. Girls were observed and interviewed to determine their interest in electronic games, how they play and watch others play, and how the presence of others affects their play.


Sixty-six children attending a Dutch school for educable mentally retarded children, grades 4-7, took pretests for reading and arithmetic ability to see whether identification of specific errors could aid in developing an intelligent tutoring system for word problems.


Describes a simulation-oriented computer microworld called CHANCE used to overcome the limitations of physical materials for experiments in introductory probability. A teaching experiment conducted with four middle school and high school students is discussed.


Discusses the origins of JRME, focusing on mathematics education in the '50s and '60s, establishment of the Research Advisory Committee of NCTM, publication of Research in Mathematics Education, and the initial structure, policy, and procedures for the new journal.


Two treatment groups, one using Logo and one using manipulatives and paper and pencil, received eight lessons on geometric motions. Both groups, especially the Logo group, outperformed a control group on geometric thinking.

Describes the development, refinement, and validation through six case studies of a framework for nurturing and assessing multidigit number sense in young children, including counting, partitioning, grouping, and number relationships. *NSNS (EC)*


This review focuses on ways that video, alone and with other media, has been used for math and science teaching. Specific curricular materials are examined, and areas of needed research are identified. *Revw, Tech (K-12)*


Discusses the interactions between technology and research in mathematics education, including CAL role of technology in learning, use of microworlds to study concept formation, research methodologies, interactive technologies, and lack of technology-related research in JRME. *Revw, Tech (Au.)*


An algebra test administered to (n=18) first-year college students found: a disregard for negative numbers, ineffective use of counterexamples, misapplication of rules, and a lack of a good grasp of relevant mathematical terminology. *Alg, Arth, Knw (Ps)*


Cooperative learning techniques proved effective in improving student performance and retention in a freshman level statistics course. Lectures interspersed with group activities proved effective in increasing conceptual understanding and overall class performance. *Grpg, Stat, ACh, Lrng (Ps)*


Investigated (n=124) pre-service teachers’ reasoning and concepts of invariance of fractional numbers under numeration systems in different bases. Most students believed that fractions change their numerical value under different symbolic representations. *Eqv, Frac, Psv (K-12)*


Features interviews with Thomas Kieren and Thomas Romberg and discussion of the evolution of views on mathematical learning, including constructivist interpretations, situated cognition, and a social-interactionist Vygotskian orientation. *Lrng, Revw, Styl (All)*

Students (n=62) in grades 1-6 believed that anyone who tried could learn mathematics; moderate achievers were just as confident as high achievers; and there was little evidence of a relation between parental support and student achievement.


Two treatments, one of teacher-directed activities and one a supplemental peer practice activity, were compared in a first-grade mathematics class. Supplemental practice with peers increased students' active responding and acquisition of content.


Tests of computational estimation ability (CEA), strategy (CES), and mental computation ability (MCA) of (n=124) 4th-, (n=143) 5th-, and (n=84) 6th-graders found significant relationships between CEA and MCA and between CEA and CES, but not between MCA and CES.

Lambdin, Diana V.; and others. (1994, April). Connecting research to teaching: Reflections on mathematics education research over the twenty-five years of JRME. Mathematics Teaching in the Middle School, 1(1), 38-43.

Discusses educational research in mathematics, the relevance of research for classroom teachers, trends in the kinds of research being conducted in mathematics education, tips for reading research studies, and unanswered questions from research.


Describes five college and two high school students' understandings of function and limit in a graphics calculator-based environment and identifies instances where students' understanding seems to have been influenced by the availability of a graphing calculator.


Reflects on the process of problem solving in the particular case of light reflection physics and abstracts objectives, methods, and values that can help (a) solve problems in the human sciences and (b) evaluate solutions using the Strategy Learner.


High-achieving (HA) and low-achieving (LA) Year 11 students were compared during solution of geometry problems. HA students not only accessed more geometric knowledge but also used it more effectively, and they more frequently managed their processing behavior.

Responses to a questionnaire given to (n=161) undergraduate elementary education majors and (n=60) elementary teachers found that the preservice teachers were more likely to prefer that math and science be integrated in the elementary grades.  


Surveys of (n=80) elementary school principals showed that teachers used microcomputers more in mathematics than science, and microcomputer and calculator use was more common in intermediate grades than in primary grades.


Reports on conceptual understanding and solution strategies for percent problems of (n=31) students of two ability levels in grades 5, 7, 9, and 11. Strategies evolved from intuitive to formal and increased in diversity with increasing age.


Provides a brief overview of past research in mathematical problem solving, discusses the apparent recent decline in research in this area, and suggests some issues and questions for future investigation.


Analyzes one third-grader’s participation in class discussions, his beliefs, and his arithmetical development during a year in a problem-centered classroom. Concludes that fruitful class discussion both necessitates and is facilitated by negotiation of social norms and mathematics meanings.


Describes the relationship between learning opportunities and the negotiation of social norms in mathematics class discussions based on data from interviews and observation of a third-grade classroom. Includes several transcripts of observations.


Results suggest that diagrams are the basis for geometry problem-solving memories and that the structure and quality of problem-solving memories affect problem-solving transfer.


Case studies of (n=5) K-3 teachers found three levels of introspection in the teachers, rank-ordered by the degree to which children’s thinking was utilized in their decision-making processes.

Discusses the effect on classroom learning environments of teacher beliefs about mathematics and teaching, teacher knowledge of children's thinking, teacher knowledge of content, and worthwhile mathematical tasks.


Analysis showed a relation in (n=38) undergraduate students between statistical competence and metacognitive knowledge of tasks and strategies in statistics. Perceived competence appeared separate from metacognitive knowledge and cognitive performance.


Results of instructing (n=12) male seventh-grade students toward developing number sense indicate that after instruction students were more likely to use strategies that reflected number sense to solve number magnitude, mental computation, and estimation problems.


Observation and interviews of (n=90) 2nd- and 3rd-graders' mathematical problem-solving behavior found that the children readily attempted unfamiliar problems and used systematic solution processes. Found no significant gender differences.


Discusses research on affective issues as it has developed over the life of the JRME, including: student beliefs and mathematics learning, emotional responses to mathematics, and new approaches to affective issues.


This study explored the measurement integrity of scores on the Fennema-Sherman Mathematics Attitude Scales using data provided by public elementary school teachers. Both factor structure and sensitivity to socially desirable response set were investigated.


Pre- and posttests of prerequisite vocabulary terms were given to (n=162) intermediate and (n=178) college algebra students to determine their word knowledge and differences between the intermediate and college algebra students.

Third- through sixth-grade mathematically talented students (n=306) enrolled in a flexibly paced university mathematics course far exceeded the normative achievement gains expected over a one-year period.


Discusses past research involving Piagetian conservation concepts in Native American students; the relation of language to mathematics education; holism in mathematics learning; mathematics and culture; and mentorship in an atmosphere of cultural diversity.


Observations and interviews with (n=16) undergraduate mathematics and mathematics education majors learning to do formal proofs found three major sources of difficulty: concept understanding, mathematical language and notation, and how to start a proof.


On two examinations taken by 12th-grade students (n=13,522 for calculus; n=18,031 for statistics) in New Zealand, males outscored females, significantly in statistics. Some differences moderated when mathematics coursework was factored in.


Achievement gains in students (n=101), grades 3-5, both boys and girls, correlated positively with "giving explanations," "receiving explanations," and "giving and receiving other help"; correlated negatively with "receiving no help after requesting it."


Presents a case study of how one eleventh grader learned the meaning of the velocity sign. Her learning was not just an acknowledgment of a rule, but a broad questioning and revision of her thinking about graphs and motion.


Studied schemes involved in solving two-step arithmetic word problems in (n=1824) elementary schoolchildren in Israel. Compound schemes and combinations of operations were found to affect the difficulty level of the problems.


Data from (n=470) students at Owens Technical College showed that high school GPA was the best predictor of grades in Basic Algebra, followed by high school rank, college GPA, ACT natural sciences, ASSET numerical skills, and ASSET elementary algebra scores.

Reviews psychology literature on the nine-dot problem and suggests implications of research on insight problems. Insight problems are problems that require "flashes of insight" or "leaps of logic" on the part of the solver.


Scores on mathematics anxiety and arithmetic achievement tests of (n=123) college students taught arithmetic using rule-oriented versus concept-oriented instructional approaches showed a significant difference in posttest anxiety scores between the two groups.


Analysis shows that the solver’s structures were modified during the solution process in a global restructuring based on certain characteristics of the solver’s mental representations.


Middle school students (n=171) with mild disabilities who participated in CHT had significantly higher (1) rates of homework completion and (2) percentages correct on homework but did not differ significantly from control students on a global measure of mathematics achievement.


Surveys of (n=295) undergraduate students in college algebra and precalculus about their perceptions of mathematics found that agreement with some myths can be reduced with more mathematical preparation. Suggests strategies to overcome these myths.

Results based on a large sample of students, ages 8-14, indicated that students with learning disabilities scored higher and had greater growth rates than students with mild mental retardation in basic mathematical concepts, vocabulary, problem solving, and fractions.

ACH, LD, FRAC, LANG, PS (El)


Testing and interviews with (n=83) 8th-grade students presented with a set of linear equation-solving tasks revealed two categories of checking behavior: structurally erroneous and executionally erroneous. Relates solving and checking behavior to metacognition. ALC, MTCG (MS)


Using taught algorithms versus invented methods of subtraction was related to age, mathematical achievement, and lateral thinking ability in (n=1370) male secondary school students. Use of invented algorithms increased with age. AJS, LRNG (SE)


Characterizes the commonalities of four exemplary mathematics teachers in terms of their mathematical preparation, conceptions of mathematics, roles of teachers and students, assessment, and teaching; and their teaching practices. TCHG, TCHR, TBIP, TKMW (MS)


Surface and relational similarity were examined using analogs of the missionaries-cannibals (MC) problem with K-, 3rd-, and 6th-grade children. The 3rd- and 6th-graders transferred relational similarity significantly more frequently than kindergartners. PS (El)


Proposes a model for the growth of mathematical understanding based on the consideration of understanding as a whole, dynamic, levelled but non-linear process. Illustrates the model using the concept of fractions. How to map the growth of understanding is explained in detail. LRNG, REP, FRAC (K-12)


Discusses the beliefs and attitudes of (n=7) mathematics teachers, (n=19) 7th- and 10th-grade students, and others participating in a pilot curriculum development program stressing active methodologies and group work. CURR, TCHG, AFF, TATT, TBIP (Sn)


Stimulated recall was used to examine the affective experiences of (n=32) 4th- and 5th-graders engaged in mathematics seatwork. Students’ affect was primarily negative and achievement related. Anger was the most prevalent affective response. ACH, AFF (El)

Compared the performance of (n=710) college students taught precalculus using graphing calculators versus the traditional approach. Students in the calculator group scored significantly higher than the control on a comprehensive final exam.


A study involving (n=40) 12th-graders found differences by gender in approaches to mathematical problem solving. Results suggest that competence is characterized by a content knowledge base and knowledge of metacognitive strategies.


A Saskatchewan sample of (n=191) (99 males, 92 females) and a Western Australian sample of (n=134) (49 males, 85 females) Grade 12 students showed significant effects for gender, locale, and their interaction on measures of achievement, self-efficacy, and attitude.


College students studied simple and complex examples, then used the examples to construct equations for algebra word problems. Evidence for good metacognitive skills included matching examples with test problems and preference for complex examples.


Presents an attempt to develop an instrument to monitor attitudinal changes towards mathematics among (n=345) preservice student teachers.


Views of (n=70) 16- and 17-year-olds on mathematical knowledge, activity, and learning showed no simple systematic relationship between beliefs about (a) the nature of mathematical knowledge and (b) the teaching and learning of mathematics.


A teaching experiment with (n=6) third graders showed that their quantitative reasoning with fractions was based on their quantitative reasoning with natural numbers. Presents the constructive itinerary of one of the most advanced children in the group.


Presents a conceptual framework to explain the differential success of Japanese children in mathematics learning based on Stevenson and Stigler’s effort-versus-ability model, and argues that the Japanese effort model needs to be examined in a social context.

Gender differences in mathematics education were found to be present in Zambia both in terms of access and performance. Possible reasons for such differences are examined in light of attitude questionnaires, including the role of teachers. **ACH, GEND, ATT (K-12)**


Describes the typical eighth-grade geometry curriculum (content, time allocations, instructional methodologies, and other factors) of \((n=109)\) typical and \((n=23)\) enriched mathematics classrooms in the United States based on data from SIMS. **CURR, GEOM, LSAS (MS)**


Discusses four major issues related to the mathematics curriculum and what research says about each of them, namely: questions of content, tracking, problem-based curricula, and the role of proof. **CURR, REVW, GRPG, PS, PRP (K-12)**


Discusses the historical context of mathematics education research methodologies, describes methodological trends as reflected in JRME, focusing on the domain of teacher knowledge and practice, and considers theoretical and methodological issues of the present and future. **REVW, RSCH, TCHG, TKNW (K-12)**


Analyzes the nature and growth of students’ algebraic knowledge and thinking, focusing on two crucial transitions: from the purely operational algebra to the structural algebra of a fixed value of an unknown and then to the functional algebra of a variable. **ALG, LNRC (Se)**


Classified solution strategies of \((n=49)\) 10th-grade students presented with linear programming problems in a predominantly visual setting in the form of a computerized game. Visual strategies were developed more frequently than either algebraic or mixed strategies. **COMP, PS, REP, ALG, VIS (HS)**


This study explored the association of scores for \((n=94)\) pharmacy majors on the 16 Personality Factor Questionnaire and grades in college calculus. Results showed that high scorers in calculus tended to be exacting, persevering, responsible, and conscientious. **CALCS, PERS (Ps)**


Compares one school district’s data with national data and analyzes what factors reinforce and perpetuate inequitable situations for females in science and mathematics. Provides a model for school districts to conduct self-study of gender equity education issues. **GEND (K-12)**

Investigation of (n=41) 8th-grade mathematics classrooms in which, of three teaching approaches (algorithmic practice, teaching with meaning, and problem-process approach), the problem-process groups showed increased achievement and improved student attitudes.

**PS, TCHG, ACH, ATT (MS)**


 Discusses two major themes that emerged from analysis of interviews with mathematics educators: the nature and role of research within the field of mathematics education and the increasingly international character of the community involved in that research.

**CC, RNCCH (A11)**


 Presents a framework used in shaping two major mathematics teacher education projects, derived from a social constructivist view of learning and incorporating French didactical theory. Describes interconnections between different domains of teacher knowledge.

**LRNG, PRSV, SOC, TKNOW (K-12)**


 Describes the development of the ability to identify a ratio as the appropriate measure of a given attribute by (n=26) prospective elementary teachers. Procedural approaches to teaching did not challenge students to develop their own mathematical models of the world.

**FRAC, MEAS, PTV, RUP (EL)**


 A study of (n=26) prospective elementary teachers’ understanding of the area of a rectangular region as a multiplicative relationship between the lengths of the sides resulted in the development of a description of the quantitative reasoning involved.

**MID, MEAS, PTV (EL)**


 Illustrates aspects of a reflective mathematics education using a project for 14- and 15-year-olds to develop different types of knowing: mathematical skills and concepts; technological competence; and reflective evaluations of consequences.

**KNW, MTCG, LRNG, TECH (HS)**

A computer algebra system was integrated into instruction for two large classes of mathematics for business and the social sciences. Comparisons of student achievement and attitude showed no significant differences, but other implications of the study are discussed.


Two experiments support the conclusion that an understanding of the relationship between a superordinate set and the basic sets that comprise it develops between 4 and 5 years of age.


Discusses various research findings aimed at helping teachers provide a classroom climate that induces better number sense. Focuses on number and symbol meaning, including size, place value, and fractions, as well as computation and computational estimation.


Describes the use of time-lapse photographs of a running cat as a model to investigate the concepts of function and derivative in a college calculus course. Discusses student difficulties and implications for teachers.


Analyzes the influence of constructivist thought on mathematics educators since 1960, including Piaget's cognitive-development psychology, a preconstructivist and constructivist revolution, and the current reform movement in school mathematics.


A survey of (n=125) teacher educators and experienced teachers identified six major components of quality teaching: communicating, problem solving, building understanding, engaging, nurturing, and organizing for learning. Presents a model that links the categories.
An action research project in (n=8) Welsh secondary schools found that participation in peer- and self-assessment involved students in a recursive, self-referential learning process supporting the development of metacognitive skills. \textit{Assm, Mtcg, Tchg (Se)}


Investigated problem-solving perseverance of (n=40) students in grades 6 and 10 while solving nonroutine number problems. Students who were ultimately successful were more inclined than others to be flexible in their use of strategies. \textit{Arth, Mtcg, Ps (Se)}


Fourth graders’ (n=117) solutions to addition problems were analyzed in terms of standard or idiosyncratic written algorithms. Students had not been taught pencil and paper algorithms. A preference for working from left to right, and a variety of written algorithms were found. \textit{Ais, Writ (Ec)}


Discusses a teaching experiment with (n=19) senior and graduate mathematics students. Difficulties with the FTOC stemmed from impoverished concepts of rate of change and poorly developed images of functional covariation and multiplicatively-constructed quantities. \textit{Cals, Lrng (Ps)}


Discusses the role of concrete materials in teaching for understanding, including research on the use of concrete materials, seeing mathematical ideas embodied in them, and identifying what teachers want students to understand. \textit{Impl, Manp, Lrng, Rep (El)}


Examines how one teacher’s conceptualizations of rate were encapsulated in the language of numbers and operations which undermined his effort to help a student understand rates conceptually. \textit{Frac, Lrng, TKnw (Ms)}


Presents a case study that describes the experiences of two classroom mathematics teachers and the impact that their own research has had on themselves as teachers; traces their entry into the world of research beyond the classroom. \textit{Impl, Rsch, Tchg, Isrv (Se)}


Focuses on the role of mathematics problems in the development of better assessment and gives examples with respect to some key concepts and operations on percentage. Reports results from use of the problems with two seventh-grade classes. \textit{Assm, Ps, Petr (Ms)}

Surveys of (n=45) elementary teachers showed that sharing mathematics knowledge, enthusiastic teachers, parental support, and practical uses of mathematics were positive influences. Drill, seatwork, and ability groupings were negative influences.  


Beliefs about mathematics teaching of (n=4) preservice mentors of first-grade students were compared with beliefs of (n=103) control students. The intervention group professed significantly stronger belief in a socio-constructivist instructional environment.  


Fifth-graders (n=40) solved and retold one-step compare word problems. Students performed better, had shorter response times, and retold problems correctly more frequently on consistent-language problems than on inconsistent-language problems.  


Presents a case study of a first-grade class and their teacher who were observed as they ascribed mathematical meanings of numbers and numerical operations to empirical phenomena. Differences in ascriptions led to negotiation of meanings.  


Describes a mapping procedure which can be used to visually display the strategies used in problem solving. Applies the procedure to solutions of the Three Hungry Men problem.  


Shows that keeping a journal, as defined within the writing-to-learn model, has two salient assessment features: (a) The journals differentiate between students at a particular grade level, and (b) They show a growth in sophistication over successive years.  


Compares the development of two students' understanding of addition and subtraction, one based on memorized rules and the other on the concept of place value. Discusses the effects of different goals for instruction and the importance of understanding place value.  


Six 7th-grade classes studied basic communication skills (only, control) and academic helping skills (both, experimental) and then worked in small groups on a 4-week unit on fractions. Latino and African-American students achieved more in the experimental group.

Results indicated that the constant time delay procedure used with material prompts was effective in teaching multiplication facts to 4 male students with learning disabilities; instruction was more efficient when students were allowed to select the material prompt.

LD, M/D (MS)


Examined the evolving knowledge of functions and beliefs of a preservice teacher in a course that emphasized mathematical and pedagogical connections. Although her understanding of function changed substantially, her anticipated approach to teaching did not.

Alg, TKnw, Tchg, Pshy, TBLF (HS)


This review analyzes, in the context of current reform recommendations, literature related to graphics calculators, including some early studies assessing the impact of graphics calculators on the achievement and disposition of secondary and early college students.

Alg, GCal, Revw (HS, Ps)


This article discusses the rationale for hypermedia, gives examples of students using hypermedia tools to construct artifacts, critiques research that examines the influence on students' learning, and outlines needed research on the effectiveness of hypermedia.

Impl, Tchh, Soft (K-12)


This study compared 5 visually impaired learning disabled children's perceived and actual mathematical competencies. Analysis indicated that their perceived competencies were significantly greater than their actual competencies.

Ach, Aff, LD, LD (El)


In addition to describing research conducted with TORUS, a diagnostic system for education, the authors suggest that the prevalence of misconceptions in students with learning disabilities argues for more emphasis on conceptual understanding in mathematics.

Di/R, LD, Soft (K-12)


Explicates 12 assertions relating to curricula, teaching, learners, and learning environments, including: unchanging and underchallenging curricula, children's number sense, curriculum restraints on teachers, collaborative learning, problem solving, and constructivism.

Curt, Revw, Tchh (EC)
Profiled interviews of (n=41) kindergarten and first-grade children's numerical development over a school year. Significant mismatches between children's numerical development and typical curricula are described, and changes to current practice are recommended.  

Students in a Logo-Based Instruction class had a deeper conceptualization of fundamental concepts in geometry than students in a control class.  

Investigated gender-related differences in the process of solving routine word problems using a nine-step strategy in (n=153) 6th- and (n=149) 8th-grade students. Females were slightly better than males at following the prescribed problem-solving process.  

Describes two problem-solving videodisc adventure stories related to geometry and reports reactions of (n=25) teachers and their students who used the adventures. Results showed that teachers and students had increased knowledge of ways to apply geometry.  

Developed and tested an audiotaped program for the reduction of math anxiety of (n=20) 9th- and 10th-grade college-bound students. Those who participated in the treatment had significant reductions in levels of math anxiety.
### Journals Searched

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### Best Copy Available

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RESEARCH PAPERS AND MONOGRAPHS PRODUCED IN 1994

MICHELLE K. REED, Ohio State University
GALE A. WATSON, Ohio State University

This section lists 57 papers and monographs in mathematics education research dated 1994 and abstracted for the ERIC database by the end of March 1995. Each entry is coded (see Key to Codes) with 1-3 MAJOR and any number of MINOR topic codes, as well as the grade LEVEL (in parentheses). All entries are indexed by MAJOR codes at the end of this volume. Please note that studies related to preservice or inservice teacher education are so indicated by the appropriate topic codes (Psrv, Isrv). The LEVEL designated on teacher education studies refers to the grade level(s) at which the intern or teacher participants teach.

Results of a study (n=128) investigating the effect on identifying, constructing, and defining functions of using graphing calculators to help in selecting appropriate domains, ranges, and scales of axes for graphing functions.

Students (n=26) in an 11th-grade Algebra II/Trigonometry class used a cooperative learning technique called scripted cooperation. The study explored the nature of students' verbal interaction, how that interaction changed over time, and its relationship to achievement.

Eight students chose a theme to be investigated, collected real data, and analyzed it using Function Probe, a software package. Observation, interview, and journal data from the students and teacher and written work of the students were compiled.


This two-year study documents changes in four elementary-certified teachers' beliefs and practices while implementing NCTM's Curriculum Standards in the 6th grade. Case studies were analyzed individually and across cases.

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Integrates current models and theories into a comprehensive model of algebra word-problem-solving behavior. The relational algebra word problem is focused on, because these problems have been researched extensively and students find them difficult.

**Alo, Ps, Revw, Rep (Se, Ps)**


Four programs—Supporting Ten-Structured Thinking, Conceptually Based Instruction, Cognitively Guided Instruction, and Problem Centered Mathematicalsshow that learning number concepts and operations with understanding is possible under a variety of conditions.

**Arth, Lrng, NSNs, Ps (El)**


Interviews of novice middle school students (n=12) and expert master's graduates (n=5) solving negative number tasks show that metaphors can intuitively justify mathematical operations, integrate mathematical knowledge, enhance computational environment, and improve recall.

**Hrr, Lang, Ps, Rep (K-12)**


Presents research findings on gender differences in mathematics course taking, mathematics achievement, and choice of careers; reasons for female underparticipation in mathematics; how to encourage females toward mathematical careers; and new questions and directions.

**Gend, Impl, Revw (All)**


Subjects were (n=107) 12-year-olds, (n=107) 15-year-olds, and (n=99) elementary student teachers. Results concern the influence of the type of number sentence on performance and the congruence of the generated problems with intuitive models.

**Lrng, MId, Ps, Psv, Rep (K-12)**


This report of the National Assessment of Educational Progress (NAEP) focuses on students' and teachers' reports about the classroom contexts for learning school mathematics in the top-performing one-third of schools compared to the bottom-performing one-third.

**Currr, LSAs, Tchg (K-12)**

Sixth-grade students (n=34) worked in pairs investigating a mathematical microworld written in Logo. The investigation had three phases: (1) open exploration, (2) group discussion and sharing of hypotheses, and (3) additional guided discovery and problem solving.

*SOFT, ORAL, PS (MS)*


Six factors drive the teacher change process: (1) a perturbation, (2) commitment to change, (3) a vision, (4) projecting self into that vision, (5) deciding to make changes, and (6) being a reflective practitioner. A case study of a middle school teacher is discussed.

*ISRV, MTCG (MS)*

Fennema, Elizabeth; and others. (1994). *Cognitively Guided Instruction.* Madison, WI: National Center for Research in Mathematical Sciences Education. [SE 054 237]

In CGI (Cognitively Guided Instruction) classrooms, students spend most of their time solving problems. This paper discusses knowledge about children's thinking and what research has shown about CGI, teachers, children, and successful implementation in primary schools.

*ISRV, LRNG (EC)*


Investigated the relationship of various cognitive factors, attributions, and gender to the solution of mathematics problems by (n=100) high school seniors. Cognitive factors included mathematics knowledge, metacognitive regulation and awareness, and beliefs.

*MTCG, PS, BLF, GEND, KNW (HS)*


Survey results suggest teachers (n=231) have differing philosophical orientations related to their stated beliefs about the need for conceptual understanding before using calculators.

*CALC, TATT, TBLF (EL)*


Four classes (n=53) of Basic Algebra and five classes (n=50) of Intermediate Algebra were randomly assigned to using or not using CAI supplemental to classroom instruction. Pre- and posttests measured achievement growth for the students.

*ACH, CAI, ALG (PS)*


A study investigating how students make sense of and utilize mathematics concepts and operations and the social context within which teachers' and students' individual contributions play a role in the sense making.

*LRNG, SOC, TCHG (MS)*

Data from the 1990 NAEP Trial State Assessment (NAEP-TSA) describe educational opportunities for students in eighth-grade mathematics in 1990. Discusses implications of the findings and highlights a follow-up study using data from the 1992 NAEP-TSA.

*ACH, LSAs, TchG, ISRV (MS)*


This report from the Calculators in Primary Mathematics Project describes some critical features of project classrooms which supported the development of number sense with (n=58) 4th-graders in Australia.

*CacL, NSnS, TchG, Arth, Est (EC)*


This paper compares 1200 (each) Asian- and Anglo-American students on adaptations of three standardized instruments—the Multidimensional Motivational Instrument, the Classroom Environment Scale, and the Instructional Learning Environment Questionnaire.

*Aff, CC, Soc, Blf (MS)*


Systematic observations in middle school mathematics classrooms examined whether or not there were gender, ethnic, or grade-level differences in (n=1315) students' use of technology. Only grade-level differences were found.

*Ethn, Gend, Tchh (MS)*


Estimated the influence of home environment, motivation, ability, classroom environment, quality of instruction, and instructional time on math outcomes using SIMS data. Instructional time was a significant influence upon both achievement and attitude.

*ACH, Aff, LSAs, Soc, TchG (MS)*


Intermediate school teachers (n=8) and secondary school teachers (n=10) were asked to (1) examine their classroom practices, (2) decide what changes they would like to make, (3) make the changes, and (4) reflect on why the changes did or did not improve achievement.

*ISRV, TchG, TKkw (K-12)*


Excerpts from two studies: The first reports the results of introducing (n=10) high-ability middle school students to enrichment activities that promote statistical discussion. The second reports a study of the ways in which group composition influences learning.

*Cur, Stat, Ach, Gend, Gr1g (MS)*

Ten high-ability middle school students participated in an enrichment program on inferential statistics, emphasizing problem solving in real world contexts. Students were familiar with probability, but struggled with the concept of equally likely outcomes.  

**Know, Prob, Stat, Oral, PS (MS)**


Analysis indicated that difficult mathematical concepts such as fractions, percents, and averages are much more prevalent in adults' magazines than in those of children and teenagers. Implications for preparing students for the numeracy demands of everyday life are discussed.  

**FraC, Perc, Soc, Decm, Nsns (ALL)**


This paper reviews some data from previous research documenting the difficulty of equivalent fractions in continuous domains, explains this difficulty in light of Piaget's theory, and suggests ways of improving instruction.  

**Eqy, FraC, Revw, Impl, Lrng (El)**


This paper describes new steps toward a computerized database of addition and subtraction word problems that could provide teachers and students with access to critical natural language terms and expressions for mathematical relationships.  

**AIS, Lang, Soft (El)**


This case study examined the short- and long-term effects on students' attitudes and performance in mathematics of single-sex mathematics classes introduced at the grade 10 level in Australia. Data were collected from students and parents.  

**Ach, Att, Gend, Soc (HS)**


This paper shows how timely questioning on the part of teachers helped (n=151) 3rd-, 4th-, and 5th-grade students: (1) justify their solutions, (2) connect two isomorphic problems, and (3) understand the strategies of other students. Four episodes are included.  

**Oral, Lrng, Prf (El)**

A framework for studying the interplay between sociocultural and cognitive developmental processes consists of three components: (1) goals, (2) cognitive forms and functions, and (3) interplay among the various cognitive forms.

LRNG, PS, Soc (HS)


Examines mathematics practice in everyday work situations by comparing in-school and out-of-school practice. Presents a framework for gaining insight into the interplay between sociocultural and cognitive developmental processes through analysis of practice.

LRNG, Soc, TchG (K-12)


Studies of college students (n=15) and high school freshmen (n=68) were conducted using a curriculum called Mathematics of the Environment (MOE) to see if working in groups to resolve environmental problems would increase their interest in mathematics.

AFF, GRPG, PS (HS, Ps)


Identifies key factors that influence Adult Basic Education (ABE) mathematics instruction in Massachusetts and develops a detailed picture of the adult basic mathematics learning environment.

DIR, Soc (Ps)


Summarizes findings from the 1992 NAEP, including trends in achievement (1990-92), distribution of overall math proficiency, constructed-response questions, national results for demographic subgroups, and trends and trouble spots in math instruction.

ACH, AFF, LSAs, ETHN, GEND, TCHG (K-12)


Data relate to school socioeconomic and demographic characteristics, absenteeism, students changing schools, school problems and climate, college-bound students, impetus for change, home support, classroom instruction, tracking, and course taking.

LSAs, Soc, Ach, TchG (K-12)


Data on (n=16,659) students show: (1) Students taking higher level math courses are more proficient at higher levels of math; (2) Students behind by 8th grade continue to fall behind; and (3) Students planning to go to college have higher math proficiency in 8th grade.

ACH (Sk)

This paper reviews research discussing what teachers and school administrators can do to establish parent-teacher partnerships in mathematics.

Philipp, Randolph; and others. (1994). *Reflective practitioners reform school mathematics.* Madison, WI: National Center for Research in Mathematical Sciences Education. [SE 054 238]

Participating middle school teachers focused on problem solving, conceptual relationships and understanding, and communication in mathematics; had a comprehensive knowledge of the math they were teaching; and participated in their own professional growth.


Three implicit mental models used by children (n=198) in complex change problems were identified: sequential, state comparison, and change comparison. Identified two conceptual leaps: (1) representation of the problem structure and (2) concept of number.


To test the theory of mental calibration for addition it was hypothesized that the mean reaction time would be faster for problems in homogeneous versus heterogeneous sets and that reaction time was inversely related to ability and grade level and independent of gender.


Observations of an eighth-grade physical science class, a sixth-grade mathematics class, and an eighth-grade science assembly, as well as interviews with the teachers of these classes, show that traditional methods of teaching prevailed in these classrooms.


Seventh-grade math students (n=18) were audiotaped in cooperative learning groups, were given edited transcripts of their discussions, and were trained in their interpretation. The self-assessment enhanced help seeking and giving and attitudes toward asking for help.

Describes problem solving in a Japanese 5th-grade classroom in terms of embedding the problem, spending a long time on one problem, acting out the problem, multiple solutions, interesting problems, manipulative aids, and interpretation rather than application.

PS, Tchg (MS)


This paper describes an experiment that investigated the effects of performance goals and self-evaluation on self-regulation processes and achievement outcomes of (n=44) fourth-grade students working with fractions. Implications are discussed. ACH, MteCg, Frac (EC)


The characterization of mathematical justifications as inductive or deductive is incomplete. There is a third type of reasoning, transformational reasoning. Topics discussed include contrasting the presence and absence of transformational reasoning and implications for teaching. LRNG, PS, Prep (K-12)


Four groups of (n=201) undergraduate students—math majors, secondary math education majors, other secondary education majors, and other majors—differed on a measure of field independence. Implications with regard to holistic teaching and curricula are discussed. Styl, Tchg, Curr, LRNG (Ps)


This report from the Calculators in Primary Mathematics Project describes the types of uses of the calculator that have become an established part of new teaching practices based on a sample of (n=11) teachers in Australia. Calc, Tchg, TblF (EC)


Describes a long-term investigation into the effects of calculators on the learning and teaching of primary mathematics, with particular emphasis on ways teachers use calculators and the resulting long-term learning outcomes for students. Calc, LRNG, Tchg (EC)


The fourth-grade teacher in this study used Cognitively Guided Instruction and underwent change in: (1) teaching and thinking; (2) stimulating the process of change; (3) learning from and helping individuals; and (4) building on children's thinking in instruction. Isry, LRNG, Tchg (EC)

Students (n=65) from two algebra classes, whose teacher was changing her teaching methods, were observed. Discussion considers teacher's answers as an influence on student questions and typical and exceptional dialogue patterns. 


Includes a summary of the views of (n=52) students from two algebra classes, whose teacher was changing her methods, prior to analysis, and then analyzes factors that influence students' classroom perceptions.


A middle school teacher's view of mathematics was that of a correct set of rules and concepts, which contributed to his insistence on maintaining a teacher-dominated classroom environment despite innovative curriculum materials.


Results of a survey of (n=744) teachers, grades K-8, to answer the following questions: (1) What is the nature of problem-solving instruction in Arizona classrooms, and (2) To what extent does classroom practice reflect the recommendations of the NCTM?


This paper reports an investigation of potential gender-related effects on sixth graders of an explicitly stated problem-solving plan.


Questionnaires to determine teachers' use, perceptions of the usefulness, confidence in using, and beliefs concerning recommendations for problem-solving instruction were given to (n=164) Korean and (n=195) American teachers, grades 1-6.
Every dissertation, journal article, paper, and monograph listed in the preceding three sections is indexed by 1-3 MAJOR and any number of MINOR topic codes (see Key to Codes). The 72 topic codes have been clustered into 18 groups of related topics for the purposes of indexing. Only the MAJOR codes are listed after each entry in the index.

Research implications, interpretations (IMPL); Reviews of research (REVW); Research issues, methods (RSCH)

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### Diagnosis, remediation (D/R); Developmental, remedial mathematics (DevM)

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