

**Writing Across the Curriculum
Mathematics Bibliography**

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I am assuming awareness of journals such as *Mathematics in School* and *For the Learning of Mathematics: An International Journal of Mathematics Education*, which are available at the Madison library, but not at UWM, and *Arithmetic Teacher* and *Mathematics Teacher*, which are available at UWM.

Additionally, I am assuming awareness of the implicit recognition of the positive role of writing assignments in the 1989 Curriculum and Evaluation Standards for School Mathematics published by the National Council of Teachers of Mathematics. Those standards suggest that mathematics education should make use of writing assignments in helping students gain understanding of mathematical concepts. Although they are more directed toward pre-college teaching, they have implications for the post-secondary curriculum.

There are literally hundreds of books and articles devoted in whole or in part to connecting mathematics and writing instruction, usually either in the guise of bettering critical thinking generally, or in the math-specific interest of helping students better integrate the vocabulary of mathematics—the specific words and their discipline-specific senses. Of those hundreds, the bulk of the entries in the Mathematics section of the *Language and Learning Across the Curriculum* bibliography, which covers roughly the middle 1980s to the middle 1990s, are pieces for elementary and secondary school instruction. In general, I have avoided including materials clearly aimed only at pre-college instruction, although I believe many useful practices and principles in the earlier grades can be successfully adapted to university-level teaching. For example, the 1997 study, “Writing in the Mathematics Classroom: Teacher Beliefs and Practices,” ends its survey of teachers at the secondary level, but it also contains a valuable survey of previous research on the efficacy of writing for teaching mathematics and on the time and attitudinal constraints that exert pressure on efforts to integrate writing in the mathematics curriculum.

In my annotations, I have tended toward description rather than evaluation, which I leave to the more capable hands of mathematicians. I have also tried to annotate more recent works, on the assumption that those works will summarize the research adequately for those who wish to know more.

Books

Borasi, R. (1996). *Reconceiving mathematics instruction: a focus on errors*. Norwood, NJ: Ablex.

Borasi is well known as a theorist of mathematics education. Here, she argues for greater reflection on the part of mathematics teachers, and for a particular focus on the study of student errors as potentially educative moments. She devotes a few early pages to discussion of writing across the curriculum and to computer programming as two exemplary disciplines rethinking errors and their role in teaching. In particular, she argues for using error to introduce a sense of inquiry and to combat reductive views of mathematics as being concerned with rigid, formulaic correctness, rather than problem-solving.

Connolly, P., & Vilardi, T. (1989). *Writing to learn mathematics and science*. New York: Teachers College Press.

A collection of 23 essays by mathematicians, scientists, and compositionists. The essays are in the main practically oriented, offering concrete teaching strategies. The book does not reduce itself to practical concerns only; “[r]ather, it represents the necessary use of ordinary language to teach science and mathematics in all their subtlety, complexity, and richness” (xvi). The volume is particularly rich in specific classroom strategies used by practicing mathematicians and scientists.

Countryman, J. (1992). *Writing to learn mathematics: strategies that work, k-12*. Portsmouth, NH: Heinemann.

Although focused on pre-college teaching, Countryman makes a solid argument for connections between writing-as-exploration and learning to solve problems in mathematics; she emphasizes the use of writing instructions as tools for making mathematics less threatening, and as tools for encouraging understanding of mathematics as concepts that can aid in understanding the world, rather than a collection of formulas to be applied without understanding.

Sterret, A., ed. (1990). *Using writing to teach mathematics*. Washington, Mathematical Association of America.

Reprints 31 papers from two meetings of the MAA. The papers cover theoretical background on WAC, considerations of the role of writing in understanding mathematical concepts, reports from the field, practical advice on using journal writing in classes, and integrating writing with course content.

Articles/Chapters

Azzolino, A. (1990). Writing as a tool for teaching mathematics: the silent revolution. In Thomas J. Cooney and Christian R. Hirsch (Ed.), *Teaching and Learning Mathematics in the 1990s* (pp. 92-100). Reston, VA: NCTM.

Acknowledges the history of writing to learn in mathematics instruction; suggests several practical uses or potential goals of writing in mathematics classes; offers several sample exercises or activities.

Bemiller, S. (1987). The mathematics workbook. In Toby Fulwiler (Ed.), *The Journal Book* (pp. 359-366). Portsmouth, NH: Boynton/Cook.

Describes a classroom technique that requires students to work through mathematical problems with an eye toward explaining them to readers in writing; enables “individualized instruction on the group level.”

Berenson, S., and Carter, G. (1995). Changing assessment practices in science and mathematics. *School Science and Mathematics* 95, 182-186.

Elementary-secondary school science and mathematics courses use assessment methods more conducive to developing a student's memory than understanding. In order to give students opportunities for making conceptual connections and for reflection upon information, alternative forms of assessment--all of which reward higher order thinking--should be incorporated into the math and science curriculum. Five alternatives are outlined: journal writing, open-ended problem solution, portfolio, interview, and performance assessment. The discussion of each alternative includes a brief overview of the method, sample assignments, and hints for incorporating the alternative into the curriculum.**

Brutlag, D., Maples, C. (1992). Making connections: Beyond the surface. *Mathematics Teacher* 85, 230-35.

The Investigations Project for grade 8 consists of a series of projects connecting math with different disciplines. The "Beyond the Surface" unit asks students to investigate the relationship among lengths, areas, and volumes of similar solids in an attempt to see how such relationships are critical to scientific applications. Although many students complete the unit with a superficial understanding of the operations, some students begin to realize the deeper implications. This understanding is revealed through the write-ups of student projects, in which students explain their methodology and results of independent projects.**

Drake, B., Amspaugh, L. (1994). What writing reveals in mathematics. *Focus on Learning*

Problems in Mathematics 16, 3, 43-50.

Having students write in math class can reveal the nature of students' conceptual problems. Once a teacher ascertains the root of a student's misunderstanding, she can address that particular aspect of the problem, rather than explaining the entire algorithm. For example, one student's writing revealed that the basis of her problem regarding regrouping during subtraction is that she internalized a previous teacher's instruction to begin the problem from the side of the room with the clock. Writing in the college classroom is likewise useful in determining students' understanding of the principles underlying story problems.**

Dusterhoff, M. (1995). Why write in mathematics? *Teaching K-8*, 48-49. Writing allows students to integrate math concepts into their everyday experiences.

Dusterhoff sketches out six reasons for using writing in a math class, beginning with the claim that math provides interesting topics for students to write about and finishing with the observation that writing helps the teacher gain insight into student learning.**

King, B. (1982). Using writing in the mathematics class. In C. W. Griffin (Ed.), *Teaching Writing in All Disciplines* (pp. 39-44). San Francisco: Jossey-Bass.

Argues that students using expressive (or personal, introspective) and transactional writing (or writing which performs a task "in the world") in mathematics classes learn the subject material better. Summarizes several research studies on writing-mathematics connections, and offers numerous sample assignments.

Powell, A. (1997). Capturing, examining, and responding to mathematical thinking through writing" *Clearing House* 71 (1) 21-25.

Powell summarizes research from both composition and mathematics to show that students learn mathematical concepts best by writing about them, and that writing by students gives teachers valuable checks on and insights into student learning. Concludes by specifically recommending a three-part, "multiple-entry log" as an informal writing activity that enhances student learning.

Quinn, R. J., and Wilson, M. (1997). Writing in the mathematics classroom: Teacher beliefs and practices. *Clearing House*, 71 (1) 14-21.

Summarizes research on efficacy of writing as a tool in mathematics education; reports research (elementary and secondary) on both time and attitudinal constraints exerting pressure on attempts to integrate writing more fully with mathematics instruction. Describes a situation analogous to the difficulties of integrating writing more fully with virtually any discipline, including literature

instruction. Recommends in-service training that models effective uses of writing to understand and teach about mathematical concepts.

Selfe, C. L., Bruce T. Peterson. (1986). Journal writing in mathematics. In Art Young and Toby Fulwiler (Ed.), *Writing Across the Disciplines: Research into Practice* (pp. 192-207). Upper Montclair, NJ: Boynton/Cook.

Describes a study of “the effects of journal writing assignments on students in a college-level mathematics class.” Reports mixed success; students claimed journal writing was a “positive addition” to their class, but the researchers were not able to identify significant changes in mathematics ability or reduction of writing apprehension. Suggests need for more rigorously conducted studies.

Venne, G. (1989). High school students write about math. *English Journal*, 64-66.

Describes a series of short writing assignments made in a math class--mainly assignments that ask students to explain a formula or mathematical expression in words. Suggests that verbalizing the mathematical relations "slows down and solidifies the thinking," and increases understanding.**

Additional Resources

Borasi, R. & Rose, B. J. (1989). Journal writing and mathematics instruction. *Educational Studies in Mathematics* 20, 347- 365.

Burton, G. (1985). Writing as a way of knowing in a mathematics education class. *Arithmetic Teacher* 33(4), 40-45.

Cangelosi, J. S. (1988). Language activities that promote awareness of mathematics. *Arithmetic Teacher* 36, 6-9.

Cappo, M. & Osterman, G. (1991). Teaching students to communicate mathematically. *The Computing Teacher* 18,34-39.

Davison, D. M. & Pearce, D. (1988). Using writing activities to reinforce mathematics instruction. *Arithmetic Teacher* 35, 42-45.

Driscoll, M., & Confrey, J. (1986). *Teaching mathematics: Strategies that work*. Portsmouth, NH: Heinemann.

Goldberg, M. (1983). Integrating writing into the mathematics curriculum. *The Two-Year College*

Mathematics Journal 14, 421-424.

Gopen, G., & Smith, D. (January, 1990). What's an assignment like you do doing in a course like this? Writing to learn mathematics. *The College Mathematics Journal* 21, 2-19.

Hatfield, M. M. & Bitter, G. G. (1991). Communicating mathematics. *Mathematics Teacher* 84, 615-622.

Hoyles, C. (1985). What is the point of group discussion? *Educational Studies in Mathematics* 16, 204-214.

Johnson, M. (1983) Writing in mathematics classes: A valuable tool for learning. *Mathematics Teacher* 76, 117-119.

McIntosh, M. (1991). No time for writing in your class? *Mathematics Teacher* 84(6), 423-433.

Mett, C. L. (1989). Writing in mathematics: Evidence of learning through writing. *Clearinghouse* 62(7), 293-296.

Miller, L. D. (1991). Writing to learn mathematics. *Mathematics Teacher* 84 (7), 516-521.

Nahrgang, C., & Peterson, B. (1986). Using writing to learn mathematics. *Mathematics Teacher* 79, 461-465.

Owen, D. (1987). Math discovery. In J. Self (Ed.), *Plain Talk: About Learning and Writing Across the Curriculum* (pp. 21- 26). Richmond, VA: Virginia Dept. of Education.

Salem, J. (1982). Using writing in teaching mathematics. In *What's Going On?* (pp. 123-134). Upper Montclair, NJ: Boynton/Cook.

Schmidt, D. (1995). Writing in math class. In A. Gere (Ed.), *Roots in the Sawdust: Writing to Learn Across the Disciplines* (pp. 104-116). Urbana, IL: National Council of Teachers of English.

Walpole, P. (1987). Yes, writing in math. In J. Self (Ed.), *Plain Talk: About Learning and Writing Across the Curriculum* (pp. 51- 59). Richmond, VA: VA Dept. of Education.

Watson, M. (1980). Writing has a place in mathematics class. *Mathematics Teacher* 73, 518-519.

**Denotes annotations prepared by the Georgia State University Writing Across the Curriculum Program; copied from their website.