



# Quantitative Literacy Bibliography

(Working Draft, 06/26/99)

A bibliography of publications related to quantitative literacy (or numeracy, as it is sometimes called). Includes analyses of quantitative literacy and its importance for society, examples of literature a numerate person should be able to understand, studies of quantitative literacy, and commentaries on education for numeracy. Arranged chronologically, and within year, alphabetically. Comments, corrections, and additions are welcome by e-mail to [Lynn A. Steen](mailto:Lynn A. Steen). ([QL Home Page](#))

## ● 1940-1969:

- **Steelman, John.** *Report to the President*. AAAS/U.S. Government, 1947. Volume 4 is devoted to Mathematics Education.
- **1954 Summer Writing Group.** *Universal Mathematics, Part I: Functions and Limits*. Lawrence, KS: University of Kansas, 1954. The first half of an experimental and preliminary general mathematics text for first-year college students produced at the behest of the MAA Committee on the Undergraduate Program (later to become CUPM).
- **Davis, R.L., ed.** *Universal Mathematics, Part II. Elementary Mathematics of Sets with Applications*. Charlottesville, VA: Committee on the Undergraduate Program, 1958. Second part of the experimental and preliminary attempt to provide, under the sponsorship of the MAA Committee on the Undergraduate Program, a text in mathematics for all "normally" prepared first-year college students.
- **Cassedy, James H.** *Demography in Early America: Beginnings of the Statistical Mind, 1600-1800*. Cambridge, MA: Harvard University Press, 1969.

## ● 1970-1979

- **Beckman, P.** *A History of Pi*. Boulder, CO: 1970.
- **Bell, Max S.,** "What does 'Everyman' Really Need from School Mathematics?" *The Mathematics Teacher*, 67:3 (March, 1974) 196-202. (Reprinted 87:7 (Oct., 1994) 546-551). Answers the title question with a list of topics and offers some advice about how the list might be used. Provides an interesting historical snapshot of thinking about QL a quarter of a century ago.
- **Heath, Douglas H.** Academic Predictors of Adult Maturity and Competence. *The Journal of Higher Education*, 48:6 (Nov.-Dec., 1977) 613-632.
- **Murray, Alexander.** *Reason and Society in the Middle Ages*. Oxford : Clarendon Press, 1978
- **Tobias, Sheila.** *Overcoming Math Anxiety*. New York, NY: Houghton Mifflin, 1978; Revised Edition, W. W. Norton, 1993.
- **Minimal Competencies Panel.** *Survey of College Graduation Mathematics Requirements*. Washington, DC: Mathematical Association of America, 1979. Report of a panel of the MAA's Committee on Undergraduate Program in Mathematics (CUPM).

## ● 1980-1989

- **Tobias, Sheila., and Weissbroad, C.** "Anxiety and Math: An Update." *Harvard Educational Review*, 50 (1980) 63-70. One of several progress reports on activities aimed at reducing "math anxiety."
- **Wilford, John Noble.** *The Mapmakers*. New York, NY: Knopf, 1981; Vintage Books 1982. A chronicle of cartography revealing both the personal and intellectual challenge of applied geometry. Map-making (and map-reading) is a major factor in the history of quantitative literacy.
- **White, Stephen.** *The New Liberal Arts*. New York, NY: Alfred P. Sloan Foundation, 1981. Argues that since technology, data analysis, and quantitative methods are increasingly influential in all aspects of life, these subjects deserve greater attention in colleges' core curricula, especially as tools in humanities and social sciences. White worries also that college campuses have succumbed to C. P. Snow's two-culture trap, devising curricular requirements that enabled most students to escape serious encounter with the world of quantification. This report, which includes brief responses by a dozen college professors and administrators, launched a decade-long [New Liberal Arts](#) program supported by the Sloan Foundation. [The New Liberal Arts Program: A 1990 Report](#) records some of the program's accomplishments.
- **Cockcroft, Sir Wilfred H.** *Mathematics Counts*. London: Her Majesty's Stationery Office, 1982. Report of a UK "committee of inquiry" into the teaching of mathematics in schools. Reports on massive math avoidance by adults who were traumatized by their school maths experience. Opens with an extensive discussion of the mathematical needs of adult life, of employment, and of further and higher education.
- **CUPM Panel.** "Minimal Mathematical Competencies for College Graduates." *American Mathematical Monthly*, 89:4 (April 1982) 266-272; reprinted in Lynn Arthur Steen, ed., *Reshaping College Mathematics*. Washington, DC: MAA, 1989, 103-108. Second report of standing subcommittee of CUPM on mathematical expectations of college graduates, along with suggestions for courses that might be used

to satisfy a mathematics requirement. (The [first report](#) appeared in 1979; a summary can be found at the end of a [1989 Memorandum to CUPM](#) outlining quantitative literacy requirements at that time for college graduates.)

- **Cohen, Patricia Cline.** *A Calculating People: The Spread of Numeracy in Early America.* Chicago, IL: University of Chicago Press, 1982; New York, NY: Routledge, 1999. In colonial America, Franklin, Jefferson, and many other intellectuals promoted numeracy both for scientific reasons and to support the new experiment in popular democracy. Yet skeptics wedded to religious and scholastic styles regularly questioned the legitimacy of policy arguments--both in government and in medicine--based on empirical rather than religious grounds. (See the [summary](#) focused on QL issues raised in this volume.)
- **Goldstein, Jerome A.** "Mathematics Appreciation Courses." *American Mathematical Monthly*, 90 (1983) 44-51; reprinted in *Reshaping College Mathematics*, Lynn Steen (Editor). Washington, DC: Mathematical Association of America, 1989, pp. 109-125. Advice from the CUPM Panel on Mathematics Appreciation Courses, supplemented with an extensive bibliography of sources for such a course.
- **Landes, David S.** *Revolution in Time: Clocks and the Making of the Modern World.* Harvard University Press, 1983. Fascinating case study of an earlier revolution driven by a growing industry whose business was to quantify time.
- **Tufte, Edward R.** *The Visual Display of Quantitative Information.* Cheshire, CT: Graphics Press, 1983. A "timeless classic"--the Stunk and White of visual communication--that provides a practical theory of data graphics, "instruments for reasoning about quantitative information," richly illustrated with both classics and lapses in statistical graphs. Data graphics, barely two centuries old, display quantities by means of the combined use of points, lines, coordinate systems, numbers, symbols, words, shading, and color. "Of all methods for analyzing and communicating quantitative information, well-designed data graphics are usually the simplest and at the same time the most powerful."
- **Cassedy, James H.** *American Medicine and Statistical Thinking, 1800-1860.* Cambridge, MA: Harvard University Press, 1984.
- **Boissiere, M., Knight, J.B., and Sabot, R.H.** "Earnings, Schooling, Ability, and Cognitive Skills." *The American Economic Review*, 75:5 (Dec., 1985) 1016-1030.
- **Alonso, William and Starr, Paul.** *The Politics of Numbers.* New York : Russell Sage Foundation, 1986. Papers prepared for a 1983 conference on the political economy of national statistics.
- **Kirsch, Irwin S. and Jungeblut, Ann.** *Literacy: Profiles of America's Young Adults.* Princeton, NJ: Educational Testing Service, 1986. Report of findings from a special literacy assessment of youth ages 21-25 conducted as part of the 1985 National Assessment of Educational Progress (NAEP). This survey adopted a broad definition of literacy ("using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential") and introduced three scales (prose literacy, document literacy, and quantitative literacy) to account for these "distinct and important" aspects of literacy. Quantitative literacy is defined here (and in many subsequent literacy surveys) as "the knowledge and skills required to apply arithmetic" in common contexts. Many skills included under the scale of document literacy (e.g., locating and using information contained in ... schedules, maps, tables, and graphs) are among those now commonly considered to be part of mathematical or quantitative literacy.
- **Porter, Theodore.** *The Rise of Statistical Thinking, 1820-1900.* Princeton, NJ: Princeton University Press, 1986. Avoiding technicalities, this book concentrates on the flow of ideas between the natural and social sciences. It emphasizes the philosophical issues raised by novel statistical methods, and how they affected the subject's development.
- **Stenmark, Jean., Thompson, V. and Cossey, Ruth.** *Family Math.* Berkeley CA: University of California, Lawrence Hall of Science, 1986.
- **Ballagh, A. and Moore, R.** *Mathematical Literacy.* Melbourne: Footscray College of Technical and Further Education, 1987.
- **Gnanadesikan, M.; Scheaffer, R. L.; and Swift, J.** *The Art and Techniques of Simulation* Palo Alto, CA: Dale Seymour Publications, 1987. One product of the Quantitative Literacy Project of NCTM and ASA.
- **Landwehr, J. M., Swift, J., and Watkins, A.** *Exploring Surveys and Information from Samples.* Palo Alto, CA: Dale Seymour Publications, 1987. One product of the Quantitative Literacy Project of NCTM and ASA.
- **Neuman, C. M.; Obremski, T. E.; and Scheaffer, R. L.** *Exploring Probability.* Palo Alto, CA: Dale Seymour Publications, 1987. One product of the Quantitative Literacy Project of NCTM and ASA.
- **Paulos, John Allen.** *Innumeracy: Mathematical Illiteracy and its Consequences.* New York, NY: Hill and Wang, 1988. The first popular book on the perils of innumeracy. Dozens of examples from stock scams to medical claims show not only how innumeracy affects personal economics but also explains inappropriate drug-testing and the allure of pseudo-science. Paulos argues that our inability to deal rationally with numbers--or with the probabilities associated with them--results in misinformed governmental policies, confused personal decisions, and an increased susceptibility to pseudo-science.
- **Peterson, Ivars.** *The Mathematical Tourist.* New York, NY: W. H. Freeman, 1988.
- **Cheney, Lynn V.** *50 hours: A Core Curriculum for College Students.* Washington, DC: National Endowment for the Humanities, 1989. A broad and demanding prescription for general undergraduate education (a "core") that puts more emphasis on mathematics than is common on campuses.

- **National Council of Teachers of Mathematics.** *Curriculum and Evaluation Standards for School Mathematics.* Reston, VA: National Council of Teachers of Mathematics, 1989. The document that defined national standards for mathematics and created momentum for standards in other subjects. Currently being revised under the title [Standards 2000.](#)
- **Resnick, Lauren.** "Treating Mathematics as an Ill-structured Discipline." In *The Teaching and Assessing of Mathematical Problem Solving*, Charles, R. and Silver, E., Editors. Reston, VA: NCTM, 1989. An essay on the advantages of not treating mathematics as a subject in which everything, including the nature of the subject itself, is settled.

## ● 1990

- **Bogue, Allan G.** "The Quest for Numeracy: Data and Methods in American Political History." *The Journal of Interdisciplinary History*, 21:1 (Summer 1990) 89-117.
- **Bower, Bruce.** "College Classes Spur Lifelong Math Memory." *Science News* 138 (15 December 1990) 375. Report of research showing that people retain for fifty years and more knowledge of high school algebra that had been reinforced by learning and applications spaced over several years, but that when algebra was not reinforced in this way performance skills rapidly deteriorate.
- **Dudley-Evans, Tony and Henderson, Willie.** *The Language of Economics: The Analysis of Economics Discourse.* London: Modern English Publications and the British Council, 1990.
- **Goldberg, Samuel.** *The New Liberal Arts Program: A 1990 Report.* New York, NY: The Alfred P. Sloan Foundation, 1990. A review of the Sloan Foundation's [New Liberal Arts](#) program of the 1980s that supported innovative approaches to technological and quantitative literacy at selective liberal arts colleges. Includes reports from most supported projects as well as a retrospective on the program. (The program was launched in 1981 with the white paper entitled [The New Liberal Arts.](#))
- **Harrison, Anna.** *Entry-Level Undergraduate Courses in Sciences, Mathematics, and Engineering: An Investment in Human Resources.* Research Triangle Park, NC: Sigma Xi, The Scientific Research Society, 1990. A comprehensive report on a workshop sponsored by the National Science Foundation and the Johnson Foundation.
- **Snyder, Benson R.** "Literacy and Numeracy: Two Ways of Knowing." *Daedalus*, 119:2 (Spring 1990) 233-256; reprinted in *Literacy: An Overview by Fourteen Experts*, Stephen R. Graubard (Editor), New York, NY: Hill and Wang (The Noonday Press), 1991, pp. 233-256. An M.D. analyses the differing reactions of MIT students to expectations for literacy and numeracy in their undergraduate and graduate studies.
- **Steen, Lynn Arthur.** "Numeracy." *Daedalus*, 119:2 (Spring 1990) 211-231; reprinted in *Literacy: An Overview by Fourteen Experts*, Stephen R. Graubard (Editor), New York, NY: Hill and Wang (The Noonday Press), 1991, pp. 211-231. An analysis of issues involved in quantitative literacy featuring five different dimensions: practical, civic, professional, leisure, and cultural numeracy.
- **Sterrett, Andrew.** *Using Writing to Teach Mathematics.* Washington, DC: MAA, 1990. Thirty-one chapters, mostly reporting on actual experiences with writing as a device for learning mathematics. Full of excellent ideas.
- **Tufte, Edward R.** *Envisioning Information.* Cheshire, CT: Graphics Press, 1990. A partial catalog for exemplary "cognitive art," the world's accumulation of charts, diagrams, graphs, maps, and guides that help people envision information. The illustrations are complex and sometimes witty, rich with meaning that repays careful study. Illustrates universal principles of information design that, like mathematics, transcend language and culture, time and space.

## ● 1991

- **Helme, S. and Marr, B.** "Mathematical Literacy." *Literacy and Numeracy Exchange*, 2 (1991) 41-46.
- **Secretary's Commission on Achieving Necessary Skills (SCANS).** *What Work Requires of Schools: A SCANS Report for America 2000.* Washington, DC: U. S. Department of Labor, 1991. A [summary](#) is available on-line.
- **Steen, Lynn Arthur,** "Reaching for Science Literacy." *Change*, 23:4 (July/August, 1991) 10-19. Theme article in a journal devoted to higher education. Offers a frank and somewhat bleak picture of lower division teaching in the sciences and mathematics, together with encouraging examples of what can be done.

## ● 1992

- **Galbraith, Peter L. et al.** "Towards Numeracy for the Third Millennium: A Study of the Future of Mathematics and Mathematics Education." *Educational Studies in Mathematics*. 23:6 (December, 1992) 569-594. Results of a three-round Delphi process conducted in Australia to determine target skills and abilities that will comprise a future numeracy within a dynamic (rather than static) concept of competency. Reveals wide differences among informed thinkers with respect to future visions of the ends, means, and mechanics of learning.
- **King, Jerry P.** *The Art of Mathematics.* New York, NY: Plenum Press, 1992. Reflections on mathematics and aesthetics, including a scathing analysis of "the aristocracy of elegance."
- **Mock, Carol and Weisberg, Herbert F.** "Political Innumeracy: Encounters with Coincidence, Improbability, and Chance." *American Journal of Political Science*, 36:4 (Nov., 1992) 1023-1046.

- Rivera-Batiz, Francisco L. "Quantitative Literacy and the Likelihood of Employment Among Young Adults in the United States." *The Journal of Human Resources*, 27:2 (Spring 1992) 313-328.
- Schoenfeld, Alan H. "Learning to Think Mathematically: Problem Solving, Metacognition, and Sense Making in Mathematics." In Grouws, Douglas A., ed., *Handbook of Research on Mathematics Teaching and Learning*, New York: Macmillan, 1992, 334-370. An extensive discussion of what it means to think mathematically.
- Sons, Linda R. "Reaching for Quantitative Literacy." In *Heeding the Call for Change* Lynn Arthur Steen, ed. Washington, DC: MAA, 1992, 95-118. Report of an e-mail focus group discussion conducted in the spring of 1991 by the QL subcommittee of CUPM.

### ● 1993

- Duffy, Diane E. "Is Industrial Statistics Out of Control?" *Statistical Science*, 8:4. (Nov., 1993) 380-384.
- Gal, Iddo. *Issues and Challenges in Adult Numeracy*. Philadelphia, PA: National Center on Adult Literacy, June 1993. Discusses the place of numeracy in adult education, and explores links between literacy and numeracy. Raises questions about teacher preparation and discusses tentative implications for policy and practice.
- Huber, Peter. "The Math That Counts." *Forbes Magazine*, 151:12 (June 7 1993) 116. Argues that in the one area of numeracy that really counts today--software--Americans still lead the world by a mile.
- Kraeger, Philip. "Histories of Demography: A Review Article." *Population Studies*, 47:3 (Nov. 1993) 519-539.
- Muller, Rolf. "Quantitative Reasoning: A New Method of Simulation with Uncertainties." *Systems Analysis, Modelling, Simulation*, 1993.
- National Center for Education Statistics. *Literacy in America*. Washington, DC: U.S. Department of Education, 1993. Report of the National Adult Literacy Survey (NALS) conducted in 1992 in response to a 1988 request from Congress for information on the nature and extent of adult literacy. Following the lead of earlier literacy studies (e.g., *Literacy: Profiles of America's Young Adults*, 1986), this survey is divided into three scales for prose, document, and quantitative literacy. Results show very similar profiles on each of the three scales: approximately 22%, 27%, 31%, 16%, and 4% from lowest to highest of five levels of literacy. Not surprisingly, there are strong correlations between literacy levels and employment, poverty, and voting.
- Sons, Linda. "Establishing Quantitative Literacy." *Undergraduate Mathematics Education Trends*, (July 1993) p. 3. Very brief report on the work of the Subcommittee on Quantitative Literacy of the Mathematical Association of America.
- Tirre, William C. and Pena, Carmen M. "Components of Quantitative Reasoning: General and Group Ability Factors." *Intelligence*, 17:4 (Oct-Dec 1993) 501-522. Analysis of how word-problem-solving components, general cognitive ability, and working memory affect quantitative reasoning. and help explain changes in mathematical test scores. Problem identification, decomposition, reordering steps, and problem translation are components of quantitative reasoning.
- Wagner, Daniel A. *Myths and Misconceptions in Adult Literacy: A Research and Development Perspective*. Philadelphia, PA: National Center on Adult Literacy, June 1993. Counters several popular misconceptions in the field of adult literacy with new findings, such as (a) even though numeracy remains the weakest component in adult literacy programs, numerical problem-solving ability is among the most stable predictors of functional literacy skills, and (b) numeracy skills are the most crucial workplace needs.
- Wolfe, Christopher R. "Quantitative Reasoning Across a College Curriculum." *College Teaching*, 41:1 (Winter 1993) 3-9. Using concrete examples from his own experience as a professor of interdisciplinary studies at Miami University (Ohio), the author argues for QR across the curriculum by showing how four aspects of quantitative reasoning (learning from data, quantitative expression, evidence and assertions, and quantitative intuition) are developed in the core curriculum as a foundation for further learning.

### ● 1994

- Barbella, P.; Kepner, J.; and Scheaffer, R. L. *Exploring Measurements*, Palo Alto, CA: Dale Seymour Publications, 1994. One of a series of supplementary statistics books produced by the Quantitative Literacy Project of NCTM and ASA.
- Devlin, Keith. *Mathematics: The Science of Patterns*. New York, NY: Scientific American Library, 1994. A lavishly illustrated survey of mathematics as a search for understanding of patterns in many different contexts.
- Maor, Eli. *e: The Story of a Number*. Princeton, NJ: Princeton University Press, 1994. An elegant exposition of the mysteries that link, for example, the spiral of seeds in a sunflower with the interest earned on a bank account--both phenomena modelled by the mysterious number  $e$ .
- Gal, Iddo. *Conference on Adult Mathematical Literacy*. Philadelphia, PA: National Center on Adult Literacy, October 1994. A concise summary of discussions and recommendations resulting from a March 1994 Working Conference on Adult Mathematical Literacy, which was co-organized by the National Council of Teachers of Mathematics, NCAL, and the Office of Vocational and Adult Education of the United States Department of Education.
- Gal, Iddo and Shuh, A. *Who Counts in Adult Literacy Programs? A National Survey of Numeracy Education*. Philadelphia, PA:



**National Center on Adult Literacy, December 1994.** Baseline information about numeracy in the United States in order to prioritize numeracy-related educational activities. Results point to the need to significantly enhance staff training, change assessment practices, and improve the use of technology for instruction.

- **Garfield, Joan; Ahlgren, Andrew** "Student Reactions to Learning About Probability and Statistics: Evaluating the Quantitative Literacy Project." *School Science and Mathematics*, 94:2 (February, 1994) 89. A survey of nearly 1000 students who studied statistics in Quantitative Literacy Project workshops. Chief finding: workshop students have generally positive attitudes toward statistics, but relatively few felt that learning statistics was useful.
  - **Guthrie, Donald.** Statistics in Sports. *Journal of the American Statistical Association*, Sept 89:47 (1994) 1064-65.
  - **Thomas, Jan.** "What is Mathematical Literacy?" *N<sup>2</sup>: Numeracy Network Newsletter*, No. 4 (June 1994). Brief personal discussion of the (Australian) author's evolving concept of quantitative literacy, from the numeracy of the [Cockcroft report](#) ("at-homeness' with numbers") to a "subversive activity" (citizens' defense against autocracy) that is socially and culturally defined.
- **1995**
- **Crawford, Walt.** "Numeracy and Common Sense: Real-World Engineering." *Library Hi Tech.*, 13:3 (1995) 83.
  - **Evans, J.; Crivello, L.** "Do we Need to Teach Numeracy, Literacy and Other Academic Skills in Higher Education?" *Journal of Access Studies*, 10:2 (1995) 156.
  - **Forman, Susan L. and Steen, Lynn A.** "Mathematics for Work and Life." in *Seventy-Five Years of Progress: Prospects for School Mathematics*. Iris Carl, Editor. Reston, Va: National Council of Teachers of Mathematics, 1995, pp. 219-241.
  - **Garfield, Joan.** "How Students Learn Statistics." *International Statistical Review*, 63 (1995) 25-34.
  - **Ginsburg, Lynda and Schuh, Alex.** [What Does "100% Juice" Mean? Exploring Adult Learners' Informal Knowledge of Percent](#). Philadelphia, PA: National Center on Adult Literacy, November 1995. Examines adult students' informal knowledge of percent such as their ideas about the meanings of three benchmark percents (100%, 50%, and 25%) as they appear in advertising and media contexts; their ability to use these numbers in everyday mental tasks; and their visual representations of these quantities. Also explores the relationship of this informal knowledge to the students' formal computational skills.
  - **Keith, Sandra Z.** "Assessment of Quantitative Literacy." *Assessment Update*, 7:2 (March, 1995) 14.
  - **Joram, Elana; Resnick, Lauren; and Gabriele, Anthony J.** "Numeracy as Cultural Practice: An Examination of Numbers in Magazines for Children, Teenagers, and Adults" *Journal for Research in Mathematics Education*, 26:4 (1995) 346.
  - **Landwehr, J. M.; and Watkins, A.** *Exploring Data* Palo Alto, CA: Dale Seymour Publications, 1995.
  - **O'Donoghue, J.** "Numeracy and Further Education: Beyond the Millennium" *International Journal of Mathematical Education in Science and Technology*, 26:3 (1995) 389.
  - **Organization for Economic Cooperation and Development (OECD).** *Literacy, Economy, and Society: Results of the First International Adult Literacy Survey*. Paris: OECD, 1995. Presents results of the first International Adult Literacy Survey (IALS) conducted in 1994 in seven countries (Canada, Germany, Netherlands, Poland, Sweden, Switzerland and the United States). Employs the same three literacy scales (prose, document, and quantitative) that are used in the NAEP and NALS literacy surveys. Includes extensive tables relating literacy to income, employment, education, and other factors in a form that allows easy comparison across nations.
  - **Porter, Theodore M.** *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life*. Princeton, NJ: Princeton University Press, 1995. A "daring" study of the history of quantification that "transforms our understanding of the social meaning of numbers." Drawing on a wide range of examples from the worlds of science, accounting, insurance, cost-benefit analysis, and civil engineering, Porter shows that it is "exactly wrong" to interpret the drive for quantitative rigor as somehow inherent in the activity of science except where political and social pressures force compromise. Instead, quantification grows from attempts to develop a strategy of impersonality in response to pressures from outside. Objectivity derives its impetus from cultural contexts, quantification becoming most important where elites are weak, where private negotiation is suspect, and where trust is in short supply.
  - **Rima, Ingrid Hahne (Editor).** *Measurement, Quantification and Economic Analysis: Numeracy in Economics*. London, New York : Routledge, 1995. A collection of essays that reveal as a misconception the notion that mathematical and quantitative tools are recent developments in economics. Most authors display skepticism about the role that quantitative tools now play in economic theory. Reviews: *Economic Journal*, 106:437 (July 1996) 1076-77.
  - **Sobel, Dava.** *Longitude : The True Story of a Lone Genius Who Solved the Greatest Scientific Problem of his Time*. New York, NY: Walker, 1995.
  - **Steen, Lynn A.** "Algebra for All: Dumbing Down or Summing Up?" in *The Algebra Initiative Colloquium*, Carol Lacampagne, et al., Editors. U.S. Department of Education, 1995, pp. 121-140.
  - **Wise, Norton M.** *The Values of Precision*. Princeton, NJ: Princeton University Press, 1995. A collection of essays examining how exactitude has come to occupy such a prominent place in Western culture. The authors support the view that centralizing states (with their

increasingly widespread bureaucracies for managing trade, taxation, and armies) and large-scale commercial enterprises (with their requirements for standardization and mass production) have been the major promoters of numerical precision. At the same time, they display the deeply cultural character of the value given to precision.

## ● 1996

- **Adelsward, Viveka and Sachs, Lisbeth.** "The Meaning of 6.8: Numeracy and Normality in Health Information Talks. *Social Science and Medicine*, 43:8 (Oct 15, 1996) 1179-88.
- **Australian Association of Mathematics Teachers (AAMT).** *Mathematical Knowledge and Understanding for Effective Participation in Australian Society*. Adelaide: AAMT, 1996. Brief sketch of the fundamentals of school mathematics (number, space, measurement, chance, statistics, representation, applying, solving) concluding with a statement on the need to extend the concept of numeracy to reflect the contemporary relation of mathematics, technology, and society.
- **Bradstreet, T. E.** "Teaching Introductory Statistics Courses So That Nonstatisticians Experience Statistical Reasoning," *The American Statistician*, 50 (1996) 69-78.
- **Curcio, Frances R. and Artst, Alice F.** "Assessing Students' Ability to Analyze Data: Reaching Beyond Computation." *Mathematics Teacher*, 89:8 (Nov 1996) 668-674. A response to the pressure to include quantitative literacy--defined here as the ability to read, interpret, and analyze statistical data in visual displays--in the secondary mathematics curriculum. Discusses how assessment tasks can encourage students to analyze real data and make meaningful discoveries.
- **Ginsburg, Lynda.** *Instructional Strategies for Teaching Adult Numeracy Skills*. Philadelphia, PA: National Center on Adult Literacy, April 1996. Identifies instructional strategies that address issues of assessment, development of mathematical skills, and development of problem-solving skills. The strategies reflect research on how adults learn, the cognitive processes involved in learning mathematics, and the mathematical concepts that are important for adults to learn for educational and real life purposes.
- **Gladwell, Malcolm.** "The Tipping Point." *The New Yorker*, (3 June 1996) 32-38. A quantitative argument that crime is like an infectious epidemic, in which case rising and falling rates may simply be expected consequences of mathematical laws.
- **Larson, Bruce.** "Numeracy in Economics: Measurement, Quantification and Economic Analysis." *Southern Economic Journal*, 63:2 (Oct 1996) 547-548.
- **National Center for Education Statistics.** *The National Assessment of College Student Learning: An Inventory of State-Level Assessment Activities*. Washington, DC: U.S. Department of Education, 1996. Reports from states on assessment issues and practices regarding higher education, preceded by policy analyses and followed by briefing papers on cross-cutting issues. Primarily about the relation of assessment, accountability, and budgets; implication for quantitative literacy are indirect.
- **Scheaffer, R. L.; Gnanadesikan, M.; Watkins, A.; and Witmer, J.** *Activity-Based Statistics*, New York: Springer-Verlag, 1996.
- **Sloan, Allan.** "Forget the Dow." *Newsweek* (October 28, 1996) 48-49. Explanation of anomalies in the behavior of averages focused on how changes in individual stock values contribute erratically and inconsistently to changes in the overall average of the Dow Jones industrial average.
- **Sons, Linda, (Editor).** *Quantitative Reasoning for College Graduates: A Complement to the Standards*. Washington, DC: Mathematical Association of America, 1996. A lengthy report of the CUPM Subcommittee on Quantitative Literacy that reflects the wide variety of opinions of members of a diverse committee. Asserts that "a quantitatively literate college graduate should be able to (1) interpret mathematical models ... and draw inferences from them; (2) represent mathematical information symbolically, visually, numerically, and verbally; (3) use arithmetic, geometric and statistical methods to solve problems; (4) estimate and check answers...in order to determine reasonableness, identify alternatives, and select optimal results; and (5) recognize the limitations of mathematical and statistical methods. Advocates "mathematics across the curriculum," and concludes with a list of core topics that can serve as a common ground.

## ● 1997

- **Australian Association of Mathematics Teachers (AAMT).** *Policy on Numeracy Education in Schools*. Adelaide: AAMT, 1997. "To be numerate is to use mathematics to meet the general demands of life at home, at paid work, and for participation in community and civic life." Includes specific commitments from AAMT to maximize all young people's numeracy development, together with a clear declaration that it is "inappropriate and inaccurate" to equate numeracy with school mathematics.
- **Bernstein, Jeremy and Penrose, Roger.** "The Large, the Small, and the Human Mind." *Times Literary Supplement*, 4931 (1997) 28.
- **Bernstein, Peter L.** *Against the Gods: The Remarkable Story of Risk*. New York, NY: John Wiley, 1996. xi + 383 pp. \$27.95. Written by an investment consultant, this volume marshalls episodes from the history of insurance, probability, and statistics as evidence that modern civilization is distinguished by its ability to understand and control risk. Ranges from traditional foundations of probability in the seventeenth and eighteenth centuries to such modern topics as game theory, portfolio selection, prospect theory, behavioral finance, and (financial) derivatives. [See the [review](#) by S. L. Zabell, *Notices of the American Mathematics Society*, 46:1 (Jan., 1999), 47-49.]
- **Bower, Bruce.** "Null Science: Psychology's Statistical Status Quo Draws Fire." *Science News* 151 (June 7 1997) 356-357. Critique of the most common research tool in psychology--null hypothesis testing--on the grounds that it only establishes the probability of obtaining a

certain set of data but provides no insight concerning an explanation for the data.

- Carss, Marjorie C. "Why Numeracy?" *The Rotarian*, 171:2 (August, 1997) 31.
- Crosby, Alfred W. *The Measure of Reality: Quantification and Western Society, 1250-1600*. Cambridge, UK: Cambridge University Press, 1997. Demonstrates how quantitative methods emerged very slowly in the middle ages as artists and merchants learned the value of imposing standardized measures (of length, of time, of money) on their crafts. Argues that this imposition of "quanta" on reality enabled the West's scientific and technological acceleration in the Renaissance. (See the [summary](#) focused on QL issues raised in this volume.)
- Dehaene, Stanislas. *The Number Sense : How the Mind Creates Mathematics*. New York: Oxford University Press, 1997. Exploration from a neuroscientific perspective of how the brain handles quantities and geometric concepts. Full of revealing insights into the mechanisms (and impediments) of numeracy.
- Gal, Iddo and Stoudt, Ashley. "Numeracy: Becoming Literate With Numbers." *Adult Learning*, 9:2 (1997) 13.
- Ginsburg, Lynda. "Numeracy Education: More Than Mathematics." *Adult Learning*, 9:2 (1997) 12.
- Gnanadesikan, Mrudulla; Scheaffer, Richard L.; Watkins, Ann E.; and Witmer, Jeffrey A. "An Activity-Based Statistics Course." *Journal of Statistics Education*, 5:2 (1997). A report on one course that emerged from the Quantitative Literacy Project sponsored by NCTM and ASA.
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  - **Organization for Economic Cooperation and Development (OECD). *Education at a Glance: OECD Indicators*. Washington, DC: OECD, 1998.** Comparative data from nations representing two-thirds of the world's population on human and financial investment in education, returns on investment, student passage through higher education, degree attainment, and life long learning.
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  - **Phipps, Ronald. *College Remediation: What it Is, What it Costs, What's at Stake*. Washington, DC: The Institute for Higher Education Policy, 1998.** Comprehensive report on the history, impact, and cost of offering pre-college courses to students who are enrolled in college--which constitutes a major component of QL work on many campuses. Key findings: (1) Remediation is a core function of higher education. although there is no agreement on what constitutes "remediation." (2) Remediation is a good investment both for society and for colleges.
  - **Poovey, Mary. *A History of the Modern Fact: Problems of Knowledge in the Sciences of Wealth and Society*. Chicago, IL: University of Chicago Press, 1998.** Beginning with the first British manual on double-entry bookkeeping in 1588 to the institutionalization of statistics in the 1830s, the author shows how the production of systematic knowledge from descriptions of observed particulars influenced government, how numerical representation became the privileged vehicle for generating useful facts, and how belief--whether figured as credit, credibility, or credulity--remained essential to the production of knowledge.
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  - **Reynolds, David. *Implementation of the National Numeracy Strategy*. Sudbury, UK: Department for Education and Employment (DfEE), June 1998.** Final report of the National Numeracy Task Force in Great Britain, following from the preliminary report [Numeracy Matters](#). Contains detailed recommendations to build up teachers' competence and confidence "as quickly as possible" as a strategy to promote "good practice" in the teaching of mathematics in elementary, middle, and special schools.
  - **Schwartz, Lisa M. "The Role of Numeracy in Understanding the Benefit of Screening Mammography." *Annals of Internal Medicine*, 127 (1997) 966-972. Abstract: JAMA 270:6 Feb. 11, (1998) 414H(1).**
  - **Steiner, Mark. *The Applicability of Mathematics as a Philosophical Problem*. Cambridge, MA: Harvard University Press, 1998.** Argues that mathematical analogies have created an anthropocentric picture of the universe as "user friendly" to human cognition. Thus the success of mathematical physics suggest that the human mind occupies a special place in the cosmos.
  - **Tisdale, J. Christopher; Turner, Danny W.; and Brooks, Gary T. [Precollege Preparation for College Mathematics: A Survey of South Carolina Faculty](#). Rock Hill, SC: Winthrop University, January 1998.**
  - **Varadarajan, V. S. *Algebra in Ancient and Modern Times*. Providence, RI: American Mathematical Society, 1998.** See [review](#) on MAA Online.
- **1999**
- **Adelman, Clifford. "The Empirical Core." *University Business*, 2 (April 1999) 46-47.** Data on the most common courses taken by college graduates who finished high school in 1972 and 1982. Reveals increases in practical quantitative courses such as economics, calculus, and accounting.

- **Bashmakova, I.G., and Smirnova, G.S. "The Birth of Literal Algebra." *The American Mathematical Monthly* 106 (January 1999) 57-66.** Historical account of the shift from geometric methods in Hellenistic Alexandria to embryonic use of symbolic algebra in the 1st to 3rd centuries with Heron, Ptolemy, and Diophantus.
- **Bruschi, Barbara A. and Coley, Richard J. *How Teachers Compare: The Prose, Document, and Quantitative Skills of America's Teachers*. Princeton, NJ: Educational Testing Service, 1999.** Data showing that teachers' literacy skills are close to average in comparison both with college-educated adults and with managers and professionals in a range of occupations.
- **Butterworth, Brian. *What Counts : How Every Brain Is Hardwired for Math*. New York, NY: Free Press, 1999.** The author, a leading neurologist, seeks to demonstrate that humans are born with an innate understanding of numbers. A pioneering work vital to comprehending the origins of quantitative thinking.
- **De Palma, Paul. "Http://www.When.is.Enough.Enough?.com: Putting Microcomputers in Their Place." *American Scholar* 68:1 (Winter 1999) 61-72.** Decries the debasement of "computer literacy" courses that focus on learning how to use commercial software. Discusses origins of the myth of prosperity through computing and reveals how the media persistently misidentify computing sciences with microcomputer gadgetry.
- **Devlin, Keith J. *Life by the Numbers*. New York: John Wiley & Sons, 1999.** Written to accompany the [PBS series](#) of the same title. See the [review](#) on MAA Online.
- **Dewdney, A. K. *A Mathematical Mystery Tour: Discovering the Truth and Beauty of the Cosmos*. New York: Wiley, 1999.** An imaginative reflection on the ancient riddle of whether mathematics is discovered or created, and from whence its power derives. Argues, in harmony with the Pythagoreans, that mathematics occupies an other-worldly "holos" that determines the rules of the "cosmos" in which we live.
- **Fabian, Ann Vincent. *Card Sharps and Bucket Shops: Gambling in 19th-Century America*. New York: Routledge, 1999.** A colorful expose of the relationship between gambling and other profit-making ventures that turns the American work ethic inside out. Covers various numbers games, speculators, and the psychological explanations for compulsive gambling.
- **Forman, Susan L and Steen, Lynn Arthur. *Beyond Eighth Grade: Functional Mathematics for Life and Work*. Berkeley, CA: National Center for Research in Vocational Education, 1999.** Outline of an approach to high school mathematics that emphasizes the common needs of work and college.
- **Gal, Iddo. "A Numeracy Assessment Framework for the International Life Skills Survey." January 1999.** Draft description of a conceptual framework for defining and assessing numeracy as part of the forthcoming [ILLS Survey](#). Identifies five facets of "numerate behavior," including managing a situation, responding to mathematical information, etc.
- **Kammen, Daniel L. and Hassenzahl, David M. *Should We Risk It?* Princeton, NJ: Princeton University Press, 1999.** A survey of theories and methodologies suitable for assessing risk in environmental, health, and technological settings.
- **Minnis, Mary. *National Numeracy Project Technical Report*. Slough, UK: National Foundation for Education Research, 1999.**
- **Moore, Thomas L. *SLAW 1987-1997. The Statistics in the Liberal Arts Workshop: A History of SLAW*. Irving, Texas: Exxon Education Foundation, January 1999.** Brief history of a project first begun under the [Sloan New Liberal Arts Program](#) that has been sustained with small annual grants from the Exxon Education Foundation. In addition to narrative about the evolution of SLAW, the report contains lists of participants, meetings, publications, presentations, workshops, and survey data. Concludes with the author's personal observations about why the effort worked as well as it has.
- ***The National Numeracy Strategy: Mathematical Vocabulary*. Sudbury, Suffolk, UK: Department for Education and Employment, 1999.**
- **Schell, Michael J. *Baseball's All-Time Best Hitters: How Statistics can Level the Playing Field*. Princeton, NJ: Princeton University Press, 1999.** A professional statistician shows how to compare hitters from different eras in a sport that begets statistics like no other. See the [review](#) on MAA Online.

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