Annotated Bibliography

Abercrombie, A. & King, J. (1996). Some effects of motivational elements in mathematical drill-and-practice software. In P. Carlson & F. Makedon (Eds.), *Educational multimedia and hypermedia, 1996 (Proceedings of the ED-MEDIA 96 World Conference on Educational Multimedia and Hypermedia)* (pp. 1-6). Boston, MA: Association for the Advancement of Computing in Education.

Adams, T.L. (1998). Alternative assessment in elementary school mathematics. *Childhood Education, 74*(4), 220-224.

Alternative techniques of assessing mathematical learning among elementary school students provide a more comprehensive view of the learner. This paper describes a variety of alternative assessment techniques, including portfolios, journals, observations, self-assessment, communication, surveys, and interviews.

Adetula, L.O. (1996). Effects of counting and thinking strategies in teaching addition and subtraction problems. *Educational Research, 38*(2), 183-195.

In this study 58 private and public 2nd grade students in Nigeria were given instructions about using counting and thinking strategies on number facts. It was found that such strategies should be included in primary school curriculum since children who do not use these strategies may be constrained in their ability to solve more difficult number tasks.

Adibnia, A. (1996). *An exploration of the effects of a teaching method on Year 6 students with different ability levels in mathematical problem solving based on Garofalo and Lester's cognitive-metacognitive framework.* Unpublished PhD, James Cook University, Townsville, Qld.

Afamasaga-Fuata'I, K. (1998). *Realistic contexts as critical sites for problem solving.* Paper presented at the 21st annual conference of the Mathematics Education Research Group of Australasia, Gold Coast, Qld.

This paper investigates students' conceptualisations of quadratics by solving quadratic contextual problems.

Anderson, A. (1995). Effects of the implicit or explicit use of 1 on students' responses when multiplying monomials. *Focus on Learning Problems in Mathematics, 17*(1), 34-38.

Anderson, J. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 33-39.

Several classroom examples explain what proving means to classrooms and why investigations do not necessarily reduce the power of solving more than one step problems. It also considers what should be meant by an emphasis on precision and proof.

Anderson, J. (1997). Teachers' reported use of problem solving teaching strategies in primary mathematics classrooms. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 50-57). Rotorua, New Zealand: MERGA.

In this paper teachers report that they regularly use strategies such as whole class discussion including suitable problem solving strategies, concrete materials and teacher modelling. They rarely have calculators available for students, allow students to choose problems or spend much time on one problem.

Anderson, M., Bloom, L., Mueller, U., & Pedler, P. (1997). Graphics calculators: Some implications for course content and examinations. In W.C. Yang & Y.A. Hasan (Eds.), *Computer technology and mathematical teaching and research (Proceedings of the 2nd Asian Technology Conference in Mathematics)* (pp. 177-191). Penang, Malaysia: Universiti Sains Malaysia.

Angelo, T. & Cross, K. (1993). *Classroom assessment techniques*. San Francisco, CA.: Jossey-Bass.

Armstrong, B. & Larson, C. (1995). Students' use of part-whole and direct comparison strategies for comparing partitioned rectangles. *Journal for Research in Mathematics Education, 26*(1), 2-19.

Arnold, S. (1996). Algebraic thinking within a technology-rich learning environment. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 49-56). Melbourne: MERGA.

This paper documents a research design which incorporated repertory grid principles within an image-based research model. Finally detailed study of perceptions of algebraic images studies offered a powerful compliment to the more usual verbal approaches.

Artzt, A.F. & Yaloz-Femia, S. (1999). Mathematical reasoning during small-group problem solving. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 115-126). Reston, VA: National Council of Teachers of Mathematics.

This article examines the mathematical reasoning behaviours of a group of grade 5 students engaged in a problem solving situation and analyses how these behaviours are integrated into the problem solving process.

Ashcraft, M. & Christy, K. (1995). The frequency of arithmetic facts in elementary tests: Addition and multiplication in Grades 1-6. *Journal for Research in Mathematics Education, 26*(5), 396-421.

Askew, M., Brown, M., Rhodes, V., Wiliam, D., & Johnson, D. (1997). *Effective teachers of numeracy: A report of a study carried out for the Teacher Training Agency*. London: King's College, University of London.

Asp, G. & McCrae, B. (2000). Technology-assisted mathematics education. In K. Owens & J. Mousley (Eds.), *Research in mathematics education in Australasia* (pp. 181-214). Sydney: MERGA.

Asp and McCrae report on why teachers use calculators and on studies, which use Geo-Logo and computer algebra systems.

Atweh, B., Owens, K., & Sullivan, P. (Eds.) (1996). *Research in mathematics education in Australasia 1996-1999.* Sydney: MERGA.

This book follows earlier reviews of research in Australasia. It provides a contextual setting for the diverse developments in mathematics education, 1992-1995.

Aubrey, C. (1993). An investigation of the mathematical knowledge and competencies which young children bring into school. *British Educational Research Journal, 19*(1), 27-41.

Australian Education Council. (1991). *National statement on mathematics for Australian schools*. Melbourne: Curriculum Corporation.

This title provides an overview of mathematics education in Australian schools at the beginning of the 1990s. It is dated but has much still to be recommended.

Australian Education Council (1994). *Mathematics: A curriculum profile for Australian schools*. Melbourne: Curriculum Corporation.

Ayres, P. (1995). Bugs and slips in bracket expansions: A calculator comparison. In B. Atweh & S. Flavel (Eds.), *Proceedings of the 18th annual conference of the Mathematics Education Research Group of Australasia* (pp. 39-43). Darwin: MERGA.

This study investigated whether the use of a calculator could reduce the load on working memory and subsequently reduce the number and type of errors made. A comparison was made between students who had use of calculators, and students who had no calculators on bracket expansion tasks.

Ayres, P. (1996). Cognitive load theory, *Mathematics Teaching*, *156*, 26-29.

This theory is used to explain why students may have difficulties with two-step problems, the value of goal-free problems and worked examples and the need to eliminate redundant material in text and drawing and drill exercises.

Ayres, P. (2000). Mental effort and errors in bracket expansion tasks. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the Twenty-third Annual Conference of the Mathematics Education Research Group of Australasia)* (pp. 80-86). Fremantle: MERGA.

When students expand brackets, errors tend to cluster around key positions due to increased working memory load. The study reported here found that by neutralising the effects of position, the occurrence of error clusters was reduced. Furthermore, a self-rating mental effort instrument was employed which found a positive correlation between errors and mental effort. The instrument also detected subtle variations in mental effort between groups of varying mathematical ability.

Baek, J-M. (1998) Children's invented algorithms for multidigit multiplication problems. In L.J. Morrow & M.J. Kenny (Eds.), *The teaching and learning of algorithms in school mathematics: 1998 Yearbook of the National Council of Teachers of Mathematics*. (pp. 151-160) Reston, VA.: NCTM.

Ball, B. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 31-33.

An investigation of the surface areas of cubes leads to students reason and explain.

Ball, D.L. (1992, April). Magical hopes: Manipulatives and the reform of math education. *The American Educator*, 14-18, 46-47.

Ball, D.L. (2000). Bridging practices: Intertwining content and pedagogy in teaching and learning to teach. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 1, pp. 3-10). Fremantle, Western Australia: MERGA.

This paper takes up 3 problems that must be solved if the challenge to prepare teachers who not only know content but can make use of it to help all students learn is to be met. The first problem concerns identifying the content knowledge that matters for teaching; the second regards understanding how such knowledge needs to be held; the third centres on what it takes to learn to use such knowledge in practice.

Balacheff, N. & Kaput, J. (1996). Computer-based learning environments in mathematics. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 469-501). Dordrecht: Kluwer.

Bana, J., Farrell, B., & McIntosh, A. (1997). Student error patterns in fraction and decimal concepts. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Educational Research Group of Australasia)* (Vol. 1, pp. 81-87). Rotorua, New Zealand: MERGA.

This paper uses data from an international study of number sense to investigate students' misconceptions and error patterns in fraction and decimal concepts. Results suggest the need for more meaningful treatment of fraction and decimal concepts and some relocation of these topics in the curriculum.

Barnard, T. (1996). (Comment on) Teaching proof. *Mathematics Teaching*, *155*, 6-10.

Barnard emphasises the need for compression of ideas and precision, and comments on fractions and decimals, time-consuming activities,.

Baroody, A. (1989). Manipulatives don't come with guarantees. *Arithmetic Teacher, 37*(2), 4-5.

Barta, J. & Schaelling, D. (1998). Games we play: Connecting mathematics and culture in the classroom. *Teaching Children Mathematics*, 388-393.

This article uses a counting game to illustrate the value of using culturally appropriate games in the teaching of mathematics.

Bashash, L. & Outhred, L. (1996). Number comparison skills of children with moderate intellectual disabilities. In P. C. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australia)* (pp. 72-79). Melbourne: MERGA.

Battista, M.T. (1999). Fifth-graders' enumeration of cubes in 3D arrays: Conceptual progress in an inquiry-based classroom. *Journal for Research in Mathematics Education, 30*(4), 417-448.

Battista, M. & Clements D. (1995). Geometry and proof. *The Mathematics Teacher*, *88*(1), 48-54.

Based on Piaget and van Hiele theory, recommendations are made with the use of computer programs, justifying and explaining by similarity and experimentation.

Battista, M.T. & Clements, D.H. (1996). Students' understanding of three-dimensional rectangular arrays of cubes. *Journal for Research in Mathematics Education, 27,* 258-292.

Battista, M.T., Clements, D.H., Arnoff, J., Battista, K., & Borrow, C.V.A. (1998). Students' spatial structuring of 2D arrays of squares. *Journal for Research in Mathematics Education, 29,* 503-532.

Battista, M. & van Auken Borrow, C. (1998). Using spreadsheets to promote algebraic thinking. *Teaching Children Mathematics, 4*(8), 470-478.

This project demonstrates how spreadsheets with mystery games and discussion can stimulate thinking about generalisations and how these apply to a number of cases.

Baturo, A. (1997). The implications of multiplicative structure for students' understanding of decimal-number numeration. In F. Biddulph & C. Kanes (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 88-95). Rotorua, New Zealand: MERGA.

This paper reports on a study that examined the importance of multiplicative structure and whether, after several years of formal instruction in the decimal-number system, Year 6 students had acquired an understanding of this structure.

Baturo, A. (1998). Year 5 students' available and accessible knowledge of decimal-number numeration. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 90-97). Gold Coast, Qld.: MERGA.

This paper reports on a study of the decimal-number numeration knowledge held by Year 5 students who had completed formal instruction in 10ths and 100ths. The results showed that performance varied markedly between classes, that regrouping was more difficult than place value, and that there was generally a direct relationship between available and accessible knowledge.

Becker, C. (2000). Integrating strands: Open ended investigations. *Australian Primary Mathematics Classroom, 5*(2), 9-14.

Beginning with a set of mixed quadrilaterals and triangles, Becker first sets the task of sorting then extends the task to 3D shapes and questions on different properties, eg., diagonals, symmetries, areas and angles.

Beesey, C., Clarke, B., Clarke, D., Stevens, M., & Sullivan, P. (1998). *Exemplary assessment materials: Mathematics.* Melbourne: Victorian Board of Studies.

This study was based on considerable research and working with teachers to write good tasks and establish criteria for assessment.

Begg, A. (2000). Algebra in an integrated approach to mathematics. *Dialogues*, 11.

This paper introduces the notion of integration in mathematics and the place of algebra within that integration.

Behr, M.J., Wachsmuth, I., & Post, T. (1998). Rational number learning aids: Transfer from continuous models to discrete models. *Focus on Learning Problems in Mathematics, 10*(4), 64-82.

This paper is concerned with how well children who have had instruction about rational number concepts based on a continuous manipulative aid (an egg carton) are able to transfer their knowledge to accomplish tasks based on a manipulative aid which can be interpreted as discrete.

Beishuizen, M., van Putten, C.M., & van Mulken, F. (1997). Mental arithmetic and strategy use with indirect number problems up to one hundred. *Learning and Instruction, 7*(1), 87-106.

This study explores two-digit numbers up to 100 and the two computation procedures used by third graders: (1) decomposition or splitting off the tens and units in both numbers (1010) and (2) counting by tens up or down from the first unsplit number (N10). Five aspects of numerical restructuring and transformation were discriminated and two types of flexibility in strategy use were found.

Bempechat, J. & Drago-Severson, E. (1999). Cross-national differences in academic achievement: Beyond ethnic conceptions of children's understandings. *Review of Educational Research, 69*(3), 287-314.

This article reviews theory and research on cross-national differences in academic achievement and shows that current research has made claims about achievement motivation with little regard for contemporary theory and has formed broad assumptions about the influence of culture. These difficulties cast doubt on the validity of the accumulated findings and their practical implementation in the classroom.

Ben-Zvi, D. (1999). Constructing an understanding of data graphs. In O. Zaslavsky (Ed.), *Proceedings of the 23rd conference of the International Group for the Psychology of Mathematics Education* (Vol 2, pp. 97-104). Haifa, Israel: PME.

Bertelli, R., Joanni, E., & Martlew, M. (1998). Relationship between children's counting ability and their ability to reason about number. *European Journal of Psychology of Education, 13*(3), 371-383.

This paper compares two groups of children aged three and four years who differ in their school entrance age. Comparison of the children's counting ability, on their ability to reason about number is made. The results show that young children may reason about number even without having represented it.

Biggs, J.B. & Collis, K.F. (1982). *Evaluating the quality of learning: The SOLO taxonomy.* New York: Academic Press.

Bishop. J. (2000). Linear geometric number patterns : Middle school students strategies, *Mathematics Education Research Journal*, *12*(2), 107-126.

Boaler, J. (1997). *Experiencing school mathematics: Teaching styles, sex and setting*. Buckingham: Open University Press.

By studying 300 students over three years, this book seeks answers about:
* the effectiveness of different teaching methods in preparing students for the demands of the 'real world' and the twenty-first century;
* the impact of ability grouping upon student attitude and achievement;
* gender and teaching styles.

Board of Secondary Education, NSW (1990). *Mathematics: Syllabus Years 7-8*. Sydney: Author.

This is the current mathematics syllabus for Years 7-8 in NSW.

Board of Studies, NSW (1996a). *Stage 5 syllabus: Mathematics standard course*. Sydney: Author.

This is the current mathematics syllabus for Years 9-10 standard course in NSW.

Board of Studies, NSW (1996b). *Stage 5 syllabus: Mathematics intermediate course*. Sydney: Author.

This is the current mathematics syllabus for the Years 9-10 intermediate course.

Board of Studies, NSW (1996c). *Stage 5 syllabus: Mathematics advanced course*. Sydney: Author.

This is the current mathematics syllabus for Years 9-10 advanced course.

Board of Studies, Victoria (2000). *Curriculum Standards Framework II*, [CD-Rom and Web site]. Author. Available: http://www.bos.vic.edu.au/csf/csfcd/ [2000, 30 November].

This is the second version of the Victorian curriculum standards framework.

Bobis, J. (1996a). *Count Me In Too*. Sydney: NSW Department of Education and Training.

This report covers comprehensive interviews with consultants, summarises questionnaire data from teachers and their principals, details three teacher case studies and summarises the data from the task-based interviews and observational data.

Bobis, J. (1996b). Visualisation and the development of number sense with kindergarten children. In J.T. Mulligan & M.T. Mitchelmore (Eds.), *Children's number learning* (pp. 17-33). Adelaide: Australian Association of Mathematics Teachers.

Bobis, J. (1997). *A report of the Count Me In Too Project*. Sydney: NSW Department of Education and Training.

This report deals with inter-rater viability for a small group of teachers and an expert rater.

Bobis, J. (1999a). *Count Me In Too: Guidelines for successful implementation*. Sydney: NSW Department of Education and Training.

This report is based on the case study schools. Interviews and teacher details provide examples of issues to be emphasised when schools implement the project.

Bobis, J. (1999b). *The impact of Count Me In Too on the professional knowledge of teachers*. Sydney: NSW Department of Education and Training.

This report provides an analysis of teachers' concepts maps drawn before and after participating in the program together with some teacher interviews. The analysis of the concept maps was qualitative with three main fields of knowledge being explored. The number of key nodes, node links and crosslinks were noted for specific teachers.

Bobis, J. (2001). Mental computation shaping our children's success. In *Mathematics: Shaping Australia* (pp. 265-270) on CD-Rom. Adelaide: AAMT.

This paper compares different mental strategies, points out good processes and provides a number of activities which will help students develop these strategies.

Bobis, J. & Gould, P. (1998). *The impact of an early number project on the professional development of teachers.* In C. Kanes, M. Goos, E. Warren (Eds.), *Teaching mathematics in new times* (*Proceedings of* *the 21st annual conference of the Mathematics Education Research Group of Australasia*) (pp. 107-113) Gold Coast, Qld.: MERGA.

Bobis, J. & Gould, P. (1999). *The mathematical achievement of children in the Count Me In Too program.* Paper presented at the 22nd annual conference of the Mathematics Education Research Group of Australasia, Adelaide.

Bobis, J., Sweller, J., & Cooper, M. (1994). Demands imposed on primary-school students by geometric models. *Contemporary Educational Psychology, 19*(1), 108-117.

This paper is concerned with the effect completed geometric models can have on primary school children. Two experiments were designed to test the prediction that a problem solving strategy (means end analysis) conventionally used by novice problem solvers would be adopted by Year 4 students who viewed a model of the completed geometrical task if displayed during initial instruction. It was concluded that displaying a completed model of a geometric tasks can increase the cognitive processing load by encouraging the use of a means end strategy.

Borovcnik, M. & Peard, R. (1996). Probability. In A. J. Bishop, M.A. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (Vol. 1, pp. 239-287). Dordrecht: Kluwer Academic Publishers.

This chapter examines the issues related to probabilistic thinking and the contemporary role of these in mathematical reasoning, including how the concept structures our thinking and perception of reality.

Boulton-Lewis, G. (1993). An assessment of the processing load of some strategies and representations for subtraction used by teachers and young children. *Journal of Mathematical Behavior, 12*(4), 387-409.

This paper uses notions of processing load to question the use of unfamiliar concrete materials in the working of subtraction problems by primary aged children.

Boulton-Lewis, G. (1999). Making sense of primary mathematics. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 3-14). Adelaide: MERGA.

The issues examined in this paper include the use of concrete representations, aspects of number, length, and time measurement and the transition from arithmetic to algebra.

Boulton-Lewis, G. M., Cooper, T.J., Atweh, B., Pillay, H., Wilss, L., & Mutch, S. (1997a). The transition from arithmetic to algebra: A cognitive perspective. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for Psychology of Mathematics Education* (Vol. 2, pp. 185-191). Lahti, Finland: PME.

This paper discusses the transition from arithmetic to algebra and proposes a two-path model for learning algebra. It uses the results of two studies to illustrate the importance of cognitive load and appropriate sequencing through binary algebra and complex arithmetic to effective learning of early algebra.

Boulton-Lewis, G. M., Cooper, T., Atweh, B., Pillay, H., Wilss, L., & Mutch, S. (1997b). Processing load and use of concrete representations and strategies for solving linear equations. *Journal of Mathematical Behavior, 16*(4), 379-397.

This paper considers the processing load of the use of concrete materials in Year 8 algebra. The students did not use the procedures taught to them for concrete representations and no students used materials voluntarily. The preferred mode of thinking to solve unknowns in equations was to use arithmetic strategies mentally.

Boulton-Lewis, G. M., Cooper, T.J., Atweh, B., Pillay, H., & Wilss, L. (1998). Pre-algebra: A cognitive perspective. In A. Olivier & K. Newstead (Eds.), *Proceedings of the 22nd conference of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 144-151). Stellenbosch, South Africa: PME.

Boulton-Lewis, G., Cooper, B., Pillay, H., & Wilss, L. (1998). Arithmetic pre-algebra and algebra: A model of transition. In C. Kanes, M. Goos, E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 114-120). Gold Coast, Qld.: MERGA.

This paper reports on a longitudinal study that investigated students' readiness for algebra to determine what constitutes a pre-algebraic level of understanding. Students in Years 7, 8 and 9 participated.

Boulton-Lewis, G. M. & Halford, G.S. (1992). The processing loads of young children's and teachers' representations of place value and implications for teaching. *Mathematics Education Research Journal, 4*(1), 1-23.

This paper considers the processing steps required in understanding and representing numbers. For example, it is likely that there is an extra step required to represent 13 compared to 30.

Boulton-Lewis, G., Wilss, L., & Mutch, S. (1996). An analysis of young children's strategies and devices for length measurement. *Journal of Mathematical Behaviour, 15*(3), 329-347.

Boulton-Lewis, G., Wilss, L., & Mutch, S. (1997). Analysis of primary school children's abilities and strategies for reading and recording time from analogue and digital clocks. *Mathematics Education Research Journal, 9*(2), 136-151.

Bove, S.P. (1995). Place value: A vertical perspective. *Teaching Children Mathematics*, 542-546.

Bragg, P. & Outhred, L. (2000). Students' knowledge of length units: Do they know more than rules about rulers? In T. Nakahara & M. Koyama (Eds.), *Proceedings of the 24th conference of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 97-104). Hiroshima, Japan: PME.

Brahier, D. & Speer, W. (1997). Worthwhile tasks: Exploring mathematical connections through geometric solids. *Mathematics Teaching in the Middle School*, 20-28.

This article integrates mathematical content to discuss 3D shapes and look for patterns. It provides illustrations of early algebra, area, statistics, and volume opportunities including examples of when a pattern does not apply.

Brenner, M. (1998). Meaning and money. *Educational Studies in Mathematics, 36*, 123-155.

This paper examines how the inclusion of everyday mathematics into classroom instruction can make mathematics more meaningful to students. The concept of mathematical meaningfulness is reviewed and compared to the experiences of Hawaiian children learning about money at home and at school. Certain kinds of differences between everyday and school mathematics can make the inclusion of everyday topics in the classroom problematic. Examples from mathematical programs which successfully include everyday mathematics are given.

Brenner, M., Herman, S., Ho, Hsiu-Zu, & Zimmer, J. (1999). Cross-national comparison of representational competence. *Journal for Research in Mathematics Education, 30*(5), 541-557.

This study showed that the non-representative samples of Year 6 students in USA generally scored lower than the other groups on being able to recognise different representations of the same question (pictorial and numerical).

Bright, G. W. & Hoeffner, K. (1993). Measurement, probability, statistics and graphing. In D.T. Owens (Ed.), *Research ideas for the classroom: Middle grades mathematics* (pp. 78-98). Reston, VA: NCTM.

This chapter provides some interesting activities based in research for teaching measurement, probability and statistical thinking in the middle school.

Brown, D. L. & Wheatley, G.H. (1997). Components of imagery and mathematical understanding. *Focus on Learning Problems in Mathematics, 19*(1), 45-70.

This paper reports on the administration of the Wheatley Spatial Abilities Test and clinical interviews with grade 5 students. In the interviews, relationships among the students' imagery, mathematical understanding and problem solving were studied.

Brown, M. (2000). What kinds of teaching and what other factors accelerate primary pupils' progress in acquiring numeracy. In Australian Council for Educational Research, *Improving numeracy learning (Research conference 2000)* (pp. 3-5). Melbourne: ACER.

This paper describes the Leverhulme Numeracy Research Programme in the United Kingdom and provides some tentative findings concerning the relationships between numeracy development and other measurable features of mathematics classrooms.

Brown, R. (1997). Cabri geometry on the Texas TI 92 in the primary school classroom. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 104-108). Adelaide: AAMT.

Bruniges, M. (1999). *Psychometric evidence of growth spurts in children's number development in the early years of schooling*. Unpublished PhD thesis, University of New South Wales, Sydney.

Burton, L. (1996). The assessment factor: The impact of heterogeneity. *Reflections*, *21*(1), 2-7.

Burton, L. (1999). Why is intuition so important to mathematicians but missing from mathematics education? *For the Learning of Mathematics*, *19(*2), 27-30.

Burton illustrates how intuition is important to mathematics and assists students to begin a problem, develop a problem, visualise, and justify.

Busatto, S. (2000). A constructive way to teach fractions. *Curriculum support for teaching in mathematics 7-12*, *5*(3), 3-4.

This paper discusses how multiplication of fractions can be shown using pies.

Cai, J., Moyer, J.C., & Grochowski, N.J. (1997). *Making the mean meaningful: Two instructional studies*. Paper presented to the annual meeting of the American Educational Research Association, Chicago, Illinois, April.

Cai, J. & Santel-Parke, C. (1995). *A cognitive analysis of U.S. and Chinese students' mathematical performance on tasks involving computation, simple problem solving, and complex problem solving*. Reston, VA.: NCTM.

Cai, J. & Santel-Parke, C. (1997). Does the task truly measure what was intended? *Mathematics Teaching in the Middle School, 3*, 74-82.

A few tasks and student responses were used to illustrate the value of open-ended formats for assessment.

Cai, J. & Silver, E. (1995). Solution processes and interpretations of solutions in solving a division-with-remainder story problem: Do Chinese and U.S. students have similar difficulties? *Journal for Research in Mathematics Education, 26*(5), 491-497.

Carpenter, T., Franke, M., Jacobs, V., & Fennema, E. (1998). A longitudinal study of invention and understanding in children's multidigit addition and subtraction. *Journal for Research in Mathematics Education, 29*, 3-20.

Carpenter, T. & Levi, L. (1999). Developing conceptions of algebraic reasoning in the primary grades. Paper presented at the American Education Research Association, Montreal, Canada.

Carpenter, T. & Moser, J. (1984). The acquisition of addition and subtraction concepts in grades 1 through 3. *Journal for Research in Mathematics Education, 15*, 178-205.

Carpenter, T., Rousseau, C., Valentine, C., Wiles, P., Gomez, C., Steinthorsdottir, O., & Wagner, L. (1999). *An analysis of student construction of ratio and proportion understanding.* Paper presented at the American Education Research Association, Montreal, Canada.

This paper discusses fourth and fifth graders construction of ratio and proportional understanding in the USA.

Carroll, W. M. (1996). Mental computation of students in a reform-based mathematics curriculum. *School Science and Mathematics, 96*(6), 302-311.

In this study fifth graders from a reform-based mathematics curriculum and a traditional mathematics curriculum. The reform-based group performed much higher than the comparison group on all but one problem. Interviews indicated that experiences in the primary grades with 'invented' algorithms and discussing alternative solutions led to a better ability to compute mentally and a stronger number sense.

Carroll, W. & Porter, D. (1998) Alternative algorithms for whole-number operations. In L. Morrow & M. Kenney (Eds.), *The teaching and learning of algorithms in school mathematics*. (pp. 106-114). Reston, VA.: NCTM.

Carter, B. (1998). Making linear and exponential functions real. In J. Gough & J. Mousley (Eds.), *Exploring all angles* (pp. 82-87). Melbourne: MAV.

Cashman, G. (1997). *Using computers to aid the teaching of geometry in lower secondary school.* Unpublished MA, Macquarie University, Sydney.

Chapin, S. (1998). Mathematical investigations - powerful learning situations. *Mathematical Teaching in the Middle School, 3*(3), 332-338.

Charles, K. & Nason, R. (1999). Children's informal composite and truncated partitioning strategies. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 143-150). Adelaide: MERGA.

This paper reports on the partitioning strategies used by Year 3 children when they were asked to solve partitioning problems.

Chick, H.L. & Watson, J.M. (1998). Showing and telling: Primary students' outcomes in data representation and interpretation. In C. Kanes, M. Goos, E. Warren (Eds.), *Teaching mathematics in new times* (*Proceedings of the 21st conference of the Mathematics Education Research Group of Australasia*) (Vol. 1, pp. 153-160). Brisbane:MERGA.

Year 5/6 students were videotaped as they worked in triads on interpreting and representing data. Their responses were categorised using the SOLO taxonomy. Connections between the two skills were considered as well as the nature and effectiveness of the collaboration which took place.

Chinnappan, M. (1998). The accessing of geometry schemas by high school students. *Mathematics Education Research Journal, 10*(2), 27-45.

Chinnappan, M. (1999). Learning to integrate representations of rational numbers. In E. Ogena & E. Golla (Eds.), *Proceedings of the 8th Southeast Asian Conference on Mathematics Education* (pp. 109-118). Manila: Southeast Asian Mathematical Society

Christou, C. & Philippou, G. (1998). The developmental nature of ability to solve one-step word problems. *Journal for Research in Mathematics Education, 29*(4), 436-442.

This paper investigates the effects of mental schemes corresponding to additive and multiplicative situations in the process of interpreting and solving problems in Years 2,3 and 4 mathematics classrooms.

Clarke, B., Gronn, D., & Clarke, D. (1998). Record keeping and the CSF: What is happening in schools? In J. Gough & J. Mousley (Eds.), *Exploring all angles* (pp. 88-92). Melbourne: MAV.

Clarke, D. (1996). Assessment. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 327-370). Dordrecht: Kluwer.

Clarke, D. (1996). Valuing what we see: Strategies for observational assessment. *Reflections*, *21*(1), 8-11.

Clarke, D. (2000). Building on what children know and can do. In J. Wakefield (Ed.), *Mathematics: Shaping the future*. Melbourne: Mathematical Association of Victoria.

Clarke, D. & Clarke, B. (1998). Rich assessment tasks for Years 9-10. In J. Gough & J. Mousley (Eds.), *Exploring all angles* (pp. 94-96). Melbourne: MAV.

Clements, D. & Sarama, J. (2000a). Young children's ideas about geometric shapes. *Teaching Children Mathematics*, 482-488.

This article suggests methods for teaching children on the basis of previous knowledge, eg. start with examples, shapes inside a circle rather than a rectangle, shapes on the computer, extending limited notions by investigation, avoiding misconceptions and adding new content to lessons.

Clements, D. & Sarama, J. (2000b). The earliest geometry. *Teaching Children Mathematics, 7*(2), 822-886.

A range of experiences with movement, blocks and computers are explained in terms of the standards document.

Clements, D., Swaminathan, S., Hannibal, M., & Sarama, J. (1999). Young children's concepts of shape. *Journal for Research in Mathematics Education, 30*(2), 192-212.

The earlier theories of Piaget and van Hiele are critiqued and data from preschool and kindergarten children assist in suggesting that students show a precognitive level and early syncretic level in which they show some stronger imagistic prototypes and gradually gain verbal declarative knowledge.

Clements, D.H. (1999a). 'Concrete' manipulatives, concrete ideas. *Contemporary Issues in Early Childhood, 1*(1), 45-60.

The notion of 'concrete', from concrete manipulatives to pedagogical sequences such as 'concrete to abstract', is embedded in educational theories, research, and practice, especially in mathematics education. The author considers research on the use of manipulatives and offers a critique of common perspectives on the notions of concrete manipulatives and concrete ideas. He introduces the notion of computer manipulatives as possibly pedagogically efficacious.

Clements, D.H. (1999b). Teaching length measurement: Research challenges. *School Science and Mathematics, 99*(1), 5-11.

This article describes several studies that challenge conventional wisdom regarding the teaching and learning of non-standard and standard units, rulers, and measurement sense and draws educational implications from their results.

Clements, D.H., Battista, M.T., Sarama, J., & Swaminathan, S. (1996). Development of turn and turn measurement concepts in a computer-based instructional unit. *Educational Studies in Mathematics, 30*, 313-337.

This study investigated the development of turn and turn measurement concepts within a computer-based instructional unit. Turns were less salient for children than 'forward' or 'back' motions. Students evinced a progressive construction of imagery and concepts related to turns.

Clements, D.H., Battista, M.T., Sarama, J., Swaminathan, S., & McMillen, S. (1997). Students' development of length concepts in a Logo-based unit on geometric paths. *Journal for Research in Mathematics Education, 28*(1), 70-95.

Clements, M.A. (1997). Proof and proving in secondary school mathematics. *Reflections*, *22*(2), 2-5.

An historical perspective on proof and its role in schools.

Cobb, P. (1990). Multiple perspectives. In L. Steffe & T. Wood (Eds.), *Transforming children's mathematics education: International perspectives* (pp. 200-215). New York: Lawrence Erlbaum.

This paper was presented at the early childhood mathematics working group of ICME in Budapest, Hungary, 1988. It considers a number of ways in which children's learning might be described.

Cobb, P. & Bauersfeld, H. (Eds.) (1995a). *The emergence of mathematical meaning: Interaction in classroom cultures*. Hillsdale, NJ: Lawrence Erlbaum Associates.

This book reports on a three year collaborative project which considered the coordination of psychological and sociological perspectives on mathematics learning.

Cobb, P. & Bauersfeld, H. (1995b). Introduction: The coordination of psychological and sociological perspectives in mathematics education. In P. Cobb & Bauersfeld, H. (Eds.), *The emergence of mathematical meaning: Interaction in classroom cultures* (pp. 1-16). Hillsdale, NJ: Lawrence Erlbaum Associates.

Introduction to Cobb and Bauersfeld's book on emergence of mathematical ideas.

Cobb, P., Boufi, A., McClain, K., & Whitenack, J. (1997). Reflective discourse and collective reflection. *Journal for Research in Mathematics Education, 28*, 258-277.

Cobb, P., McClain, K., & Gravemeijer, K. (2000). *Learning about statistical covariation.* Paper presented at the Annual meeting of the American Educational Research Association, New Orleans, LA.

This article reports on a teaching experiment in a Year 8 classroom that focused on statistical covariation. It considers both the trajectory of the students' learning and on the researchers' learning about how to support the students' learning.

Cobb, P., Stephan, M., McClain, K., & Gravemeijer, K. (1998). *Participating in classroom practices.* Paper presented to the annual meeting of the American Educational Research Association, San Diego, CA, April.

Cobb, P., Yackel, E., & Wood, T. (1992). A constructivist alternative to the representational view of mind in mathematics education. *Journal for Research in Mathematics Education, 23*(1), 2-33.

This paper presents an alternative to the transmission model of teaching mathematics and questions the unlimited use of concrete materials in this teaching. Details of the approach taken by Cobb and his colleagues in the development of constructivist theories of knowing are also given.

Cockroft, W. (1982). *Mathematics counts: Report of the committee of inquiry into the teaching of mathematics in schools*. London: Her Majesty's Stationery Office.

This is an important historical document which had a major impact on thinking during the 1980s and 1990s.

Comiti, C. & Moreira Baltar, P. (1997). Learning process for the concept of area of planar regions in 12-13-year-olds. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for the*

Psychology of Mathematics Education (Vol. 3, pp. 264-271). Lahti, Finland: PME.

Confrey, J. & Smith, E. (1995). Splitting, covariation, and their role in the development of exponential functions. *Journal for Research in Mathematics Education, 26*(1), 66-86.

Conroy, J. & Perry, B. (1997). Australian and Indonesian student teacher beliefs about mathematics and performance on a classic ratio task. In E. Pehkonen (Ed.), *Proceedings of the Twenty-first Conference of the Psychology of Mathematics Education Group* (pp. 177-184). Lahti, Finland: PME.

This paper investigates the links between student teachers' performance on the classic student / professor ratio task in Indonesia and Australia and their beliefs about mathematics, mathematics teaching and mathematics learning.

Cooper, M. (1997). How is the new 9-10 syllabus different to the old? *Reflections*, *22*(4), 5-6.

A succinct summary of changes in the curriculum for NSW Years 9-10 syllabus

Cooper, T., Boulton-Lewis, G., Atweh, B., Pillay, H., Wilss, L., & Mutch, S. (1997). The transition from arithmetic to algebra: Initial understanding of equals, operations and variable. In E. Pehkonen (Ed.), *Proceedings of the 21st annual conference of the International Group for the Psychology of Mathematics Education* (Vol. 2, pp. 89-95). Lahti, Finland: PME.

Cooper, T., Heirdsfeld, A., & Irons, C. (1996). Children's mental strategies for addition and subtraction word problems. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 147-162). Adelaide: AAMT and MERGA.

Cooper, T. & Williams, A. (1997). *Teaching 3x.* Paper presented at the Annual conference of the Australian Association for Research in Education, Brisbane.

Cotter, J. (2000). Using language and visualisation to teach place value. *Teaching Children Mathematics, 7*, 108-114.

The Asian abacus is used to establish mental images of numbers and operations to 10 and 100, and discourages counting by one.

Cumming, J. (2000). Computational numeracy. In Australian Council for Educational Research, *Improving numeracy learning (Research Conference 2000)* (pp. 43-47). Brisbane: ACER.

This paper provides an overview of the research on computational numeracy among school children and adults and compares it to overseas data. In particular, it considers the notion of computational fluency and its importance in the workplace.

Curcio, F.R. (1987). Comprehension of mathematical relationships expressed in graph. *Journal for Research in Mathematics Education, 18*, 382-393.

Curcio, F.R., Nimerofsky, R.P., & Yaloz, S. (1997). Exploring patterns in nonroutine problems. *Mathematics Teaching in the Middle School, 2*(4), 262-269.

Currie, P. & Pegg, J. (1997). Is an equilateral triangle isosceles? Student perspectives. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 124-131). Rotorua, NZ: MERGA.

Currie, P. & Pegg, J. (1998a). Investigating students' understanding of the relationships among quadrilaterals. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 1, pp. 177-184). Brisbane: MERGA.

Currie, P. & Pegg, J. (1998b). *"Three sides means it is not isosceles".* Paper presented at the 22nd Conference of the International Group for the Psychology of Mathematics Education, Stellenbosch, South Africa.

Davies, A. (1991). Piaget, teachers and education: Into the 1990s. In P. Light, S. Sheldon, M. Woodhead (Eds.), *Learning to think*. London: Routledge.

Day, R. & Jones, G.A. (1997). Building bridges to algebraic thinking. *Mathematics Teaching in the Middle School, 2*(4), 208-212.

de Lange, J. (1996). Using and applying mathematics in education. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 49-98). Dordrecht: Kluwer.

Del Campo, G., & Clements, M.A. (1987). Elementary school children's processing of 'change' arithmetic word problems. In J. Bergerson, M. Herscovics, & C. Kieran (Eds.), *Proceedings of 11th international conference on the Psychology of Mathematics Education*. Montreal: PME.

Department of Education and Community Services, ACT. (1992). *Mathematics Curriculum Framework*. Canberra: Author.

This is the mathematics framework for ACT, years Preschool - Year 10.

It is solidly based on the *National Statement on Mathematics for Australian Schools*.

Department for Education and Employment (1998). *The implementation of the national numeracy strategy: The final report of the numeracy taskforce*. Sudbury, Suffolk: Author.

This is the final report which set the parameters for the implementation of the National Numeracy Strategy in the United Kingdom.

Department for Education and Employment, (1999). *The National Numeracy Strategy*. Author. URL: <http://www.standards.dfee.gov.uk/numeracy> [2000, December 8].

This site contains details of the National Numeracy Strategy from the United Kingdom.

Department for Education and Employment and Qualifications and Curriculum Authority (1999). *The National Curriculum for England: mathematics*. Author. URL: <http://vtc.ngfl.gov.uk/vtc/curriculum/maths/curriculum.html> [2000, December 8].

This is the current mathematics syllabus in England and Wales.

Department of Education, Training and Employment, South Australia. (2000). *South Australian Curriculum Standards and Accountability Framework--Draft*. Adelaide: Author. URL: <http://www2.nexus.ed.au/ems/sacsa/welcome.html> [2000, December 8].

This URL contains the details of the draft South Australian Curriculum Standards and Accountability Framework from birth to year 12.

De Villiers, M. (1990). The role and function of proof in mathematics, *Pythagoras*, *24*, 17-24.

This South African teachers magazine provides examples of proof for theorems often treated in high schools and gives a theoretical model of the types of proofs that can be expected.

De Villiers, M. (1995). An alternative approach to proof in dynamic geometry. *Micromath*, *11*(1), 14-19.

Diezmann, C.M. (1998). *A mathematical inquest: Explaining a negative outcome of instruction.* Paper presented at the annual conference of Mathematics Education Research Group of Australasia, Gold Coast, July.

Diezmann, C.M. (1999). Assessing diagram quality: Making a difference to representation. In J.M. Truran & K.M. Truran (Eds.), *Making a difference* (pp. 185-191). Adelaide: MERGA.

Diezmann, C.M. & Watters, J.J. (1996a). *The difficulties of the young gifted child.* Paper presented at the 6th national conference of the Australasian Association for the Education of Gifted and Talented, Adelaide. URL: <www.nexus.edu.au/TeachStud/gat/diez.htm>

Diezmann, C.M. & Watters, J.J. (1996b). Two faces of mathematical giftedness. *Teaching Mathematics, 21*(2), 22-25.

Dix, K. (1999). The application of computer technology in the teaching of junior high school geometry. *Australian Mathematics Teacher, 55*(3), 4-7.

This article demonstrates that the purpose of dynamic geometry software and other programs is to provide a medium for students to recognise, analyse and order mathematical and to investigate in a way that is powerful for learning.

Dockett, S. & Perry, B. (1996). Young children's construction of knowledge. *Australian Journal of Early Childhood, 21*(4), 6-11.

This paper considers the development of constructivist notions from the more ‘radical’ approaches to the socio-cultural and applies them to early childhood education.

Dockett, S. & Perry, B. (2000). *"Air is a kind of wind": Argumentation and the construction of knowledge.* Paper presented at the Annual conference of the Association for the Study of Play, Baltimore.

This paper considers data drawn from excerpts of children’s play and shows that there are aspects of argumentation being shown by the children. Comparison of this evidence with theoretical tools for argumentation highlight the development of the children’s ideas in this area.

Dole, S. (1999). Successful percent problem solving for Year 8 students using proportional number line method. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australia)* (pp. 43-52). Adelaide: MERGA.

Dole, S., Cooper, T. J., Baturo, A. R., & Conoplia, Z. (1997). Year 8, 9 and 10 students' understanding and access of percent knowledge. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 147-154). Rotorua, NZ: MERGA.

Douady, R. (1999). *Relation function/al algebra: An example in high school (age 15-16)*. European Research in Mathematics Education I: Group 1. URL: <http://www.find.uni-osnabrueck.de/ebooks/erme/cerme1-proceedings/cerme1-proceedings.html> [2000, December 12].

This paper presents some didactical engineering elements concerning an algebraic question from both an algebraic and topological point of view. It is shown that one reason for difficulty with such questions is the impossibility for pupils to implement personal knowledge which is not algebraic but which can be pertinent in tackling the problem.

Douek, N. (1999). *Some remarks about argumentation and mathematical proof and their educational implications*, URL: <www.find.uni-snabrueck.de/ebooks/cermel-proceedings/cermel-proceedings.html> [2000, December 15.]

Dowker, A. (1997). Young children's addition estimates. *Mathematical Cognition, 3*(2), 141-154.

This paper describes a study in which 215 children aged between 5-9 were asked to estimate the answers to addition sums. They were divided into 5 groups depending on their addition ability. In the base correspondence, children of higher levels tended to produce more reasonable estimates than did children of lower levels. As difficulty increased the reasonableness of the estimates declined. The existence and nature of a zone of partial knowledge and understanding are discussed.

Dunne, H. & Brown, R. (1996). Graphic calculators and motion to enhance understanding of linear graphs and rates of change. In H. Forgasz, T. Jones, G. Leder, J. Lynch, K. Maguire, & C. Pearn (Eds.), *Mathematics: Making connections (Proceedings of the 33rd annual conference of the Mathematical Association of Victoria)* (pp. 500-503). Melbourne: MAV.

Ellerton, N., Clarkson, P., & Clements, M. A. (2000). Language factors in mathematics education. In K. Owens & J. Mousley (Eds.), *Research in mathematics education in Australasia 1996-1999* (pp. 29-95). Sydney: MERGA.

This chapter reviews the role of language and politics on curriculum. In particular, it considers the implicit influence of terms like ‘stages’ and ‘levels’. It also consider the different modes of language and the role of culture on learning and looks at mathematics as a language.

Empson, S.B. (1999). *Considerations of systematic change and teachers' knowledge of students' novel strategies for whole-number operations.* Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

This paper discusses the fact that the current reform movement requires an understanding of mathematics which is deeper and more extensive than many teachers have. The paper focuses on whole number operations and how changing knowledge, beliefs and practice might be seen as both an individual and collective problem.

Engebretsen, A. (1997). On teaching and learning mathematics using technology. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 1-8). Adelaide: AAMT.

English, L. (1996). Children's problem posing and problem-solving preferences. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 227-242). Adelaide: Australian Association of Mathematics Teachers and MERGA.

English, L.D. (1998). Children's problem posing within formal and informal contexts. *Journal for Research in Mathematics Education, 29*(1), 83-106.

English, L.D. (1999). Reasoning by analogy: A fundamental process in children's mathematical learning. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 22-36). Reston, VA: National Council of Teachers of Mathematics.

This paper argues the value of analogues - concrete aids, illustrations, diagrams, more abstract models - in the development of mathematical reasoning. As well, it stresses the need to analyse the analogues to ensure that they readily portray the intended mathematical concepts and processes.

English, L.D. & Halford, G.S. (1995). *Mathematics education: Models and processes*. Mahwah, NJ: Lawrence Erlbaum Associates.

English, L.D. & Sharry, P. (1996). Analogical reasoning and the development of algebraic abstraction. *Educational Studies in Mathematics, 30*, 135-157.

English, L. & Warren, E. (1995). General reasoning processes and elementary algebraic understanding: Implications for initial instruction. *Focus on Learning Problems in Mathematics, 17*(4), 1-14.

A correlational study of year 7 and 8 students showed that reasoning was important for algebra. Generalising from a pattern was often by trial and error and without scrutiny.

Ernest, P. (Ed.) (1994). *Constructing mathematical knowledge: Epistemology and mathematical education*. London: The Falmer Press.

This book emphasises epistemological issues encompassing multiple perspectives on the learning of mathematics, as well as broader philosophical reflections on the genesis of knowledge.

Everett, J. (1999). Children's ability to visualise three-dimensional shapes. *Reflections, 24*(1), 87-90.

Ewers-Rogers, J. & Cowan, R. (1996). Children as Apprentices to Number. *Early Child Development and Care, 125*, 15-25.

This paper investigated preschool children's understandings and use of numerals in a series of tasks constructed to draw upon common experiences at home and found that across the range of tasks understanding preceded use of numerals.

Faragher, R. (1999). Helping students whom graphics calculators hinder. In K. Baldwin & J. Roberts (Eds.), *Mathematics: The next millennium (Proceedings of the 17th biennial of the Australian Association of Mathematics Teachers)* (pp. 235-242). Adelaide: AAMT.

This paper describes the reaction of students who do not like graphics calculators, provides a profile of a student who might exhibit this reaction and then offers suggestions for helping these students overcome their difficulties with the use of graphics calculators.

Feeney, S. M. & Stiles, J. (1996). Spatial analysis: An examination of preschoolers' perception and construction of geometric patterns. *Developmental Psychology, 32*(5), 933-941.

An extensive series of construction-based studies have shown that children as young as 3 years of age engage in active spatial analytic processing. The present study was intended to demonstrate that this kind of analysis is not limited to situations that require reproduction.

Feijs, E. (1999). *Constructing a learning environment that promotes reinvention*. URL: <www.fi.uu.nl/en/publications.html> [2000, December 12].

The paper describes the development of student materials in geometry developed by the Mathematics in Context project. Three themes run through the geometry curriculum: orientation and navigation; shape and construction; and visualisation and representation.

Fennema, E., Carpenter, T., Franke, M., Levi, L., Jacobs, V. & Empson, S. (1996). A longitudinal study of learning to use children's thinking in mathematics instruction. *Journal for Research in Mathematics Education, 27*(4), 403-434.

Filloy, E. & Sutherland, R. (1996). Designing curricula for teaching and learning algebra. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, &

C. Laborde (Eds.), *International handbook of mathematics education* (pp. 139-160). Dordrecht: Kluwer.

Flores, A. (1995). Bilingual lessons in early-grades geometry. *Teaching Children Mathematics*, 420-424.

Foley, G. & Schuck, S. (1998). Web-based conferencing: Pedagogical asset or constraint? *Australian Journal of Educational Technology, 14*(2), 122-140.

Forman, S.L. & Steen, L.A. (2000). Beyond eighth grade: Functional mathematics for life and work. In M.J. Burke & F.R. Curcio (Eds.), *Learning mathematics for a new century* (pp. 127-157). Reston, VA.: National Council of Teachers of Mathematics.

Fouche, K.K. (1997). Algebra for everyone: Start early. *Mathematics Teaching in the Middle School, 2*(4), 226-229.

Fox, T. (2000). Implications of research on children's understanding of geometry. *Teaching Children Mathematics, 7*, 572-576.

This article expands on the young child's early reasoning by expanding the van Hiele model to include direct and indirect resemblance, attributes and properties.

Fraivillig, J., Murphy, L., & Fuson, K. (1999). Advancing children's mathematical thinking in Everyday Mathematics classrooms. *Journal for Research in Mathematics Education, 30*(2), 148-170.

18 Year 1 teachers were observed using the EM curriculum: using the framework of eliciting children's solution methods, supporting children's conceptual understanding, and extending children's mathematical thinking. Though some teachers supported students' mathematical thinking, they were less often eliciting or extending it.

Frid, S. & Malone, J. (1995). Negotiation of meaning in mathematics classrooms: A study of two year 5 classes. *Mathematics Education Research Journal, 7*(2), 132-147.

This study shows that in fact the teacher did most of the negotiation and so ratification and endorsement really characterised the classrooms. The beliefs, expectations, and norms were too dominant for true negotiation to take place.

Friederwitzer, F.J. & Berman, B. (1999). The language of time. *Teaching Children Mathematics, 6*(4), 254-259.

This article describes concrete time-teaching models that make connections to fractions and measurement. Fraction circles are related to the analog clock. Students use Cuisenaire rods to measure time on a number line and to discover the meaning of the language used to describe the passing of time.

Friel, S.N., Bright, G.W., & Curcio, F.R. (1997). Understanding students' understanding of graphs. *Mathematics Teaching in the Middle School, 3*, 224-227.

Fuson, K.C. (1992). Research on whole number addition and subtraction. In D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 343-403). Reston, VA: NCTM.

Galbraith, P., Renshaw, P., Goos, M., & Geiger, V. (1999). Technology, mathematics, and people: Interactions in a community of practice. In J.M. Truran & K.M Truran (Eds.), *Making the difference (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 223-230). Adelaide: MERGA.

This paper describes a socio-cultural perspective on learning in secondary mathematics classroom where technology is integrated as a central resource. Four roles are proposed for technology in relation to student learning: master, servant, partner, and extension of self.

Garfield, J.B. & Gal, I. (1999). Teaching and assessing statistical reasoning. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 207-219). Reston, VA: National Council of Teachers of Mathematics.

This chapter begins by distinguishing statistical and mathematical reasoning, suggests was students may be assisted to develop sound statistical reasoning skills and offers one way of assessing this reasoning through a paper and pencil instrument.

Garofalo, J. & Lester, F.K. (1985). Metacognition, cognitive monitoring, and mathematical performance. *Journal for Research in Mathematics Education, 16*, 163-176.

Geiger, V. (1998). Students' perspectives on using computers and graphing calculators during mathematical collaborative practices. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 217-224). Gold Coast, Queensland: MERGA.

This paper presents the results of a study of students' perspectives of, and attitudes towards, the use of mathematically enabled technologies in a collaborative secondary mathematics classroom setting. The inclusion of technology in mathematics instruction was found to be generally beneficial to both learning and peer-peer interaction.

Geiger, V. & Goos, M. (1996). Number plugging or problem solving? Using technology to support collaborative learning. In P. Clarkson (Ed.), *Technology and mathematics education (Proceedings of the 19th annual conference of the Mathematics Educational Research Group of Australasia)* (pp. 229-236). Melbourne: MERGA.

This paper reports on a study that examined student interaction and discussion while working on computer-based tasks in a senior secondary classroom. Analysis suggested that the task itself was an important variable influencing the degree of collaboration between students, and that the teacher's intervention could change students' engagement with the task.

Geist, E.A. (2000). Lessons from the TIMSS videotape study. *Teaching Children Mathematics, 7*(3), 180-185.

This paper uses the TIMSS video study to illustrate how different countries - US and Japan - treat their students like mathematicians.

Gifford, S. (1995). Numeracy in early childhood. *Early Child Development and Care, 109*, 95-132.

This paper contextualises the research into how young people learn about number and reviews its progress. It also focuses on appropriate ways of building on this within the holistic ethos of the early years curriculum.

Ginsburg, H.P. (2000). *Children's minds and developmentally appropriate goals of preschool mathematics education.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA, April.

This paper summarises several years' work observing preschool children in their everyday mathematical activities. It considers the amount of time and effort put into a wide range of activities by the children, socio-economic differences and the design of a curriculum based on the observations. The frequency of overall mathematical activity and the relative frequency of different types of activity are related to age but not to social class and gender.

Giroux, J. & Lemoyne, G. (1998). Coordination of knowledge of numeration and arithmetic operations on first grade students. *Educational Studies in Mathematics, 35*, 283-301.

The aim of this study was to develop a better understanding of the processes involved in the construction of the oral and written symbolic systems of numbers and to grasp their role in the elaboration of the modelling function of numbers. Ideas for teaching are suggested.

Glasersfeld, E. von. (Ed.) (1991). *Radical constructivism in mathematics education*. Dordrecht: Kluwer.

This is a now classic book which considers the development of constructivism as a force in mathematics education.

Glasgow, R., Ragan, G., Fields, W., Reys, R., & Wasman, D. (2000). The decimal dilemma. *Teaching Children Mathematics, 7*, 89-93.

The TIMSS USA results demonstrated that performance on decimals lagged behind fractions in grades 3 and 4. This is explained by lack of exposure and students understanding of notation. More pictorial representations and links to fractions are recommended.

Goffree, F. & Oonk, W. (1999). Educating primary school mathematics teachers in the Netherlands: Back to the classroom. *Journal of Mathematics Teacher Education, 2*, 207-214.

This paper gives a brief history of mathematics teacher education in the Netherlands, leading to the Freudenthal inspired programs of the present.

Gough, J. (1997). *Exploring constructivism(s): The gaps between philosophy, psychology, praxis and common sense(s).* Paper presented at the Contemporary Approaches to Research in Mathematics, Science, Health and Environmental Education, Geelong, December.

This paper considers possible meanings for the term 'constructivism', looks at differences which can be ascribed to this term, the consequences of these meanings to descriptions of knowledge and the consequences of all of this to the mathematics classroom.

Gould, J. (1997). Understanding mathematics. *Reflections*, *22*(4), 9-12.

This article illustrates how to change the instructional sequence in high school in order that students work on problems prior to teacher demonstration by teaching with open-ended questions and stories to establish relational understanding.

Gould, P. (2000). Count me in too: Creating a choir in the swamp. In Australian Council for Educational Research, *Improving numeracy learning (Research conference 2000)* (pp. 23-26). Melbourne: ACER.

Graham, A. & Thomas, M. (1997). Tapping into algebraic variables through the graphic calculator. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for Psychology of Mathematics Education* (Vol. 3, pp. 9-16). Lahti, Finland: PME.

This paper describes a study in which graphic calculator was used to provide an environment in which students could begin to build an understanding of variable. The graphic calculator proved to be a motivating instrument for successfully achieving a significant improvement in student understanding.

Granger, T. (2000). Math is art. *Teaching Children Mathematics, 7*(1), 10-13.

This article details a project on tessellations can be art and mathematics but students instead talked of shape, angles and line segments with obvious enjoyment.

Gravemeijer, K. (1999). How emergent models may foster a constitution of formal mathematics. *Mathematical Thinking and Learning, 1*(2), 155-177.

The design of an instructional sequence, which deals with flexible mental computation strategies for addition and subtraction up to 100, is taken as an instance for elaborating what is meant by *emergent models* and what role they play in fostering the constitution of formal mathematics.

Gray, E. & Tall, D. (1994). Duality, ambiguity, and flexibility: A "perceptual" view of simple arithmetic. *Journal for Research in Mathematics Education, 25*, 116-140.

Greenes, C. (1995). Mathematics learning and knowing: A cognitive process. *Journal of Education, 177*(1), 85-106.

This paper discusses varieties of constructivism - Steffe, von Glasersfeld, Piaget, Vygotsky - and illustrates their application in a curriculum focussing on big mathematical ideas.

Greenes, C. & Findell, C. (1999). Developing students' algebraic reasoning abilities. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 127-137). Reston, VA: National Council of Teachers of Mathematics.

This paper argues for the early introduction of algebraic experiences through consideration of 'big ideas' such as: deductive reasoning, inductive reasoning, representation, equality, variable, function and proportion.

Groves, S. (1996). Good use of technology changes the nature of classroom mathematics. In P.C. Clarkson (Ed.), *Technology in mathematics education* (*Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia*) (pp. 10-19) Melbourne: MERGA.

This paper claims that powerful use of technology has the potential to radically alter the nature of classroom mathematics. It explores some of the effects of technology on the nature of mathematical activity, classroom practice and the curriculum.

Groves, S. (1997). The effect of long-term calculator use on children's understanding of number: Results from the Calculators in Primary Mathematics project. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 150-158). Melbourne: AAMT.

Groves, S. & Stacey, K. (1998). Calculators in primary mathematics: Exploring number before teaching algorithms. In L.J. Morrow & M.J. Kenny (Eds.), *The teaching and learning of algorithms in school mathematics: 1998 Yearbook of the National Council of Teachers of Mathematics*. Reston, VA.: NCTM.

Hai, S.K. (1999). Imagery in the cultivation of mathematical creativity. In M. A. Clements & P. Leong (Eds.), *Cultural and language aspects of science, mathematics and technical education (Proceedings of the 4th conference of Department of Science and Mathematics Education, Universiti Brunei Darussalam)* (pp. 271-280). Gadong, Brunei Darussalam: Universiti Brunei Darussalam.

Haimes, D. (1996). The implementation of a "Function" approach to introductory algebra: A case study of teacher cognition's, teacher actions, and the intended curriculum. *Journal for Research in Mathematics Education, 27*(5), 582-602.

Hancock, C., Kaput, J.J., & Goldsmith, L.T. (1992). Authentic inquiry with data: Critical barriers to classroom implementation. *Educational Psychologist, 27*, 337-364.

Hanna, G. & Jahnke, E. (1996). Proof and proving. In A. Bishop, M.A. Clements, C. Keitel, J. Kilpatrick, C. Laborde (Eds.), *International handbook of mathematics education* (pp. 877-908). Dordrecht: Kluwer.

Hanna, G., & Jahnke, H. (1999). Using arguments from physics to promote understanding of mathematical proofs. In O. Zaslavsky (Ed.), *Proceedings of the 23rd conference of the international Group for the Psychology of Mathematics Education* (pp. 73-80). Haifa: PME.

After reviewing the developments in thinking about proof and its role in school mathematics, they refer to some physical examples of mathematical theorems and propose new ways of presenting proof in schools.

Harvey, J.G., Waits, B.K., & Demana, F.D. (1995). The influence of technology on the teaching and learning of algebra. *Journal of Mathematical Behavior, 14*, 75-109.

This paper argues that technologies such as graphing calculators and computer algebra programs are essential in a reform algebra curriculum.

Hatano, G. (1982). Learning to add and subtract: A Japanese perspective. In T. Carpenter, J. Moser & T. Romberg (Eds.), *Addition and subtraction: A cognitive perspective*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Hayes, B. (1996). Investigating the teaching and learning of negative number concepts and operations. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of 19th annual conference of Mathematics Education Research Group of Australasia*) (pp. 245-252). Melbourne: MERGA.

These investigations show the effectiveness of using +1, -1 number cards to make negative numbers and to operate on numbers.

Hedren, R. (1999). *The teaching of traditional standard algorithms for the four arithmetic operations versus the use of pupils' own methods*. European Research in Mathematics Education I: Group 2. URL: <http://www.fmd.uni-osnabrueck.de/ebooks/erme/cermel-proceedings/cermel-proceedings.html> [2000, December 15].

This article argues in favour of pupil algorithms as opposed to traditional algorithms and describes research into this issue.

Heller, P., Post, T., Behr, M., & Lesh, R. (1990). Qualitative and numerical reasoning about fractions and rates by 7th and 8th grade students. *Journal for Research in Mathematics Education, 21*(5), 388-402.

Helme, S. & Stacey, K. (2000). Improving decimal understanding: Can targeted resources make a difference? In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 299-306). Fremantle: MERGA.

Hembree, R. & Dessart, D.J. (1992). Research on calculators in mathematics education. In J.T. Fey (Ed.), *Calculators in mathematics education* (pp. 23-32). Reston, VA: National Council of Teachers of Mathematics.

This chapter reports on a meta-analysis of 88 studies on the use of calculators. Only one study reported negatively about calculator use.

Hershkowitz, R., Parzysz, B., & van Dormolen, J. (1996). Space and shape. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 161-204). Dordrecht: Kluwer.

Heuvel-Panhuizen, M. van den. (1999). Mathematics education in the Netherlands: A guided tour.
URL: <http://www.fi.uu.nl/en/publications.shtml> [2000, December 12].

This paper addresses mathematics education in the Netherlands, showing the main aspects of the Dutch approach to mathematics education by focussing on the number strand of primary school mathematics.

Hewitt, D. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 27-31.

Classroom examples illustrate how proof should focus attention on properties. There are many challenges to our thinking about proof.

Hiebert, J. (1999). Relationships between research and the NCTM standards. *Journal for Research in Mathematics Education, 30*(1), 3-19.

In this paper the role that research can and should play in shaping standards is discussed. Brief summaries of some research findings which might contribute to the current debates are given.

Ho, C. S.-H. & Fuson, K.C. (1998). Children's knowledge of teen quantities as tens and ones: Comparisons of Chinese, British, and American kindergartens. *Journal of Educational Psychology, 90*(3), 536-544.

This article describes and compares three studies which examined the effects of individual differences and language differences on children's understanding of teen quantities as counted cardinal tens and ones.

Hoffer, A. (1981) Geometry is more than proof, *Mathematics Teacher*, *74*, 11-18.

Hogan, J. (2000). Numeracy - across the curriculum? *Australian Mathematics Teacher, 56*(3), 17-20.

Horn, I. S. (1999). *Accountable argumentation as a participant structure to support learning through disagreement.* Paper presented at the Annual meeting of the American Educational Research Association, Montreal, April.

Howard, P. & Perry, B. (1999). Learning mathematics and manipulatives: Not just child's play. *New England Mathematics Journal, 32*(1), 5-15.

This paper raises issues for the primary teacher about the role of manipulatives in the development of students' mathematical thinking. It links teacher beliefs to the use of manipulatives in their classrooms.

Howlett, A. (1998). Using technology to teach Year 8-10 statistics. In K. Baldwin & J. Roberts (Eds.), *Mathematics: The next millennium (Proceedings of the 17th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 85-89). Adelaide: AAMT.

In Victoria, the curriculum and standards framework has increased the emphasis on the teaching of statistics in the junior-secondary area. This has come at the same time as graphics calculator use has spread into these same classes. This paper discusses some of the changes happening in a leading Bendigo 7-10 college.

Hughes, M. (1986). *Children and number: Difficulties in learning mathematics*. Oxford: Blackwell.

This book proposes a new perspective on children’s understanding of number which is still relevant in 2001.

Hughes, M., Desforges, C., & Mitchell, C. (2000). *Numeracy and beyond: Applying mathematics in the primary school*. Buckingham: Open University Press.

This book aims to help teachers develop their understanding and practice in the area of using and applying mathematics in primary schools. It makes some comparisons between practices in the UK and Japan.

Hunting, R. (1996). Some results and curriculum implications from recent research on young children's pre-fraction knowledge. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 109-124). Adelaide: AAMT & MERGA.

This paper describes the results of several studies into young children's conceptions of division, sharing and fractions, and provides a picture of intuitive knowledge and skills that young children bring to the formal school setting.

Hunting, R. & Davis, G. (Eds.) (1991). *Early fraction learning*. New York: Springer-Verlag.

Hunting, R.P., Davis, G.E., & Pearn, C.A. (1996). Engaging whole-number knowledge for rational number learning using a computer-based tool. *Journal for Research in Mathematics Education, 27*(3), 354-379.

This study demonstrates an interdependence between the development of rational number knowledge and whole number knowledge. Facility with the whole number relationships enabled students to solve fraction comparison problems.

Hunting, R.P., Davis, G.E., & Pearn, C.A. (1997). The role of whole number knowledge in rational number learning. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 239-246). Rotorua, New Zealand: MERGA.

This paper presents data from a teaching experiment to investigate fractional learning and the role whole number knowledge might play in it. A major source for the children's experiences was an operator-like computer program called CopyCat.

Hunting, R.P., Oppenheimer, L.M., Pearn, C.S., & Nugent, E. (1998). How sixth grade students explain connections between common and decimal fractions. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of Mathematics Education Research Group of Australasia)* (pp. 271-278). Gold Coast, Qld.: MERGA.

This paper reports on relationships between common fractions and decimal fractions as seen by Year 6 students. A most favoured explanation involved relating decimal and common fractions to a unit of 100.

Inagaki, K., Morita, E. & Hatano, G. (1999). Teaching-learning of evaluative criteria for mathematical arguments through classroom discourse: A cross-national study. *Mathematical Thinking and Learning, 1*(2), 93-111.

The paper compares and contrasts seven US and six Japanese Year 5 classrooms in terms of the pattern of discourse between students and teachers. Two approaches to the teaching-learning of the criteria for the evaluation of mathematical arguments were found, with each country's teachers overwhelmingly preferring a different one of these.

Irwin, K. (1996). Making sense of decimals. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 243-257). Adelaide: AAMT & MERGA.

Irwin, K. (1997). What conflicts help students learn about decimals. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 247-254). Rotorua, New Zealand: MERGA.

Students worked in pairs to solve problems involving decimal fractions. Their discussions were analysed to see what kinds of conflicts led to learning about the meaning of decimals.

Irwin, K. (2000). Effective teaching of decimals: Evaluating Teachers' Practices. In J. Bana & A. Chapman (Eds.), *Mathematics Education Beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 339-346). Fremantle: MERGA.

This study reports results on current methods for teaching decimals in 14 classes of students aged 9-12. The main factors leading to students' improvement appeared to be careful planning to meet their needs, the use of a clear model which enabled students to visualise decimal division, and careful bridging from visualisation to numerical forms.

Johnson, T.M., Jones, G.A., Thornton, C.A., Langrall, C.W., & Rous, A. (1998). Students' thinking and writing in the context of probability. *Written Communication, 15*(2), 203-229.

Jones, G.A., Langrall, C.W., Thornton, C.A., & Mogill, A.T. (1997). A framework for assessing and nurturing young children's thinking in probability. *Educational Studies in Mathematics, 32*, 101-125.

Jones, G.A., Langrall, C.W., Thornton, C.A., & Mogill, A.T. (1999). Students' probabilistic thinking in instruction. *Journal for Research in Mathematics Education, 30*(5), 487-519.

This study evaluated the thinking of Year 3 students in relation to an instructional program in probability which was informed by a research-based framework.

Jones, G.A., Langrall, C.W., Thornton, C.A., Mooney, E.S., Wares, A., Perry, B., Putt, I.J., & Nisbet, S. (2000). Using students' statistical thinking to inform instruction. In T. Nakahara & M. Koyama (Eds.), *Proceedings of the 24th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 95-102). Hiroshima, Japan: PME.

This study designed and evaluated a teaching experiment in data exploration for a grade 2 class. The teaching experiment was informed by a cognitive framework that described elementary students' statistical thinking. The children showed significant gains on all four statistical processes associated with the framework.

Jones, G.A., Thornton, C.A., Putt, I., Hill, K., Mogill, A., Rich, B. & Van Zoest, L. (1996). Multidigit number sense: A framework for instruction and assessment. *Journal for Research in Mathematics Education, 27*, 310-336.

Jones, G.A., Thornton, C.A., Langrall, C.W., Mooney, E.S., Perry, B., & Putt, I. (1998). Students' statistical thinking. In S. Berenson, K. Dawkins, M. Blanton, W. Coulombe, J. Kolb, K. Norwood, & L. Stiff (Eds.), *Proceedings of the nineteenth annual meeting, North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol. 1, pp. 371-376). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Jones, G.A., Thornton, C.A., Langrall, C.W., & Tarr, J.E. (1999). Understanding students' probabilistic reasoning. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 146-155). Reston, VA: National Council of Teachers of Mathematics.

This article reports on the extensive study of children's probabilistic thinking conducted by the authors. It reveals a conceptual framework and argues that careful construction of instructional activities using the framework as a guide can result in the development of students' probabilistic reasoning.

Jones, K., Kershaw, L., & Sparrow, L. (1995). *Aboriginal children learning mathematics.* Perth: Mathematics, Science and Technology Centre, Edith Cowan University.

Jordan, N.C. (1998). *Mathematical thinking in second-grade children with different forms of learning difficulties.* Paper presented at the Annual conference of the American Educational Research Association, San Diego, CA.

In this study children were given a series of tasks to assess thinking across four areas of mathematics: number facts, story problems, place value and written calculations. Their performance was assessed according to their classification of learning difficulties. Differences were noted across the groups.

Jun, Y. (1997). Linear Kid: A mathematical software designed as a computer-based peer tutoring system. In W.C. Yang & Y.A. Hasan (Eds.), *Computer technology in mathematical research in teaching (Proceedings of the 2nd Asian Technology conference in mathematics)* (pp. 71-79). Penang, Malaysia: Universiti Sains Malaysia.

Kamii, C. & Clark, F.B. (1997). Measurement of length: The need for a better approach to teaching. *School Science and Mathematics, 97*(3), 116-121.

Students in grades 1-5 were interviewed to find out when they construct unit iteration out of transitive reasoning. The results indicated that most children construct transitive reasoning by second grade and unit iteration by fourth grade.

Kamii, C. & Warrington, M.A. (1997). Multiplication with fractions: A constructivist approach. *Hiroshima Journal of Mathematics Education*, *5*(11), 11-20.

Kamii, C. & Warrington, M.A. (1999). Teaching fractions: Fostering children's own reasoning. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 82-92). Reston, VA: National Council of Teachers of Mathematics.

This article considers a constructivist approach to the development of children's own reasoning and own procedures for dealing with fractions.

Kaur, B. (1996). How do good novice problem solvers solve problems? In H. Forgasz, T. Jones, G. Leder, J. Lynch, K. Maguire, & C. Pearn (Eds.), *Mathematics: Making connections (Proceedings of the 33rd annual* *conference of the Mathematical Association of Victoria)* (pp. 180-183). Melbourne: MAV.

Kendal, M. & Stacey, K. (1996). Trigonometry: Comparing ration and unit circle. In P. C. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the19th annual conference of Mathematics Education Research Group of Australasia)* (pp. 322-330). Melbourne: MERGA.

Kidman, G.C. (1999). Grade 4, 6 and 8 students' strategies in area measurement. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 298-305). Adelaide: MERGA.

Kidman, G.C. & Cooper, T.J. (1996). Assessing the major trends and directions of research into students' judgements of area. In P.C. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 337-344). Melbourne: MERGA.

Kidman, G.C. & Cooper, T.J. (1997). Area integration rules for grades 4, 6 and 8 students. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 136-143). Lahti, Finland: PME.

Kidman, G. & Nason, R. (1997). *The EMU experience: Developing communities of mathematics practice in preservice teachers.* Paper presented at the Researching education in new times (Proceedings of the annual conference of the Australian Association for Research in Education).

Kieran, C. & Sfard, A. (1999). Seeing through symbols: The case of equivalent expressions. *Focus on Learning Problems in Mathematics, 21*(1), 1-17.

Through a teaching experiment, this paper considers the notion of equivalent expressions in algebra and uses graphing technology to develop understanding.

Kieren, T. (1993). Rational and fractional numbers: From quotient fields to recursive reasoning. In T. Carpenter, E. Fennema, & T. Romberg (Eds.), *Rational numbers: An integration of research* (pp. 49-84). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

This chapter contains some suggested elements of models of students' conceptual structures with respect to fractional and rational numbers, of conceptualisations of rational number knowing toward which instruction might be directed, and conceptualisations of curricula based on such elements.

Kieren, T. (1994). Multiple views of multiplicative structures. In G. Harel & J. Confrey (Eds.), *Multiplicative reasoning in the learning of mathematics*. Albany, New York: SUNY Press.

Kilpatrick, J. & Silver, E.A. (2000). Unfinished business: Challenges for mathematical educators in the next decades. In M.J. Burke & F.R. Curcio (Eds.), *Learning mathematics for a new century* (pp. 223-236). Reston, VA.: National Council for Teachers of Mathematics.

Kissane, B. (1997). The graphics calculator and the curriculum: The case of probability. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 397-404). Adelaide: AAMT.

Kissane, B. (1998). Inferential statistics and the graphics calculator. In W.C. Yang, K. Shirayanagi, S.C. Chu, & G. Fitz-Gerald (Eds.), *Proceedings of the 3rd Asian Technology Conference in Mathematics* (pp. 111-121). Japan: Springer-Verlag.

Kissane, B. (1999). Graphics calculators and algebra. In N. Scott, H. Hollingsworth (Eds.), *Mathematics: Creating the future* (*Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers*) (pp. 387-404). Adelaide: AAMT.

The paper highlights some of the important connections between algebra in the secondary school and graphics calculators.

Klein, T., Beishuizen, M., & Treffers, A. (1995). *The empty numberline in Dutch second grades under two conditions: A 'realistic' versus 'gradual' program design.* Paper presented at the Sixth EARLI conference, Nijmegen, The Netherlands.

This study showed that the empty number line as a mental model for the mental addition and subtraction of numbers was practical in both the realistic and gradual program approaches but that the former led to greater diversity of approaches.

Knapp, N. & Peterson, P. (1995). Teachers' interpretations of 'CGI' after four years: Meanings and practices. *Journal for Research in Mathematics Education, 26*(1), 40-65.

Kouba, V.L., Champagne, A.B., Ceziturk, O., Sherwood, S.A., van Benshoten, M., & Ho, C-H. (2000). *Assessing mathematics literacy.* Paper presented at the Annual Conference of the American Educational Research Association, New Orleans, LA.

This study examined middle school students' mathematics literacy and/or fluency in responses to a task requiring an explanation, and characterised the nature of the responses. Most students did not interpret the task in a systematic way, did not attend to multiple conditions, and were not aware of audience or expected forms of argumentation.

Krummheuer, G. (1995). The ethnography of argumentation. In P. Cobb & H. Bauersfeld (Eds.), *The emergence of mathematical meaning: Interaction in classroom cultures* (pp. 220-269). Hillsdale, NJ: Erlbaum.

Kuchemann, D. (1978). Children's understanding of numerical variable. *Mathematics in School, 7*(4), 23-28.

Lajoie, S.P. & Romberg, T.A. (1998). Identifying an agenda for statistics instruction and assessment in K-12. In S.P. Lajoie (Ed.), *Reflections on statistics: Learning, teaching, and assessment in grades K-12* (pp. xi-xxi). Mahwah, NJ: Lawrence Erlbaum.

Lakoff, G. & Nunez, R. (1997). The metaphorical structure of mathematics. In L. English (Ed.), *Mathematical reasoning: Analogies, metaphors and images* (pp. 21-89). Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Lambdin, D., Kloosterman, P., & Johnson, M. (1994). Connecting research to teaching. *Mathematics Teaching in the Middle School, 1*(1), 38-43.

This article summarises the changes in research methodology, showing how it is increasingly carried out in the classroom and as such is more relevant within classrooms.

Lamon, S. (1996). The development of unitizing: Its role in children's partitioning strategies. *Journal for Research in Mathematics Education, 27*(2), 170-193.

Lamon, S. J. (1999). *Teaching fractions and ratios for understanding: Essential content knowledge and instructional strategies for teachers*. Mahwah, NJ: Lawrence Erlbaum Associates.

This book pushes readers beyond the limits of their current understanding of rational numbers. All activities are to be solved by reasoning alone, with the readers forced to abandon fraction rules and procedures.

Langrall, C. W. (1999). *Instructional strategies to promote the development of proportional reasoning.* Paper presented at the Annual meeting of the National Council of Teachers of Mathematics, San Francisco.

The paper presents a framework of proportional reasoning strategies, activities for instruction, and recommendations for grade levels at which various concepts might be met.

Lappan, G. (1999). Geometry: The forgotten strand (NCTM Presidents' message). *NCTM News Bulletin*, December 1999, 3.

President's message encouraging teachers to teach the geometry strand of NCTM's Standards.

Lean, G., Clements, M.A., & Del Campo, G. (1990). Linguistic and pedagogical factors affecting children's understanding of word problems. *Educational Studies in Mathematics, 21*, 165-191.

Lee, B. (1998). The development of a model of assessment principles for mathematical competence, *Reflections, 23*(1), 81-84.

Legrande, P-O (2001). *Building the concept of number with young children*. Paper presented at the 18th biennial conference of the Australian Association, Mathematics: Shaping Australia, Canberra, January 2001.

Legrande discussed the constructivist approach to mathematics in French Polynesia which emphasised the aptitude to see small collections and avoid counting.

Lehrer, R., Fennema, E., Carpenter, T., & Ansell, E. (1994). Review of NCRSME research, *NCRSME Research Review: The teaching and learning of mathematics* (pp. 10-13). Madison, Wis.: National Center for Research in Mathematical Sciences Education Research, Wisconsin Center for Education Research.

Lehrer, R. & Romberg, T. (1996). Exploring children's data modelling. *Cognition and Instruction, 14*(1), 69-108.

Leikin, R., Berman, A., & Zaslavsky, O. (2000). Learning through teaching: The case of symmetry. *Mathematics Education Research Journal, 12*(1), 18-36.

This paper focuses on the development of the Year 8 students' understanding of line symmetry. Findings show that the implemented learning environment served as a vehicle for student teachers to learn mathematics. Positive dispositions towards symmetry and its role in mathematics were developed.

Lerman, S. (1989). Constructivism, mathematics and mathematics education. *Educational Studies in Mathematics, 20*, 211-223.

This is an historical document which critiques the then current views on constructivism and its application to mathematics learning.

Lesh, R. (1979). Mathematical learning disabilities: Considerations for identification, diagnosis, and remediation. In R. Lesh, D. Mierkiewicz & M.G. Kantowski (Eds.), *Applied mathematical problem solving* (pp. 111-180). Columbus, OH: ERIC/SMEAC.

Leung, M., Low, R., & Sweller, J. (1997). Learning from equations or words. *Instructional Science, 25*(1), 37-70.

The advisability of using equations during initial learning of mathematics or science concepts or procedures may depend on the cognitive load consequences of the equations and verbal material. An analysis of both from a cognitive load theory perspective may provide us with guidance concerning the relative emphasis that should be placed on words or equations.

Lewis, C. (2000, April). *Lesson study: The core of Japanese professional development.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

The paper describes research lessons which are a feature of the Japanese education system and lists eight ways in which such lessons contribute to the improvement of Japanese instruction. Also listed are six features of the Japanese education system which seem to support such lessons.

Lewis, E. J. (1996). *Modes of presentation of ideas, computers and learning styles in K-6 mathematics.* Unpublished MEd, University of Western Sydney, Sydney.

Liedtke, W.W. (1996). "Three times four" Is that 3 x 4 or 4 x 3? or does it make any difference? *B. C. Journal of Special Education, 20*(2), 57-64.

This article makes suggestions for diagnosis of students with multiplication difficulties and describes possible intervention strategies. The fact that for many students the order of interpretation is important is highlighted.

Linchevski, L. & Williams, J. (1996). Situated intuitions, concrete manipulations and the construction of mathematical concepts: The case of integers. In L. Puig & A. Gutiérrez (Eds.), *Proceedings of the 20th conference of International Group for the Psychology of mathematics Education* (Vol. 3, pp. 265-272). Spain: PME.

This is a study of negative numbers that allows students to develop their intuitive knowledge of operations by basing the work on a real type of example.

Lindsay, M. (2000). Assessing technology-rich mathematical tasks. *Australian Mathematics Teacher, 56*(3), 12-16.

Linsell, C. (1997). *Learning about probability in a constructivist classroom.* Paper presented at the 20th annual conference of the Mathematics Education Research Group of Australasia, Rotorua, NZ.

Four Year 9 students were videorecorded during lessons on probability. The video recordings were then used to conduct stimulated recall interviews with each student. A wide range of achievement was shown, with even the most able students finding some concepts difficult to grasp.

Liyanage, S., Irwin, K., & Thomas, M. (2000). Informal assessment questions used by secondary school mathematics teachers. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 377-384). Sydney: MERGA.

Lockwood, G. & Boland, J. (1998). *The use of spreadsheets to illustrate mathematical concepts.* Paper presented at the Where's ITT at? The 15th Australian Computers in Education conference, Adelaide.

Lokan, J., Ford, P., & Greenwood, L. (1996a). *Maths & Science on the line: Australian junior secondary students' performance in the Third International Mathematics and Science Study*. Melbourne: ACER.

Lokan, J., Ford, P., & Greenwood, L. (1996b). *Maths & science on the line: Australian middle primary students' performance in the Third International Mathematics and Science Study*. Melbourne: ACER.

Looi, C.K. & Tan, B.T. (1996). A computer-based tutor for teaching and learning word problem solving. In P. Carlson & F. Makedon (Eds.), *Educational multimedia and hypermedia, 1996 (Proceedings of the ED-MEDIA 96 World Conference on Educational Multimedia and Hypermedia)* (pp. 401-406). Boston, MA.: Association for the Advancement of Computing in Education.

Lopez-Real, F. (1997). Effect of different syntactic structures of English and Chinese in simple algebraic problems. In F. Biddulph & K. Carr (Eds.), *People in mathematics (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 317-323). Rotorua, New Zealand: MERGA.

This paper compares the performance of first language Chinese and English secondary students in Hong Kong on a set of items requiring the students to express simple relationships algebraically. The results are discussed in terms of the construction of mental models.

Lott, J.W. (Ed.) (1999). *Mathematics education dialogues* (Vol. 3). Reston, VA: National Council of Teachers of Mathematics.

This volume presents balanced debate on what is basic in school mathematics, how movements such as curriculum standards affect those basics and how we can guarantee that children's mathematics education will meet their future needs.

Lott, J.W. & Soudrada, T.A. (2000). As the century unfolds: A perspective on secondary schools. In M.J. Burke & F.R. Curcio (Eds.), *Learning mathematics for a new century* (pp. 96-111). Reston, VA.: National Council of Teachers of Mathematics.

Lovitt, C. (2000). Investigations: A central focus for mathematics. *Australian Primary Mathematics Classroom, 5*(4), 8-11.

The paper contrasts 'investigation' and 'problem solving' and suggests that investigations might provide a coherent big picture showing how skills and problem solving can be balanced in harmony within a productive curriculum.

Lowrie, T. (1997). The use of imagery in primary school mathematics: A case study. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia*) (p. 618). Rotorua, NZ: MERGA.

Lowrie, T. (1998). The importance of visual processing in non-routine and novel problem-solving situations. In A. McIntosh & N. Ellerton (Eds.), *Research in mathematics education: A contemporary perspective* (pp. 186-209). Perth: Edith Cowan University.

Lowrie, T. & Hill, D. (1996). The development of a dynamic problem-solving model. *Journal of Science and Mathematics Education in Southeast Asia, 14*(1), 1-11.

Lowrie, T., Hill, D., & Hemmings, B. (1996). *Integrating science and mathematics using a spreadsheet.* Paper presented at the Education research: Building new partnerships (Proceedings from the joint conference of Educational Research Association, Singapore and Australian Association for Research in Education), Singapore.

Lowrie, T. & Owens, K. (2000). Making connections with space and measurement. In K. Owens & J. Mousley (Eds.), *Research in mathematics education in Australasia* (pp. 181-214). Sydney: MERGA.

Lowrie and Owens illustrate how concept development cannot be separated readily from either the learner or the context of learning. Two- and three-dimensional space studies are reviewed along with theoretical positions on variations of the van Hiele theory, role of imagery, and abstraction in learning. Topics covered space and measurement, early childhood, computer programs, the use of drawings, and workplace mathematics.

Lubinski, C.A., Fox, T., & Thomason, R. (1998). Learning to make sense of division of fractions: One K-8 preservice teacher's perspective. *School Science and Mathematics, 98*(5), 247-253.

The purpose of this article is to provide one way in which preservice teachers can come to better understand the mathematics they will teach.

Lynch, D.C. & Cuvo, A.J. (1995). Stimulus equivalence instruction of fraction-decimal relations. *Journal of Applied Behavior Analysis, 28*(2), 115-126.

This article describes how stimulus control technology was applied to the instruction of fraction ratio and decimal relations with 7 students who had demonstrated difficulty in these tasks. Post-test performance by all indicated the emergence of equivalence relations between fractions represented as ratios, decimals, and pictures. Limited generalisation of fraction-decimal relations was observed.

Ma, L. (1999). *Knowing and teaching elementary mathematics: Teachers' understanding of fundamental mathematics in China and the United States*. Mahwah, NJ: Lawrence Erlbaum Associates.

This book describes the nature and development of the 'profound understanding of fundamental mathematics' that elementary teachers need to become accomplished mathematics teachers. It suggests that such teaching knowledge is much more common in China than in the US, despite US teachers having more formal education than those in China.

MacGregor, M. & Price, E. (1999). An exploration of aspects of language proficiency and algebra learning. *Journal for Research in Mathematics Education, 30*(4), 449-467.

In a large study, in which students in years 7 to 10 were assessed for metalinguistic awareness of symbol, syntax, and ambiguity it was found that few students with low metalinguistic awareness could achieve high algebra scores. Students need to recognise the syntax of algebra.

MacGregor, M. & Stacey, K. (1993). Seeing a pattern and writing a rule. In I. Hirabayashi, N. Nohda, K. Shigematsu & Fou-Lai Lin (Eds.), *Proceedings of the 17th conference of the International Group for Psychology of Mathematics Education* (pp. 181-188). Tsukuba, Japan: PME.

MacGregor, M. & Stacey, K. (1995). The effect of different approaches to algebra on students' perceptions of functional relationships. *Mathematics Education Research Journal, 7*(1), 69-85.

MacGregor, M. & Stacey, K. (1996a). Origins of students' interpretation of algebraic notation. In L. Puig & A. Gutierrez (Eds.), *Proceedings of the 20th conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 297-304). Valencia, Spain: PME.

MacGregor, M., Stacey, K. (1996b). Using algebra to solve problems:

Selecting, symbolising, and integrating information. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 360-366). Melbourne: MERGA.

This paper traces a progression of stages from naming quantities through describing relationships to writing equations and solving them. Even when all relationships were recognised and correctly symbolised, integrating them into an equation was a common difficulty.

MacGregor, M. & Stacey, K. (1997). Students' understanding of algebraic notation: 11-15. *Educational Studies in Mathematics, 33*(1), 1-19.

MacGregor, M. & Stacey, K. (1998). Cognitive models underlying algebraic and non-algebraic solutions to unequal partition problems. *Mathematics Education Research Journal, 10*(2), 46-60.

MacKernan, J. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 14-20.

MacKernan points out that too much rigour in proof is counter-productive.

Mack, N. (1995). Confounding whole-number and faction concepts when building on informal knowledge. *Journal for Research in Mathematics Education, 26*(5), 422-441.

Macmillan, A. (1998). Investigating the mathematical thinking of young children. In A. McIntosh and N. Ellerton (Eds.), *Research in mathematics education: A contemporary perspective* (pp. 108–133). Perth: Edith Cowan University.

Maher, C.A. & Martino, A.M. (1996). The development of the idea of mathematical proof: A 5-year case study. *Journal for Research in Mathematics Education, 27*(2), 194-214.

This longitudinal case study presents a sequence of episodes that document the mathematical thinking of one child over a 5-year period from Years 1-5. The study provides significant insight into the process by which the student learned to make proofs within a setting that encouraged the development of her ideas.

Malloy, C. (1999). Developing mathematical reasoning in the middle grades: Recognising diversity. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 13-21). Reston, VA: National Council of Teachers of Mathematics.

This article challenges the notion that effective mathematics instruction is dominated by one culture or one method of reasoning.

Mansfield, A. (1996). Assessment strategies for Years 7-10. *Reflections*, *21*(1), 18-21.

Marley, V., Skinner, T., & Kenny, J. (1998). What do young children think about calculators? *Australian Primary Mathematics Classroom, 3*(2), 4-6.

Calculators were introduced to a Year 1 class. Higher ability children generally made considered decisions and only used the calculators when other methods were less efficient. Students of average ability started off using the calculator at all times but, after becoming more experienced, made considered decisions. The less able students found the calculator confusing.

Mascolo, M.F., Kanner, B.G., & Griffin, S. (1998). Neo-Piagetian systems theory and the education of young children. *Early Child Development and Care, 140*, 31-52.

The paper reviews constructivist and sociocultural approaches to development and early education and outlines a neo-Piagetian systems approach to early learning and development. It continues by discussing a neo-Piagetian curriculum for teaching number sense to young children and analysing the relevance of this new version of constructivism for education.

Mason, J. (1993). Questions about geometry. In D. Pimm & E. Love (Eds.), *Teaching and learning mathematics*. London: Holder & Stoughton.

Mathews, S. (1997). The effect of using two variables when there are two unknowns in solving algebraic word problems. *Mathematical Education Research Journal, 9*(2), 122-135.

McClain, K., Cobb, P., & Gravemeijer, K. (2000). Supporting students' ways of reasoning about data. In M.J. Burke (Ed.), *Learning mathematics for a new century* (pp. 174-187). Reston, VA: National Council of Teachers of Mathematics.

This book section describes how one group of students came to reason about data while developing statistical understandings related to exploratory data analysis.

McClain, K., Cobb, P., Gravemeijer, K., & Estes, B. (1999). Developing mathematical reasoning within the context of measurement. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 93-106). Reston, VA: National Council of Teachers of Mathematics.

This paper describes episodes from an instructional sequence on linear measurement in a grade 1 classroom and examines measurement as a context for supporting students' construction of sophisticated ways to think and reason mathematically.

McCoy, L.P. (1997). Algebra: Real-life investigations in a lab setting. *Mathematics Teaching in the Middle School, 2*(4), 220-224.

McGatha, M., Cobb, P., & McClain, K. (1999, April). *Starting points for a learning trajectory.* Paper presented at the Annual Meeting of the American Educational Research Association, Montreal.

This paper documents the analysis of performance assessments on seventh grade students' statistical understandings. This analysis forms the basis for instructional design of current research project.

McIntosh, A. & Dole, S. (2000a). Mental computation, number sense and general mathematics ability: Are they linked? In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 401-408). Fremantle: MERGA.

McIntosh, A. & Dole, S. (2000b). Early arithmetical learning and teaching. In K. Owens & J. Mousley (Eds.), *Research in Mathematics Education in Australasia* (pp. 215-239). Sydney: MERGA.

This chapter reviews research on whole number including studies in early number, early development of operations and understanding of operations, children with learning difficulties, aspects of word problems, and assessment, the value of calculators, mental computation, negative numbers, place value and decimals.

McIntosh, A.J., Nohda, N., Reys, B., & Reys, R. (1995). Mental computation performance in Australia, Japan and the United States. *Educational Studies in Mathematics, 29*, 237-258.

McIntosh, A., Reys, B.J., & Reys, R.E. (1997). Mental computation in the middle grades: The importance of thinking strategies. *Mathematics Teaching in the Middle School, 2*(5), 322-327.

This paper focuses on mental strategies in middle grade mathematics, describes what they are and why they are important and provides some teaching ideas for developing these strategies among students.

Mecardo, C. (1999). *Results of Ateneo schools on TIMSS items.* Paper presented at the 8th Southeast Asian Conference on Mathematics Education, Manila.

Menon, R. (1996). *Singapore students' performance in two "real-life" mathematics word problems.* Paper presented at Educational Research: Building New Partnerships, the joint conference of Educational Research Association, Singapore & Australian Association of Research in Education, Singapore, November.

Menon, R. (2000). Should the United States emulate Singapore's education system to achieve Singapore's success in the TIMSS? *Mathematics Teaching in the Middle School, 5*(6), 345-347.

This paper asks whether it is sensible to follow blindly Singapore's success in the TIMSS. It points out the need to consider cultural differences as well as differences in mathematics education.

Menne, J. (2000). *Jumping ahead: An innovative training programme up to 100*. Freudenthal Institute. URL: <http://www.fi.uu.nl/en/publications.shtml> [2000, December 21].

This paper makes innovative use of the open number line to develop ideas of counting and place value for numbers up to 100.

Milton, K. & Reeves, H. (2001). Using algebra in the early stages of its learning. In *Mathematics: Shaping Australia* (pp. 341-349) on CD-Rom. Adelaide: AAMT.

Mitchelmore, M. (1996). Children's concepts of turning: Dynamic or static. In L. Puig & A. Gutierrez (Eds.), *Proceedings of the 20th annual conference of International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 415-421). Lisbon: PME.

Mitchelmore, M. (1997). Young students' concepts of turning. *Cognition and Instruction, 16*, 265-284.

Mitchelmore, M. (2000). Teaching angle measurement without turning. *Australian Primary Mathematics Classroom, 5*(2), 4-8.

This article details an approach where equal corners fit around a point, makes fraction angles and compares corners by fitting, defining the standard unit (degree) and using this to measure the corners.

Mitchelmore, M. & White, P. (1995). Abstraction in mathematics: Conflict, resolution and application. *Mathematics Education Research Journal, 7*(1), 50-68.

The article reviews the literature on abstract thinking, reification, and conceptual knowledge and proposes that abstract-apart and abstract-general notions tie this literature together in a better way than earlier dichotomies about knowledge.

Mitchelmore, M. & White, P. (1996). Young children's interpretations of physical angle situations. In P.C. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 383-389). Melbourne: MERGA.

Mitchelmore, M. & White, P. (1998). Development of angle concepts: A framework for research. *Mathematics Education Research Journal, 10*(3), 4-27.

Mittag, K.C. & van Reusen, A.K. (1999). One fish, two fish, pretzel fish: Learning estimation and other advanced mathematics concepts in an inclusive class. *Teaching Exceptional Children*, 66-72.

This article shows how teachers can work together to help students in inclusive classrooms learn advanced mathematical concepts and skills. The key to the success of the students are teamwork, research-based strategies, and student engagement and ownership.

Mokros, J. & Russell, S.J. (1995). Children's concepts of average and representativeness. *Journal for Research in Mathematics Education, 26*, 20-39.

Moloney, K. & Stacey, K. (1997). Changes with age in students' conceptions of decimal notation. *Mathematical Education Research Journal, 9*(1), 25-38.

Momsavi, S.Y., Low, R., & Sweller, J. (1995). Reducing cognitive load by mixing auditory and visual presentation modes. *Journal of Education Psychology, 87*(2), 319-334.

This article reports findings on the use of a partly auditory and partly visual mode of presentation for geometry worked examples. Effective working memory may be increased by presenting material in a mixed rather than a unitary mode. If so, the negative consequences of spilt attention in geometry might be ameliorated by presenting geometry statements in auditory, rather than visual, form. The results of 6 experiments supported this hypothesis.

Morgan, G. (1999). *An analysis of the nature and function of mental computation in primary mathematics curricula*. Unpublished PhD thesis, Queensland University of Technology, Brisbane.

Moritz, J.B. (1999). *Graphing data: Relating representation and interpretation.* In K. Baldwin & J. Roberts (Eds.), *Mathematics: The next millenium* (*Proceedings of the Australian Association of Mathematics Teachers conference*) (pp. 90-99). Adelaide: AAMT.

Two related aspects of teaching graphing--representation and interpretation--are explored through discussion of curriculum documents and research literature. Recommendations are made for the inclusion of a wide variety of graphing aspects in both primary and secondary curricula.

Moritz, J.B. (2000). Graphical representations of statistical associations by upper primary students. In J. Bana & A. Chapman (Eds.), *Proceedings of the 23rd Conference of the Mathematics Education Research Group* *of Australasia* (Vol. 2, pp. 440-447). Fremantle: MERGA.

Students' graphical representations of statistical associations are explored through analyses of responses from students in grades 4-6. Issues for developing student representations are discussed.

Moses, B. (2000). Exploring our world through algebraic thinking. *Dialogues*, 5.

This paper explores the development of algebraic thinking in primary aged children and discusses the role of technology in this development.

Moss, J. & Case, R. (1999). Developing children's understanding of the rational numbers: A new model and an experimental curriculum. *Journal for Research in Mathematics Education, 30*(2), 122-147.

Mousley, J. (2000). Understanding multiplication concepts. *Australian Primary Mathematics Classroom*, 26-29.

Moyer, P. & Jones, G. (1998). *Tools for cognition: Student free access to manipulative materials in control-versus-autonomy-orientated middle grades teachers' classrooms*. ERIC, 2000.

Mulligan, J.T. (1992). Children's solutions to multiplication and division word problems: A longitudinal study. *Mathematics Education Research Journal, 4*(1), 24-42.

Mulligan, J.T. (1996). Assessing mathematics K-6. *Reflections*, *21*(1), 15-18.

Mulligan., J.T. (1998). A research-based framework for assessing early multiplication and division strategies. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia*. Gold Coast, Qld: MERGA.

Mulligan, J.T. & Mitchelmore, M. (Eds.) (1996). *Children's number learning* (pp. 163-184). Adelaide: Australian Association of Mathematics Teachers and MERGA.

This book reports on numerous Australian studies dealing with number development in primary aged children.

Mulligan, J.T. & Mitchelmore, M.C. (1997). Young children's intuitive models of multiplication and division. *Journal for Research in Mathematics Education, 28*(3), 309-330.

Mulligan, J., Mitchelmore, M., Outhred, L., & Bobis, J. (1996). Children's representation and conceptual understanding of number. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of* *the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 406-413). Melbourne: MERGA.

This study focuses on the structure of children's representations of estimating, counting, grouping, regrouping, partitioning, and multiplicative processes.

Mulligan, J.T., Mitchelmore, M., Outhred, L., & Russell, S. (1997). Second grader's representations and conceptual understanding of number: A longitudinal study. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia*) (pp. 361-368). Rotorua, NZ: MERGA.

Mulligan, J.T. & Thomas, N. (1998). The role imagery in representing number. In A. McIntosh & N. Ellerton (Eds.), *Research in mathematics education: A contemporary perspective* (pp. 90-107). Perth: MASTEC, Edith Cowan University.

Munn, P. (1994). The early development of literacy and numeracy skills. *European Journal of Early Childhood, 2*(1), 5-18.

Mwangi, W. & Sweller, J. (1998). Learning to solve compare word problems: the effect of example format and generating self-explanations. *Cognition and Instruction, 16*(2), 173-199.

Reported here are a series of three experiments designed to investigate relations between some techniques designed to reduce cognitive load and techniques such as the use of self- explanations that encourage mental effort. The experiments examined factors that influence learning to solve 2-step arithmetic word problems by studying worked examples.

Nagel, N. & Swingen, C. (1998). Students' explanations of place value in addition and subtraction. *Teaching Children Mathematics, 5*(3), 164-170.

Narode, R., Board, J., & Davenport, L. (1993). Algorithms supplant understanding: Case studies of primary students’ strategies for double-digit addition and subtraction. In J.R. Becker & B.J. Pence (Eds.), *Proceedings of the 15th annual meeting, North American chapter of the International Group for Psychology of Mathematics Education* (Vol. 1). Pacific Groves, CA.

Nathan, M. J., Kintsch, W., & Young, E. (1992). A theory of algebra-word-problem comprehension and its implications for the design of learning environments. *Cognition and Instruction, 9*, 329-289.

National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.

This is an important historical document which had a major impact on mathematics education thinking during the 1990s. It has been superseded by the 2000 version.

National Council of Teachers of Mathematics (1991). *Professional standards for teaching mathematics*. Reston, VA: National Council of Teachers of Mathematics.

National Council of Teachers of Mathematics (1995). *Assessment standards for school mathematics*. Reston, VA: Author.

National Council of Teachers of Mathematics (1998). *Principles and standards for school mathematics: Draft*. Reston, VA: Author.

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

This book sets out principles and standards on which it is hoped US mathematics education will be based. It puts forward a highly ambitious program aimed at the achievement of best practice in mathematics education.

Newman, A. (1983). *The Newman language of mathematics kit*. Sydney: Harcourt, Brace & Jovanivich.

Nisbet, S. & Putt, I. (2000). Research in problem solving in mathematics. In K. Owens & J. Mousley (Eds.), *Research in mathematics education in Australasia: 1996-1999* (pp. 97-121). Sydney: MERGA.

This chapter reviews Australasian research on problem solving in mathematics during the years 1995-1999.

Niss, M. (1996). Goals of mathematics teaching. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 11-48). Dordrecht: Kluwer.

Northern Territory Department of Education (2001). NT Curriculum Framework, Pilot Version 1.0 [CD-Rom]. Darwin: Author.

Nortvedt, G.A. (1999). Difficulties in calculating the volume of three-dimensional arrays of cubes. In O. Zaslavsky (Ed.), *Proceedings of the 23rd conference of the International Group for the Psychology of Mathematics Education* (Vol 1, p. 305). Haifa, Israel: PME.

Nowlin, D. (1996). Division with fractions. *Mathematics Teaching in the Middle School, 2*(2), 116-119.

Practical division helps students gain a sense of this concept.

NSW Department of Education, (1969/1972). *Curriculum for primary schools: Mathematics*. Sydney: Author.

This is the mathematics syllabus for primary schools which immediately followed the current syllabus.

NSW Department of School Education. (1989). *Mathematics K-6*. Sydney: Author.

This is the current syllabus for K-6 mathematics in NSW.

Nunes, T., Light, P., & Mason, J.H. (1993). Tools for thought: The measurement of length and area. *Learning and Instruction, 3,* 39-54.

O'Brien, J. (2000). High-quality assessment: A construct and framework. *Reflections*, *25*(1), 2-7.

O'Connor, M. (1999). Developing dynamic visualisation in geometry. In N. Scott & H. Hollingsworth (Eds.), *Mathematics across the age (Proceedings of the 36th annual conference of the Mathematical Association of Victoria*) (pp. 288-295). Melbourne: MAV.

O'Daffer, P., & Thornquist, B. (1993). Critical thinking, mathematical reasoning, and proof. In P. Wilson (Ed.), S. Wagner (Project Director). *Research ideas for the classroom: High school mathematics*. (pp. 39-56). Reston, VA: NCTM.

A concise summary of statements on mathematical reasoning, mathematical thinking, logical reasoning, different types of proof, and research studies.

Op't Eynde, P., de Corte, E., & Verschaffel, L. (2000, April). *A socio-constructivist perspective on the origins and the role of emotions in mathematical problem solving.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

This study analyses the relationships between junior secondary students' mathematics-related beliefs, their emotions, and their problem-solving behaviour in the classroom.

O'Rode, N. (1999). *Mental computation strategies used by students in traditional and reform classrooms.* Paper presented at the Annual meeting of the American Educational Research Association, Montreal, Canada.

The purpose of this study is to examine the strategies used in mental computation by students in traditional and reform-based classrooms in the USA. The evidence suggests that students in a mathematics reform curriculum use varied strategies, including sense-making strategies. They are less likely to use procedural algorithms to solve mental computation problems.

Outhred, L. & McPhail, D. (2000). A framework for teaching early measurement. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 487-494). Fremantle, WA: MERGA.

Outhred, L.N. & Mitchelmore, M.C. (2000). Young children's intuitive understanding of rectangular area measurement. *Journal for Research in Mathematics Education, 31*(2), 144-167.

Outhred, L. & Sardelich, S. (1997). Problem solving in kindergarten: The development of children's representations of numerical situations. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 376-384). Rotorua, NZ: MERGA.

Outhred, L. & Sardelich, S. (1998). Representing problems in the first year of school. In A. Oliver & K. Newstead (Eds.), *Proceedings of the 22nd Conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 319-326). Stellenbosch, South Africa: PME.

Outhred, L. & Shaw, P. (1999). Visual representations in first year statistics. In J.M. Truran & K.M. Truran (Eds.), *Making a difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 411-417). Adelaide: MERGA.

Owens, K. (1992). Spatial mathematics: A group test for primary school students. In M. Stephens & J. Izard (Eds.), *Reshaping assessment practices: Assessment in the mathematical sciences under challenge* (pp. 333-354). Melbourne: ACER.

Owens, K. (1994). Concrete materials: Why they do or don't work. In D. Rasmussen & K. Beesey (Eds.), *Mathematics without limits (Proceedings of the 31st annual conference of the Mathematical Association of Victoria)* (pp. 342-347). Melbourne: MAV.

Owens, K. (1996a). Responsiveness: A key aspect of spatial problem solving. In L. Puig & A. Gutierrez (Eds.), *Proceedings of the 20th Conference of the International Group for Psychology of Mathematics Education* (Vol. 4, pp. 99-106). Valencia, Spain: PME.

Owens, K. (1996b). Recent research and a critique of theories of early geometry learning: The case of the angle concept. *Nordisk Matematikk Didaktikk-Nordic Studies in Mathematics Education, 4*(2/3), 85-106.

Owens, K. (1997). Classroom view of space. In B. Doig & J. Lokan (Eds.), *Learning from children: Mathematics from a classroom perspective* (ACER Research Monograph, No. 52, pp. 125-146). Melbourne: ACER.

Owens, K. (1998a). Developing the angle concept through investigations. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 436-444). Gold Coast, Qld: MERGA.

Owens, K. (1998b). Creating designs using mathematics. *PNG Journal of Mathematics, Computing & Education, 4*, 79-98.

Owens, K. (1999a). The role of culture and mathematics in a creative design activity in Papua New Guinea. In E. Ogena & E. Golla (Eds.), *Proceedings of the 8th Southeast Asian Conference on Mathematics Education technical papers* (pp. 289-302). Manila: Southeast Asian Mathematical Association.

Owens, K. (1999b). The role of visualisation in young students' learning. In O. Zaslavsky (Ed.), *Proceedings of the 23rd conference of International Group for the Psychology of Mathematics Education* (Vol. 1, pp. 220-234). Haifa, Israel: PME.

Owens, K. (2000). Students' mapping and spatial knowledge. *Square One, 10*(1), 17-21.

This article outlines some of the spatial thinking literature and discusses results of assessing using classroom spatial tasks and notes the correlations with scores for spatial thinking but not with each other.

Owens, K. & Clements, M. (1998). Representations used in spatial problem solving in the classroom. *Journal of Mathematical Behavior, 17*(2), 197-218.

Owens, K., Leberne, P., & Harrison, I. (1999). Framework for elementary school space mathematics. *Reflections, 24*(1), 26-31.

Owens, K. & Mousley, J. (Eds.) (2000). *Research in mathematics education in Australasia 1996-1999.* Sydney: MERGA.

This book reviews a large proportion of research in Australasia from 1996-1999. It illustrates the difficulties of learning, the changes in approach to teaching, and some of the leading research in the world.

Owens, K. & Outhred, L. (1997). Early representations of tiling. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 312-319). Lahti, Finland: PME.

Owens, K. & Outhred, L. (1998). Covering shapes with tiles: Primary students' visualisation and drawing. *Mathematics Education Research Journal, 10*(3), 28-41.

Paley, V. (1981). *Wally's stories*. Cambridge, MA.: Harvard University Press.

Patterson, A.C. (1997). Building algebraic expressions: A physical model. *Mathematics Teaching in the Middle School, 2*(4), 238-242.

Peard, R. (1996). Problems with probability. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 437-444). Melbourne: MERGA.

This research examines misconceptions in probability held by a sample of pre-service primary teachers.

Pearn, C. (1996). Young children's strategies in solving rational number tasks. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 125-143). Adelaide: AAMT & MERGA.

This paper reports on Year 3 children's thinking processes when solving fractional tasks. Students were utilising two types of strategies: using known whole number facts or solving tasks through physical manipulation of available materials.

Pearn, C. (1998). *Mathematics intervention: A school based program informed by mathematics education research.* Paper presented at the Annual conference of the Australian Association for Research in Education, Adelaide.

Pegg, J. (1995). Report on the Year 9/10 Advanced Syllabus. Unpublished report to the Board of Studies, NSW.

This report focuses on the problem of returning to a 1950s or 1960s type geometry which ignores the last 30 years of research into how students learn geometry and provide what only a small percentage of students could do.

Pegg, J. (1997). Interpreting the demands of geometry questions within an extended form of the van Hiele theory. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 241-246). Adelaide: AAMT.

Pegg, J. (1998). Broadening the descriptors of van Hieles' Levels 2 and 3. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 391-399). Rotorua, NZ: MERGA.

Pegg, J. & Davey, G. (1998). Interpreting students' understanding of geometry: A synthesis of two models. In R. Lehrer & D. Chazan (Eds.), *Designing learning environments for developing understanding of geometry and space* (pp. 109-135). Hillsdale, NJ: Erlbaum.

Pegg, J. & Hadfield, R. (1999). An analysis of year 12 students' performances on basic algebra questions. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 418-424). Adelaide: MERGA.

Pegg, J., Hadfield, R., & Hastings, A. (1997). Benchmarking student performance: Student understandings of the number plane. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future* (*Proceedings of 16th biennial conference Australian Association of Mathematics Teachers*) (pp. 247-254). Adelaide: Australian Association of Mathematics Teachers.

This paper looks at the first and last two parts of a question for HSC on the number plane. Most students had the question correct but some analysis is given.

Pepper, K.L. & Hunting, R.P. (1998). Preschoolers' counting and sharing. *Journal for Research in Mathematics Education, 29*(2), 164-183.

Peressini, D. & Webb, N. (1999). Analyzing mathematical reasoning in students' responses across multiple performance assessment tasks. In L. Stiff & F. Curcio (Eds.), *Developing mathematics reasoning in grades K-12* (pp.156-174). Reston, VA: NCTM.

Perry, B. (1996). Children constructing their mathematics: Implications for teachers. *The Mathematics Educators, 1*(1), 17-24.

Perry, B., Dawe, L., Howard, P., & Dengate, B. (2000). An investigation of literacy in the teaching and learning of mathematics in secondary schools serving low socio-economic status communities. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 2, pp. 495-502). Fremantle: MERGA.

This paper reports on an investigation to identify the best ways to provide support for mathematics teachers in NSW secondary schools serving low SES communities, so that they can assist their students meet the literacy demands of mathematics.

Perry, B. & Dockett, S. (1998). Play, argumentation and social constructivism. *Early Child Development and Care, 140*, 5-15.

Perry, B. & Howard, H. (1994). Manipulatives: Constraints on construction? In

G. Bell, B. Wright, N. Leeson, & J. Geake (Eds.), *Challenges in mathematics educations: Constraints on construction* (pp. 487-496). Lismore: MERGA.

Perry, B. & Howard, P. (2000). *Evaluation of the impact of the Counting On program*. Sydney: New South Wales Department of Education and Training.

This report considers an evaluation of a systemic intervention program aimed at improving the mathematics learning outcomes of students in Year 7 who have had learning difficulties with mathematics. This program works through the professional development of teaching teams. The results of the evaluation confirm that the program can have a dramatic effect on the learning outcomes of the students.

Perry, B., Jones, G., Thornton, C. & Langrall, C. (1997). Using technology links in data exploration. *Australian Primary Mathematics Classroom, 2*(4), 27-31.

Perry, B., Jones, G. A., Thornton, C. A., Langrall, C W., Putt, I. J. & Kraft, C. (1999). Exploring visual displays involving Beanie Baby data. *Teaching Statistics, 21*(1), 11-13.

Perry, B., Putt, I.J., Jones, G.A., Thornton, C.A., Langrall, C.W. & Mooney, E.S. (2000). Elementary school students' statistical thinking: An international perspective. In T. Nakahara & M. Koyama (Eds.), *Proceedings of the 24th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 65-72). Hiroshima, Japan: PME.

This paper reports on the validation process conducted in two Australian states for a framework for assessing and fostering elementary students' statistical thinking. The data confirmed four levels of thinking for each construct but the degree of consistency with respect to the framework was greater for the US sample than for the Australian samples.

Perso, T. (2001). Aboriginal numeracy. In *Mathematics: Shaping Australia* (pp. 357-362) on CD-ROM. Adelaide: AAMT.

This paper covers the general cultural practices that impact on teaching Aboriginal students and some more specific aspects of Aboriginal cultural mathematics

Piaget, J., Inhelder, B., & Szeminska, A. (1960). *The child's conception of geometry.* London: Routledge and Kegan Paul.

Piel, J. & Green, M. (1994). De-mystifying division of fractions: The convergence of quantitative and referential meaning. *Focus on Learning Problems in Mathematics, 16*(1), 44-50.

Pillay, H., Wills, L., & Boulton-Lewis, G. (1998). Sequential development of algebraic knowledge: A cognitive analysis. *Mathematics Education Research Journal, 10*(2), 87-102.

Pimm, D. (1987). *Speaking mathematically: Communication in mathematics classrooms*. London: Routledge & Keagan Paul.

Pirie, S. & Kieren, T. (1991). Folding back: Dynamics in the growth of mathematical understanding. In F. Fulvinghetti (Ed.), *Proceedings of 15th annual conference of International Group for the Psychology of mathematics Education* (Vol. 3, pp. 169-176). Italy: PME.

Pitkethly, A. & Hunting, R.P. (1996). A review of recent research in the area of initial fraction concepts. *Educational Studies in Mathematics, 30*, 5-38.

In this review 5 subconstructs associated with initial fraction concepts: part-whole, quotient, ratio, operator, and measure are identified. The authors suggest two interpretations of findings: initial fraction concepts emerge either from application of intuitive mechanisms or from ideas of ratio and proportion.

Pope, S. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 22-23.

Two visual proofs form an argument for proof other than by deduction

Post, T.R., Cramer, K.A., Behr, M., Lesh, R., & Harel, G. (1993). Curriculum implications on research on the learning, teaching and assessing of rational number concepts. In T. Carpenter, T. Romberg & E. Fennema (Eds.), *Rational Numbers: An integration of research* (pp. 327-362). Hillsdale, NJ: Lawrence Erlbaum Associates.

Presmeg, N. (1986). Visualization in high school mathematics. *For the Learning of Mathematics, 6*(3), 42-46.

Price, P. (1997). Teacher presence as a variable in research into students' mathematical decision making. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 422-428). Rotorua, New Zealand: MERGA.

In this study Years 5-7 students were asked to chose among calculator, written and mental computation methods to answer a series of multiplication questions with a teacher either absent or present. Findings indicate that the students made choices based on what they believed the teacher really wanted, rather than on valid mathematical factors.

Price, P. (1999). *Using place-value blocks or a computer to teach place-value* *concepts*. European Research in Mathematics Education I: Group 2. URL: <http://www.fmd.uni-osnabrueck.de/ebooks/erme/cermel-proceedings/cermel-proceedings.html> [2000].

This article describes an Australian study which compared the use of computers and of place-value blocks by Year 3 students as they learned place-value concepts. This project found that students using the software tended to focus on the quantities being modelled, whereas students using blocks spent large amounts of time counting and re-counting the blocks.

Putt, I. (1995). Preservice teachers ordering of decimal numbers: When more is smaller and less is larger! *Focus on Learning Problems in Mathematics, 17*(3), 1-15.

Putt, I.J., Jones, G.A., Thornton, C.A., Langrall, C.W., Mooney, E.S. & Perry, B. (1999). Young students' informal statistical knowledge. *Teaching Statistics*, *21*(3), 74-78.

Putt, I.J., Perry, B., Jones, G., Thornton, C., Langrall, C., & Mooney, E. (2000, July). *Primary school students' statistical thinking: A comparison of two Australian states.* In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000* (*Proceedings of the annual conference of the Mathematics Education Research Group of Australasia*) (Vol. 2, pp. 519-526). Fremantle: MERGA.

This study considers the data from two Australian states--NSW and Queensland--concerning the validation of the statistical thinking framework devised by Jones et al (1998).

Queensland School Curriculum Council. (2000a). *P-10 Curriculum Framework (draft-in-development)*. Brisbane: Author.

This is the current overall statement on curriculum in Queensland's compulsory years of schooling. It is in draft form and not generally available.

Queensland School Curriculum Council. (2000b). *Years 1 to 10 Mathematics: Syllabus-in-development*. Brisbane: Author.

This is the current draft mathematics syllabus for Queensland schools in Years 1-10.

Quek, T. (2000, November 28). Parents fork out $320m a year on kid's tuition. *The Straits Times,* pp. H7.

This article reports on the results of a newspaper survey measuring the amount and nature of private tuition undertaken by school students in Singapore.

Quinlan, C. (1996). The concept of a numerical variable. *Australian Senior Mathematics Journal, 10*(1), 11-20.

Redden, E. (1996a). Patterns, language and algebra: a longitudinal study. In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 469-476). Melbourne: MERGA.

Redden, E. (1996b). "Wouldn't it be good if we had a symbol to stand for any number": The relationship between natural language and symbolic notation in pattern description. In L. Puig & A. Gutierrez (Eds.), *Procceedings of the 20th annual conference of the International Group of the Psychology of Mathematics Education* (Vol. 4, pp. 195-202). Valencia: PME.

Redden, E. & Clark, G. (1997). Can students induce geometry properties within an interactive computer environment? In D. Fisher & T. Rickards (Eds.), *Science, mathematics and technology education and national development (Proceedings of the 1997 International conference on Science, Mathematics and Technology Education)* (pp. 220-229). Perth: Curtin University of Technology.

Reid, D. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 23-26.

Reid uses several scenarios to establish the importance of proof and different kinds of proof

Reynolds, A. & Wheatley, G.H. (1996). Elementary students' construction and coordination of units in an area setting. *Journal for Research in Mathematics Education, 27*(5), 564-581.

Reynolds, A. & Wheatley, G. (1997). Third-grade students engage in a playground measuring activity. *Teaching Children Mathematics, 4*(3), 166-170.

This article gives a number of measuring activities and the kinds of questions that can be posed to engage the students in a problem.

Reys, B.J., & Barger, R.H. (1994). Mental computation: Issues from the United States perspective. In R.E. Reys & N. Nohda (Eds.), *Computational alternatives for the twenty-first century: Cross-cultural perspectives from Japan and the United States* (pp. 31-47). Reston, VA: NCTM.

Reys, R.E., Reys, B.J., Nohda, N., & Emori, H. (1995). Mental computation performance and strategy use of Japanese students in grades 2, 4, 6, and 8. *Journal for Research in Mathematics Education, 26*, 304-326.

Richards, A. (1997). Pre-service education and the potential for spreadsheets in the primary mathematics classroom. In D. Fisher & T. Rickards (Eds.), *Science, mathematics and technology education and national development (Proceedings of the 1997 International Conference of Science, Mathematics and Technology Education)* (pp. 240-249). Hanoi, Vietnam: Curtin University of Technology.

Riddle, M. & Rodzwell, B, (2000). Fractions: What happens between kindergarten and the army? *Teaching Children Mathematics*, *7*(4), 202-206.

Students naturally used a filling up wholes method to add mixed numbers so that formal approaches such as changing to equivalent fractions confused students.

Robinson, E.E., Robinson, M.F., & Maceli, J.C. (2000). The impact of standards-based instructional materials in mathematics in the classroom. In M.J. Burke & F.R. Curcio (Eds.), *Learning mathematics for a new century* (pp. 112-126). Reston, VA.: National Council of Teachers of Mathematics.

Rogers, A. (2000). Investigating in the early years. *Australian Primary Mathematics Classroom, 5*(4), 19-22.

The paper reports on a study which analysed young (3-5 years) children's investigations with blocks. The results show that the children constructed abundant and valuable knowledge, skills and processes, built their mathematical language and linked their practical investigations to prior knowledge and skills.

Rogers, A.M. (1999). Children and block play: Mathematical learning in early childhood. In K. Baldwin & J. Roberts (Eds.), *Mathematics: The next millennium* (pp. 162-181). Adelaide: AAMT.

This paper shows that block building was found to be a beneficial activity for all children (aged 3-6) to engage in. The extension of children's construction of mathematical knowledge was observed in block play.

Rogoff, B. (1990). *Apprenticeship in thinking*. New York: Oxford University Press.

This is a classic text exploring the ideas of Vygotsky on socio-cultural approaches to the development of knowledge.

Rollo, G. & Bobis, J. (1996). What does an expert teacher in instructional computing look like? In P. Clarkson (Ed.), *Technology in mathematics education (Proceedings of the 19th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 486-493). Melbourne: MERGA.

The aim of this study was twofold: to describe exemplary practice in teaching with computers and to isolate criteria appropriate for the identification of expertise in instructional computing.

Rowan, T. & Robles, J. (1998). Using questions to help children build mathematical power. *Teaching Children Mathematics, 5*, 504-509.

The reasons for different kinds of questions are supported by classroom vignettes that illustrate children's mathematical thinking and generalising in primary school.

Rudnitsky, A., Etheredge, S., Freeman, S., & Gilbert, T. (1995). Learning to solve addition and subtraction word problems through a structure-plus-writing approach. *Journal for Research in Mathematics Education, 26*(5), 467-486.

Russell, S. (1999). Mathematical reasoning in the elementary grades. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 1-12). Reston, VA: National Council of Teachers of Mathematics.

The article stresses four points about mathematical reasoning in the elementary grades: development, justification and use of generalisations; leads to interconnected web of knowledge; foundation of 'mathematical sense'; necessity for flawed reasoning.

Russell, S. (2000). Developing computational fluency with whole numbers. *Teaching Children Mathematics, 7*(3), 154-158.

This paper develops the idea of computational fluency as an aim of elementary mathematics education. It shows what it means and how to teach for its development.

Ruthven, K. (1996). Calculators in the mathematics curriculum: The scope of personal computational technology. In A.J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 435-468). Dordrecht: Kluwer Academic Publishers.

This article overviews the use and impact of calculators in mathematics classrooms. It reports on success and lack of success over a period of twenty years.

Ruthven, K. (1997). Calculator use by upper-primary pupils tackling a realistic number problem. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 96-103). Lahti, Finland: PME.

This paper analyses how a structured sample of pupils in the last year of English primary school tacked a realistic number problem, focusing on the use of a calculator.

Ruthven, K. (1998). The use of mental, written and calculator strategies of numerical computation by upper primary pupils within a calculator-aware number curriculum. *British Educational Research Journal, 24*(1), 21-42.

This study examines the use of mental, written and calculator strategies of numerical computation by year 6 pupils drawn from neighbouring schools with very different traditions in the teaching of number. Calculator aware pupils were found to make greater use of mental computation, particularly of multiplication strategies.

Saenz-Ludlow, A. (In press). The role of the format of arithmetical tasks in classroom interactions: A case in a fourth grade classroom. *Focus on Learning Problems in Mathematics*.

Open-ended and multiple-choice tasks were posed to fourth-graders who participated in a year-long teaching experiment. The analysis of their solutions indicated that the format of the arithmetical tasks influence the mathematical interactions among the students and the teacher. Multiple-choice tasks appear to limit the students' freedom to think in ways that make sense to them. Open-ended tasks appear to elicit their creativity and means of symbolising.

Saul, K.E. (1997). Money matters - Exploring money concepts with young children. *Dimensions of Early Childhood, 25*(2), 17-21.

This article offers hands-on learning activities to help teach young children about money.

Sawada, D. (1997). Mathematics as reasoning: Episodes from Japan. *Mathematics Teaching in the Middle School, 2*, 416-421.

Classroom episodes illustrate the tasks and questions used with a timetable and hundreds chart to find patterns in grades 1 and 2.

Scheaffer, R. (2000). Statistics for a new century. In M.J. Burke (Ed.), *Learning mathematics for a new century* (pp. 158-173). Reston, VA: National Council of Teachers of Mathematics.

This article argues that the K-12 statistics curriculum needs to change. Four areas to be stressed are: exploratory data analysis, association, inferential reasoning and principles of planning studies. Curriculum recommendations for each level of schooling are given.

Schifter, D. (1999). Reasoning about operations: Early algebraic thinking in grades K-6. In L.V. Stiff (Ed.), *Developing mathematical reasoning in grades K-12* (pp. 62-81). Reston, VA: National Council of Teachers of Mathematics.

This paper considers current practice in mathematical reasoning in K-6 classrooms, particularly the development of 'operation sense'. In particular, it asks "How far can children's engagement with the four basic operations take them in preparation for algebra?".

Schwarz, B. & Hershkowitz, R. (1999). Prototypes: Brakes or levers in learning the function concept? The role of computer tools. *Journal for Research in Mathematics Education, 30*(4), 362-389.

Year 9 students showed more flexibility and use of part-whole reasoning, and understanding of function attributes after course that included graphical function software, open-ended investigations, and collaborative group work.

Schwartz, S. & Whitin, D. (2000). Don't delay: Build and talk about rich experiences from the beginning. *Dialogues*, 4.

This paper questions whether we sufficiently understand how symbolic thinking in algebra develops so that we can recognise and support the process.

Seah, W.T. & Bishop, A.J. (2000, April). *Values in mathematics textbooks: A view through two Australasian regions.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

This paper outlines a preliminary investigation into the kinds of mathematical and mathematics educational values conveyed in representative lower secondary mathematics textbooks in Singapore and Victoria. Data reveal an unbalanced portrayal for each of the eight selected pairs of complementary values. Differences in the way values are portrayed in the two culturally different regions are also discussed.

Seidel, J. (1998). Symmetry in season. *Teaching Children Mathematics, 5*, 244-249.

This article illustrates the use of programs that allow symmetric and other rotations and geometer sketchpad to develop cards and various other designs on screen in grade 2.

Senk, S. (1985). How well do students write geometry proofs? *Mathematics Teacher*, *78*(6), 448-456.

A study of the proofs provided by over 1500 students on a range of typical questions on proof show only 70% achieve any level of proof after a year on geometry and of those, only 25% can be said to master proof.

Senk, S. (1989). Van Hiele levels and achievement in writing geometry proofs. *Journal of Research in Mathematics Education*, *20*(3), 309-321.

The tests of van Hiele levels is used to show that students will struggle with proof unless they have reached the higher levels.

Sfard, A. (1991). On the dual nature of mathematical conceptions: Reflections on processes and objects as different sides of the same coin. *Educational Studies in Mathematics, 22*, 1-36.

Shaughnessy, J.M. (1992). Research in probability and statistics: Reflections and directions. In D.A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (pp. 465-494). New York: Macmillan.

Shaughnessy, J.M. (1997). Missed opportunities in research on the teaching and learning of data and chance. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 1, pp. 6-22). Rotorua, NZ: MERGA.

This paper considers three areas of needed research in the teaching and learning of probability and statistics: (i) following up on students' initial thinking to watch for future transitions, (ii) investigating students' thinking on variability; and (iii) finding what students can do rather than pointing out what they cannot do.

Shaughnessy, J.M., Garfield, J., & Greer, B. (1996). Data handling. In A.J. Bishop, M.A. Clements, C. Keitel, J. Kilpatrick, C. Laborde (Eds.), *International handbook of mathematics education* (pp. 382-393). Dordrecht: Kluwer.

Shield, M. (2000). Virtual 'real life' mathematics. *Australian Mathematics Teacher, 56*(3), 25-28.

Shuard, H. (1992). CAN: Calculator use in the primary grades in England and Wales. In J.T. Fey & S.C. Hirsch (Eds.), *Calculators in mathematics education* (pp. 33-45). Reston, VA.: NCTM.

This paper reports on the well known CAN calculator program and its results in the primary grades.

Silver, E.A. (1997). "Algebra for all": Increasing students' access to algebraic ideas, not just algebra courses. *Mathematics Teaching in the Middle School, 2*(4), 204-207.

Silver, E. & Cai, J. (1996). An analysis of arithmetic problems-posing by middle school students. *Journal for Research in Mathematics Education, 27*(5), 521-539.

Simon, M. (1996). Beyond inductive and deductive reasoning: The search for a sense of knowing. *Educational Studies in Mathematics, 20*, 197-210.

Skemp, R. (1989). *Mathematics in the primary schools*. London: Routledge.

Skemp, R.R. (1986). *The psychology of learning mathematics*. London: Penguin.

Slavit, D. (1998). Above and beyond AAA: The similarity and congruence of polygons. *Mathematics Teaching in the Middle School, 3*, 276-280.

This article demonstrates that conjecturing and reasoning about congruence and similarity with available materials such as pencils, compasses and straws, dynamic geometry software provides excellent opportunities for developing the notion of similarity and its related ideas on proportion.

Slomson, A. (1996). (Comment on) Teaching proof, *Mathematics Teaching*, *155*, 10-13.

Mathematical proof, pattern and proof, proof in classrooms, good proof and does proof matter are issues raised in this article.

Smith, J. (1996). Efficacy and teaching mathematics by telling: A challenge for reform. *Journal for Research in Mathematics Education, 27*(4), 387-402.

Smith, T. (2000). Exploring the nexus between assessment and instruction in mathematics. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 550-557). Fremantle: MERGA.

Sophian, C. & Vong, K.I. (1995). The parts and wholes of arithmetic story problems: Developing knowledge in the preschool years. *Cognition and Instruction, 13*(3), 469-477.

This study found that for 4-year olds problem solving is constrained by the temporal sequence of events in a story problem. By 5 years of age children were able to give directionality appropriate responses to both the final-unknown and the initial-unknown problems.

Southwell, B. (2000). Working mathematically in measurement. *Square One, 10*(2), 15-17.

This paper sets out various aspects of measurement and the associated mathematical thinking such as classifying, analysing and visualising which is used.

Southwell, B. (2001). Characteristics of good mathematical investigations. In *Mathematics: Shaping Australia* (pp. 370-377) on CD-ROM. Adelaide: AAMT.

This paper is one of a number on investigations and gives some examples and how they are important in getting students to conjecture.

Sparrow, L. & Swan, P. (1997a). *Calculator use in Western Australian primary schools*. Perth: Mathematics, Science and Technology Education Centre, Edith Cowan University.

Sparrow, L. & Swan, P. (1997b). Should all children use calculators? A Western Australian survey. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematical Education Research Group of Australasia)* (pp. 464-469). Rotorua, New Zealand: MERGA.

This paper outlines some of the findings of a recent survey undertaken in Western Australia primary schools which collected data on young children using calculators. Initial findings suggest that integrated calculator use is rare with most use being outside mathematics learning and trivial in nature.

Stacey, K. (1988). *Describing, explaining, convincing*. Nottingham: The Shell Centre for Mathematical Education.

The book is a guide to teachers for introducing proof to 15-20 year olds. It covers issues about what is proof, is 'it' true, describing clearly, precise definitions, why is it true and means and ends.

Stacey, K. (1997). Computer algebra: The coming challenge for the mathematics curriculum. *Vinculum, 34*(2), 16-18.

Stacey, K. (convenor) (1999). Discussion document for the twelfth ICMI study: the future of the teaching and learning of algebra, to be held in December 2001, reprinted in the Mathematics Education Research Group of Australasia's newsletter 48. Sydney: MERGA.

Stacey, K. & Groves, S. (1996). Redefining early number concepts through calculator use. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 205-226). Adelaide: Australian Association of Mathematics Teachers and MERGA.

Stacey, K. & MacGregor, M. (1997). Multiple referents and shifting meaning of unknowns in students' use of algebra. In E. Pehkonen (Ed.), *Proceedings of the 21st conference of the International Group for the Psychology of Education* (Vol. 4, pp. 190-197). Lahti, Finland: PME.

Interviews with students identified 3 modes of use of variables: to refer to different quantities in the one equation; to refer to different quantities at different stages of a solution; and as a general label for any quantity or a combination of unknowns.

Stacey, K. & MacGregor, M. (1999a). Taking the algebraic thinking out of algebra. *Mathematics Education Research Journal, 11*(1), 24-36.

Stacey, K. & MacGregor, M. (1999b). Learning the algebraic method of solving problems. *Journal of Mathematical Behavior, 18*(2).

Stacey, K. & Steinle, B. (1999). Understanding decimals: The path to expertise. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 446-453). Adelaide: MERGA.

This paper reports the longitudinal study of children's understanding of decimal notation. Over about a year, many students remain in the same misconception category, but in the longer term they move between misconceptions.

Steffe, L., Cobb, P., & von Glaserfeld, E. (1998). *Construction of arithmetical meanings and strategies*. New York: Springer-Verlag.

Steinle, V. & Stacey, K. (1998). The incidence of misconceptions of decimal notation among students in grades 5-10. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 548-555). Gold Coast, Qld.: MERGA.

This paper reports the results of a test of decimal understanding based on choosing the larger number from pairs of decimals. Ten incorrect ways of thinking about decimal notation are described.

Stephan, M. (2000, April). *Unitizing in a linear measurement context.* Paper presented at the Annual Meeting of American Educational Research Association, New Orleans, LA.

This paper reports on a Year 1 teaching experiment in linear measurement and the students' creation of units of different qualities. It compares the students' unitizing in the linear measurement context with that of Steffe's counting types.

Stephens, M. & Sullivan, P. (1997). Developing tasks to assess mathematical performance. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of 20th annual conference of Mathematics Education Research Group of Australasia*) (pp. 470-476). Rotorua: MERGA.

Stewart, A. (1999). Computers, communication and the congruence conundrum. In N. Scott & H. Hollingsworth (Eds.), *Mathematics across the ages (Proceedings of the 36th annual conference of the Mathematical Association of Victoria*) (pp. 351-357). Melbourne: MAV.

Stewart, R., Wright, B. & Gould, P. (1998). Kindergarten students' progress in the Count Me In Too project. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 556-563). Gold Coast, Qld: MERGA.

Stigler, J.W. & Hiebert, J. (1999). *The teaching gap.* New York: The Free Press.

Using videotaped Grade 8 mathematics lessons from the USA, Germany and Japan, this book reveals stark differences in the ways in which mathematics is taught in these countries and offers suggestions as to how the use of approaches from other countries might help enhance the mathematical performance of US students.

Stigler, J.W. & Stevenson, H.W. (1991). How Asian teachers polish each lesson to perfection. *American Educator, 14*(4), 13-20, 43-46.

Stillman, G. (1998). Task context and applications at the senior secondary level. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 564-571). Gold Coast, Qld.: MERGA.

This study investigated the impact of prior knowledge of task context on senior secondary students' approaches to application tasks and the effect of engagement with context on performance.

Suggate, J., Aubrey, C., & Pettitt, D. (1997). The number knowledge of four and five year olds at school entry and at the end of their first year. *European Early Childhood Education Research Journal, 5*(2), 85-101.

The paper illustrates the wide range on number knowledge possessed by children entering school and an even greater range at the end of their first year. There are some connections between early and later school entry.

Sullivan, P., Warren, E., & White, P. (1999). Comparing students' responses to content specific open-ended and closed mathematical tasks. In O. Zaslavsky (Ed.), *Proceedings of the 23rd conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 249-256). Haifa, Israel: PME.

This paper compares the responses of Year 8 students to comparable closed and open-ended tasks and explores the effect of using specific contexts for such tasks.

Sulzer, J.S. (1998). The function box and fourth graders: Squares, cubes and circles. *Teaching Children Mathematics, 4*(8), 442-447.

This article details how this well-known function box is extended to explore generalities about shapes, cubes and roots, and formulae.

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction, 4*(4), 295-312.

This paper is concerned with some of the factors that determine the difficulty of material that needs to be learned. It is suggested that when considering intellectual activities, schema acquisition and automation are the primary mechanisms of learning. The consequences of cognitive load theory for the structuring of information in order to reduce difficulty by focusing cognitive activity on schema acquisition is briefly summarised. It is pointed out that cognitive load theory deals with learning and problem solving difficulty that is artificial in that it can be manipulated by instructional design. Intrinsic cognitive load in contrast, is constant for a given area because it is a basic component of the material.

Sweller, J. & Chandler, P. (1994). Why some material is difficult to learn. *Cognition and Instruction, 12*(3), 185-233.

The experiments reported in this article flow from the following assumptions concerning our cognitive processes: Schema acquisition and automation are major learning mechanisms when dealing with higher cognitive activities and are designed to circumvent our limited working memories and emphasise our highly effective long term memories. A limited working memory makes it difficult to assimilate multiple elements of information simultaneously. Under conditions where multiple elements of information interact, they must be assimilated simultaneously. As a consequence, a heavy cognitive load is imposed when dealing with material that has a high level of element interactivity.

Szymanski, T. (1998). The teaching of percent. *Research & Teaching in Developmental Education, 15*(1), 101-103.

Tada, W.L. & Stiles, J. (1996). Developmental change in children's analysis of spatial patterns. *Developmental Psychology, 32*, 951-970.

This paper demonstrates that children as young as 3 engage in active spatial analytic processing. That is, young children attend to the constituent parts of a spatial array and the whole, as well as to the relation between the parts and the more complex whole.

Tall, D. (1996). Functions and calculus. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 289-326). Dordrecht: Kluwer.

Tang, E.P. & Ginsburg, H.P. (1999). Young children's mathematical reasoning: A psychological view. In L.V. Stiff (Ed.), *Developing* *mathematical reasoning in grades K-12* (pp. 45-61). Reston, VA: National Council of Teachers of Mathematics.

This article builds on the authors' work with five year olds and their mathematical reasoning. It stresses seven aspects of such reasoning and also points out that even low socio-economic status children display these aspects. Perhaps this means that young children's abilities in this area are underestimated as they commence school.

Tarr, J.E. & Jones, G.A. (1997). A framework for assessing middle school students' thinking in conditional probability and independence. *Mathematics Education Research Journal, 9*(1), 39-59.

Teese, R. (2000). *Academic success and social power: Examinations and inequality*. Melbourne: Melbourne University Press.

This is a study of Victorian senior secondary education and what shapes success in this system. The author argues that the system is sharply polarised and that the most economically vulnerable populations are those most at risk of educational failure. There are four chapters analysing the role of mathematics in the system.

TERC (1995-1998). *Investigations in number, data, and space (grades K-5)*. Menlo Park, CA.: Dale Seymour.

Thomas, M. & Hall, D. (1998). A computer environment to encourage versatile understanding of algebraic equations. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of 21st annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 2, pp. 605-612). Gold Coast, Queensland: MERGA.

In this study the value of a computer environment which enables students gradually to investigate algebraic expressions and equations was assessed with very encouraging initial results.

Thomas, M., Tyrrell, J., & Bullock, J. (1996). Using computers in the mathematics classroom: The role of the teacher. *Mathematics Education Research Journal, 8*(1), 38-59.

Thomas, N. & Mulligan, J. (1995). Dynamic imagery in children's representations of number. *Mathematics Education Research Journal, 7*(1), 5-25.

Thomas, N. & Mulligan, J. (1999). *Children's understanding of the number system.* Paper presented at the Annual conference of the Australia Association for Research in Education, Melbourne.

This study investigated which aspects of developing number knowledge contributed to the apparent failure of children to make sense of numeration as a number system.

Thornton, C.A., Jones, G.A., & Neal, J.L. (1995). The 100s chart: A stepping stone to mental mathematics. *Teaching Children Mathematics, 1*(8), 480-483.

This article reports on an instructional lesson in a primary class. It analyses progress made towards mental mathematics using the 100s chart as a bridge between concrete materials and mental computation.

Thorpe, P. (1995). Spatial concepts and young children. *International Journal of Early Years Education*, *3*(2), 63-73.

Threlfall, J. (1996). The role of practical apparatus in the teaching and learning of arithmetic. *Educational Review, 48*(1), 3-12.

This article reviews the arguments for the value of practical number apparatus and examines the practical activities for which the apparatus is used, to try to explain why the theoretical benefits do not seem to be translating into practice. The unhelpful use of the apparatus as an aid to calculation is found to be one of the most notable reasons. A change in emphasis in the use of the apparatus is recommended.

Tickle, B. (In press a). Helping children articulate their thoughts processes, Part 1 Getting them talking. *Square One*.

This article provides clear purposeful points for number lessons and explains how class discussion can encourage students to develop efficient number strategies.

Tickle, B. (In press b). Helping children to articulate their thought processes, Part 2, Making them visible. *Square One*.

This article explains how astutely selected activities can encourage students to see useful number strategies.

Tobin, P. (1997). Graphics calculators and VCE mathematics examinations. In N. Scott & H. Hollingsworth (Eds.), *Mathematics: Creating the future (Proceedings of the 16th biennial conference of the Australian Association of Mathematics Teachers)* (pp. 317-324). Adelaide: AAMT.

Tobin, P. (1998). New technology and curriculum change. *Teaching Mathematics and Its Applications, 17*(3), 97-105.

Trafton, P. & Hartman, C. (1997). Developing number sense and computational strategies in problem-centered classrooms. *Teaching Children Mathematics, 4*(4), 230-233.

By illustrating students' strategies for solving problems it can be seen how they work to make sense of numbers.

Troyahn, W. (1998). *An investigation of the effects of an intervention on Year 8 students' mathematical problem-solving performance, metacognition and affect.* Unpublished PhD, James Cook University, Townsville.

Truran, J.M. (1995). Animism: a view of probability behaviour. In B. Atweh, & S. Flavel (Eds.), *MERGA 18: Galtha (Proceedings of the 18th Annual Conference of the Mathematics Education Research Group of Australasia*) (pp. 537-541). Darwin: MERGA

Truran, J.M. (1998). Using research into children's understanding of the symmetry of dice in order to develop a model of how they perceive the concept of a random generator. In A. Olivier & K. Newstead (Eds.), *Proceedings of the 22nd conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 121-128). Stellenbosch, South Africa: PME.

Turner, J. (1999). *Use of the Logo programming language as software to support constructivist learning within a post-primary school mathematics environment: A techne-action research study.* Unpublished PhD, Monash, Melbourne.

Tynan, D. & Asp, G. (1998). Exploring the impact of CAS in early algebra. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 621-628). Gold Coast, Queensland: MERGA.

This paper reports on an investigation into the impact of the availability of a hand-held computer algebra system on student performance and patterns of algebraic thinking, particularly their performance in a range of symbol manipulation tasks.

Tzekaki, M. (1996). Reasoning in early childhood. *European Early Childhood Education Research Journal, 4*(2), 49-61.

This paper proposes that preschool children have a solid explanatory basis for their everyday life, within which, on the one hand, the facts are not generally accepted but are interpreted through a certain 'logic' and, on the other, the motives of actions and facts are clear and comprehensible.

Vacc, N.N. (1995). Gaining number sense through a restructured hundreds chart. *Teaching Exceptional Children*, 50-55.

This article presents a novel hundreds chart and numerous activities involving it. The hundreds chart has particular applicability for children with learning difficulties.

Vacc, N., Ervin, C., & Travis, S. (1995). Beyond the classroom. *Teaching*

Children Mathematics, 1(8), 494-497.

This article investigates the range of interesting problems which were explored following first and fifth grade classroom discussions about gorillas.

van Reeuwijk, M. & Wijers, M. (1997). Students' construction of formulas in context. *Mathematics Teaching in the Middle School, 2*(4), 230-236.

Verschaffel, L. & De Corte, E. (1996). Number and arithmetic. In A. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 99-138). Dordrecht: Kluwer.

Verschaffel, L., De Corte, E., & Vierstraete, H. (1999). Upper elementary school pupils' difficulties in modelling and solving nonstandard additive word problems involving ordinal numbers. *Journal for Research in Mathematics Education, 30*(3), 265-285.

Students in Years 5 and 6 in Belgium generally failed to gain the correct answers, which were generally one too many or too less for these kinds of word problems, due to a reliance on formal algorithms for addition and subtraction. When number differences were small, informal methods were more likely to result in correct solutions. The main reasons were postulated as being a limited understanding of ordinal numbers, lack of heuristic methods such as making a diagram, or metacognitive awareness about possible fallacious patterns of thinking and a distrust of "weak" informal solutions.

Vincent, J. (1998). Progressing through the van Hiele levels with Cabri-geometre. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 645-652). Gold Coast, Qld.: MERGA.

The influence of the dynamic geometry tool, Cabri-geometre, on the learning of geometry in Years 7 & 8 was investigated in this paper. All students increased their van Hiele levels for some or all of the concepts involved.

Vincent, J. & McCrae, B. (1999). Cabri geometry: A catalyst for growth in geometric understanding. In J.M. Truran & K.M. Truran (Eds.), *Making the difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 507-514). Adelaide: MERGA.

This report focuses on the experiences of two junior high schools students as they progressed in geometric understanding through the use of Cabri geometry.

Vygotsky, L. (1978). *Mind and society*. Cambridge: Harvard University Press.

This is the 'classic' book by Vygotsky which has been interpreted in many ways to back arguments for social constructivism, interaction and the zone of proximal development.

Vygotsky, L. (1986). *Thought and language*. Cambridge, MA.: Massachusetts Institute of Technology

Waits, B.K. & Demana, F. (2000). Calculators in mathematics teaching and learning: Past, present and future. In M.J. Burke (Ed.), *Learning mathematics for a new century* (pp. 51-66). Reston, VA: National Council of Teachers of Mathematics.

This article discusses the influence of calculators in making sophisticated mathematical software available to students and considers the 'appropriate use' of computer and calculator technology in the learning of school mathematics.

Warren, E. (1997). Generalising from and transferring between algebraic representation systems: Characteristics that support this process. In F. Biddulph & K. Carr (Eds.), *People in mathematics (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia*) (pp. 560-567). Rotorua, NZ: MERGA.

Warren, E. (1998). Students' understanding of the concept of a variable. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia*) (pp. 661-668). Gold Coast, Qld: MERGA.

Warren, E. (2000a). Visualisation and the development of early understanding in algebra. In T. Nakahara & M. Koyama (Eds.), *Proceedings of the 24th conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 273-280). Hiroshima, Japan: PME.

This paper explores the role of visualisation in the algebraic domain and in particular how the ability to visualise assists students in reaching generalisations from visual patterns and tables of values.

Warren, E. (2000b). Research in teaching and learning algebra. In K. Owens & J. Mousley (Eds.), *Research in Mathematics Education in Australasia* (pp. 161-180). Sydney: MERGA.

Warren discusses how beginning algebra students move from arithmetic thinking to algebraic thinking. Two approaches are common (a) generalising the patterns in arithmetic, and (b) generalising the patterns found in functional situations such as number patterns, visual patterns, and tables of values. The second part of this chapter focuses on the teaching of algebra.

Warrington, M. (1997). How children think about division with fractions. *Mathematics Teaching in the Middle School, 2*, 390-394.

Children show how they intuitively think about dividing as how many halves are needed for two, etc. Carefully sequenced problems are presented.

Warrington, M. & Kamii, C. (1998). Multiplication with fractions: A Piagetian constructivist approach. *Mathematics Teaching in the Middle School, 3*(3), 339-343.

Watanabe, T. (1995). Coordinations of units and understanding of simple: Case studies. *Mathematical Education Research Journal, 7*, 160-175.

Watson, J.M., Collis, K.F., Callingham, R.A. & Moritz, J.B. (1995). A model for assessing higher order thinking in statistics. *Educational Research and Evaluation, 1*(3), 247-275.

Watson, J.M., Collis, K.F., & Campbell, K.J. (1995). Developmental structure in the understanding of common and decimal fractions. *Focus on Learning Problems in Mathematics, 17*(1), 1-24.

Watson, J.M., Collis, K.F., & Moritz, J.B. (1997). The development of chance measurement. *Mathematics Education Research Journal, 9*(1), 60-82.

The paper analyses three questions which explore students' understanding of chance measurement in relation to the development of formal probability ideas.

Watson, J.M. & Moritz, J.B. (1998). Longitudinal development of chance measurement. *Mathematics Education Research Journal, 10*(2), 103-127.

Data on chance measurement of more than 1000 students in Years 3, 6, and 9 was collected in 1993, 1995, and 1997. The SOLO taxonomy was used to document changes in the levels of student learning outcomes.

Watson, J.M. & Moritz, J.B. (2000). Developing concepts of sampling. *Journal for Research in Mathematics Education, 31*(1), 44-70.

The objective of this research was to understand the characteristics of students' constructions of the concept of sampling. Students in grades 3, 6, and 9 were involved. The results of the study illustrate helpful and unhelpful foundations for an appropriate understanding of representativeness.

Way, J. (1997). Which jar gives the better chance? Children's decision making strategies. In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the*

Mathematics Education Research Group of Australasia) (Vol. 2, pp. 568-576). Rotorua, NZ: MERGA.

Forty-eight K-6 students were asked to choose between two jars containing different mixes of two different colours of counters. The students applied a variety of strategies ranging from idiosyncratic to proportional reasoning.

Western Australian Curriculum Council. (2000). *Curriculum Framework*. Perth: Author.

This is the overall curriculum framework for Western Australian schools in mathematics and other key learning areas.

Wheatley, G. & Reynolds, A. (1996). The construction of abstract units in geometric and numerical settings. *Educational Studies in Mathematics, 20*, 67-83.

Wheatley, G.H. (1998). Imagery and mathematics learning. *Focus on Learning Problems in Mathematics, 20*(2/3), 65-77.

This paper considers ideas of imaging and image to define processes which construct, re-present, and transform images. These constructs prove useful in interpreting children's mathematical activity.

White, A. (1998). Beliefs about the use of calculators in an upper primary mathematics classroom: A partial application of the theory of planned behavior. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematical Education Research Group of Australasia)* (pp. 685-692). Gold Coast, Queensland: MERGA.

This study examined primary school teacher intentions to allow their students to use calculators in the classroom and influences upon these intentions.

White, P. & Mitchelmore, M. (1996). Conceptual knowledge in introductory calculus. *Journal for Research in Mathematics Education, 27*(1), 79-95.

Whitin, P. & Whitin, D.J. (1999). Mathematics is for the birds: Reasoning for a reason. In L.V. Stiff (Ed.), *Developing mathematical reasoning in Grades K-12* (pp. 107-114). Reston, VA: NCTM.

Whitland, J. & Pegg, J. (1999). Exploring diversity: Year 2 students' responses to questions concerning 2D shapes. In J.M. Truran & K.M. Truran (Eds.), *Making a difference (Proceedings of the 22nd annual conference of the Mathematics Education Research Group of Australasia)* (pp. 546-553). Adelaide: MERGA.

Williams, C. (1998). Using concept maps to access conceptual knowledge of function. *Journal for Research in Mathematics Education, 29*(4), 414-421.

The study of 28 students from reform and traditional classrooms suggested that those from reform schools understood functions as models of real contextual problems more but both groups had limited depth of conceptual knowledge about functions.

Williams, G. (1996). *Unusual connections*. Brighton, Victoria: Gaye Williams Publications.

Williams, G. (1997). Creating an atmosphere conducive to learning: A small group/class feedback model. In N. Scott & H. Hollingsworth (Eds.) *Mathematics: Creating the future* (pp. 354-361). Adelaide: AAMT.

Williams, G. (2000a). Collaborative problem solving and discovered complexity. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia*) (Vol. 2, pp. 656-663). Fremantle, WA: MERGA.

Two collaborative groups of senior secondary mathematics students with similar ability to solve unfamiliar challenging problems demonstrated different levels of engagement and different levels of conceptual development when they worked with the same task.

Williams, G. (2000b). Investigating volumes of cuboids. In J. Wakefield (Ed.), *Mathematics: Shaping the future* (pp. 136-149). Melbourne: Mathematics Association of Victoria.

Working with a Year 5 class, activities are presented and the students worked collaboratively in groups to complete the task. The conceptual stages reached by the end of the lesson are discussed and ideas are presented about ways to proceed.

Williams, G. (2000c). Angles in parallel lines: engaged and learning about learning. In J. Wakefield (Ed.), *Mathematics: Shaping the future* (pp. 395-407). Melbourne: Mathematical Association of Victoria.

This paper reports on six lessons used to 'teach' angles in parallel lines. Collaborative group work is highlighted as are student journal reflections. A proposal about 'what helps students to learn' is made.

Williams, G. & Clarke, D. (1997). Issues and perspectives: Mathematical task complexity and task selection. In D. Clarke, P. Clarkson, D. Gronn, M. Horne, L. Lowe, M. Mackinlay, & A. McDonough (Eds.), *Mathematics: Imagine the possibilities!* (406-415). Melbourne: MAV.

Willis, S. (2000). Strengthening numeracy: Reducing risk. In Australian Council for Education Research, *Improving numeracy learning*

(Research conference 2000) (pp. 31-33). Brisbane: ACER.

This paper considers the concept of children being 'at risk' in their numeracy development in terms of their long term progress or mathematical growth.

Willoughby, S.S. (1997). Functions from Kindergarten through sixth grade. *Teaching Children Mathematics, 3*, 314-318.

Willoughby, S.S. (2000). Perspectives on mathematics education. In M.J. Burke (Ed.), *Learning mathematics for a new century* (pp. 1-15). Reston, VA: National Council of Teachers of Mathematics.

Mathematics education in the twenty-first century must find a way to make learning mathematics instructive and rewarding for the student. Gives a list of what mathematics every person should know and what should be done to improve mathematics education.

Wilson, B.L. & Jones, G.A. (1998). A multimedia statistical unit for general education. *Primus, 8*(1), 52-66.

Wilson, J. (1998). Metacognition within mathematics: A new and practical multi-method approach. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 693-700). Gold Coast, Qld.: MERGA.

This paper is concerned about the assessability of metacognition within mathematics.

Wilson, M.A. & Robinson, G.L. (1997). Representations and strategies for subtraction used by primary school children. *Mathematics Education Research Journal, 9*(2), 174-190.

Wong, P.L. (2000, April). *New math, same old story: Standards-based mathematics curriculum and English language learners.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

This study is an initial attempt to respond to the question: 'What barriers do English language learners face in accessing standards-based mathematics curriculum and to what extent are teachers minimising these barriers?'.

Wotley, S.E. (2000). Changing immigration patterns and teacher perceptions of responses in mathematics classroom education in the last fifty years. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 2, pp. 664-671). Fremantle: MERGA.

This paper investigates the changing patterns of migration to Australia over the last 50 years and their links with mathematics classroom environments through the perceptions of Victorian mathematics teachers.

Wright, M.D. & Foster, P.N. (1996). Constructive activity for teaching elementary-school math and communications. *The Technology Teacher, 56*(2), 20-25.

This paper reports on a technology activity involving the construction of binary counters by third grade children and the mathematical opportunities this construction realised.

Wright, R. (1996). Problem-centred mathematics in the first year of school. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 35-54). Adelaide: Australian Association of Mathematics Teachers.

Wright, R. (1998). An overview of a research-based framework for assessing and teaching early number. In C. Kanes, M. Goos, & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (pp. 701-708). Gold Coast, Qld: MERGA.

Wright, R., Stanger, G., Cowper, M., & Dyson, R. (1996). First-graders' progress in an experimental mathematics recovery program. In J.T. Mulligan & M.C. Mitchelmore (Eds.), *Children's number learning* (pp. 55-72). Adelaide: Australian Association of Mathematics Teachers.

Yackel, E. (1998). A study of argumentation in a second-grade mathematics classroom. In A. Olivier & K. Newstead (Eds.), *The proceedings of the 22nd conference of the International Group for the Psychology of Mathematics Education* (Vol. 4, pp. 209-216). Stellenbosch, South Africa: PME.

Yackel, E. & Cobb, P. (1995). Classroom sociomathematical norms and intellectual autonomy. In L. Meira & D. Carraher (Eds.), *Proceedings of 19th annual conference of the International Group of the Psychology of Mathematics Education* (Vol. 3, pp. 264-271). Recife, Brazil: Program Committee.

Yackel, E. & Cobb, P. (1996). Sociomathematical norms, argumentation and autonomy in mathematics. *Journal for Research in Mathematics Education, 27*(4), 458-477.

Yeap, B.H. & Kaur, B. (1996). *Problem solving in regular classrooms: The use of pattern observation.* Paper presented at the Educational Research: Building new partnerships (Joint conferences of Educational Research Association, Singapore and Australian Association of Research in Education), Singapore.

Yeap, B.H. & Menon, R. (1996). *Metacognition during mathematical problem solving.* Paper presented at the Educational Research: Building new partnerships (Joint conference of Educational Research Association, Singapore and Australian Association of Research in Education), Singapore.

Yelland, N. (1997). Technology: Changing the way we think and learn or maintaining the status quo? *Australian Educational Computing, 12*(1), 3-8.

Yelland, N.J. & Masters, J.E. (1997). Learning mathematics with technology: Young children's understanding of paths and measurement. *Mathematics Education Research Journal, 9*(1), 83-99.

Yoong, W.K. (1997). Learning graphs and geometric transformations with a computer: An experience with primary pre-service student teachers. In D. Fisher & T. Rickards (Eds.), *Science, mathematics and technology education and national development (Proceedings of the 1997 International Conference of Science, Mathematics and Technology Education)* (pp. 326-334). Hanoi, Vietnam: Curtin University of Technology.

Young-Loveridge, J. (1987). *The development of children's number concepts* (Research Report 87-1). Christchurch, NZ: Education Department, University of Canterbury.

Young-Loveridge, J. (1991). *The development of children's number concepts from ages five to nine: Early mathematics learning project: Phase II*. Hamilton, NZ: University of Waikato.

Young-Loveridge, J. (1997). From research tool to classroom assessment device: The development of Checkout/Rapua, a shopping game to assess numeracy at school entry. In F. Biddulph & K. Carr (Eds.), *People in mathematics (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (pp. 608-615). Rotorua, NZ: MERGA.

Young-Loveridge, J. (2000). How children's understanding of the number system varies as a function of ethnicity and socio-economic status. In J. Bana & A. Chapman (Eds.), *Mathematics education beyond 2000 (Proceedings of the 23rd annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 2, pp. 672-679). Fremantle, WA: MERGA.

This study considered Year 3 children's understanding of the number system at four schools with varying socio-economic status in New Zealand. About one-third of the children were Maori. The children's understanding of the number system varied as a function of ethnicity and socio-economic status.

Zevenbergen, R. (1997). Do disadvantaged students fail mathematics or does mathematics fail disadvantaged students? In F. Biddulph & K. Carr (Eds.), *People in mathematics education (Proceedings of the 20th annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 1, pp. 23-38). Rotorua, NZ: MERGA.

This paper considers the social context of contemporary mathematics and its implication in the outcomes for disadvantaged students. It is argued that reliance on individualistic models of theory and research need to be considered in conjunction with the social context.

Zevenbergen, R. (1998). Language, mathematics, and social disadvantage: A Bourdieuian analysis of cultural capital in mathematics education. In C. Kanes, M. Goos & E. Warren (Eds.), *Teaching mathematics in new times (Proceedings of the 21st annual conference of the Mathematics Education Research Group of Australasia)* (Vol. 2, pp. 709-715). Gold Coast, Queensland: MERGA.

The focus of this paper is the examination of why students from socially disadvantaged backgrounds are less likely than their middle class peers to be successful in their study of mathematics.