

# Alternative Instruction and Alternative, Performance-Based Assessment: An Annotated Bibliography

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*The following annotated bibliography was compiled by Jane Ehrenfeld under the direction of Professor K. Ann Renninger at Swarthmore College in Swarthmore, Pennsylvania. It is hosted by the Math Forum, a virtual centre for mathematics on the Internet, as part of the Forum's series on Learning and Mathematics—Research in Math Education: summaries and discussions of seminal articles on learning and mathematics. These summaries and similar bibliographies can be found on the Web at <http://forum.swarthmore.edu/learning.math.html>. Reprinted with permission. Minor changes have been made to spelling and punctuation to fit ATA style.*

In a recent discussion in the Learning and Mathematics Discussion Series on the Math Forum, I noticed a flurry of interest in alternative instruction. There is a fair amount of information on the Forum concerning alternative instruction, but an annotated list of resources was lacking, so I chose to gather a bibliography on alternative instruction and performance-based assessment.

Portfolio assessment, a significant issue in alternative instruction, is not included; however, I felt that this bibliography would be more accessible to teachers if it presented ways in which assessment could be altered without drastic restructuring of class and curriculum. Some of the articles and books referenced herein have links to portfolio-based instruction and assessment, and can therefore provide resources for teachers interested in pursuing portfolio systems in their classrooms. All of the articles are math-related, and many give concrete lesson plans and suggestions for practice.

The list is in two parts—one for alternative instruction and one for performance-based assessment.

Critical sources are the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics* (in section 1, number 9), which forms the basis for much of the work in alternative instruction and assessment being currently undertaken, and Ruth Mitchell's *Testing for Learning* (in section 2, number 6), which provides an excellent argument for changing assessment practices in American education.

Note: All of the references cited in this bibliography except Mitchell (in section 2, number 6) and Perrone (in section 2, number 9) are available from ERIC Document Reproduction Service, 7420 Fullerton Road Suite 110, Springfield, VA 22153-2852, 1-800-443-3742.

## Reference

Mitchell, R. *Testing for Learning: How New Approaches to Evaluation Can Improve American Schools*. Toronto: Maxwell Macmillan Canada, 1992.

## Alternative Instruction

1. Aronson, G., et al. *Using a Calculator. Math in Action. Workbook*. Hayward, Calif.: Janus Book, 1985.

A workbook for slower-paced learners to help them use calculators so that they can focus on conceptual aspects of mathematics rather than on computational skills. Teachers might consider extending the use of calculators in their classrooms, especially when working with these slower-paced learners, to focus on a deeper understanding of the material to supplement math-facts practice.

2. Cooper, R. *Alternative Math Techniques Instructional Guide*. Harrisburg, Penn.: Pennsylvania State Department of Education. Bureau of Adult Basic and Literacy Education, 1994.

A guide for children with learning problems that emphasizes alternative methods. Includes a discussion of the principles behind teaching students with special needs, specific lessons and a guideline to the problems that the children might encounter with each lesson.

3. Dossey, J. A. "Transforming Mathematics Education." *Educational Leadership* 47, no. 3 (November 1989): 22-24.

Overview of the *National Council of Teachers of Mathematics Standards*, with references. The Standards (which are also referenced below), promote conceptually based instruction that builds a true understanding of mathematics in the students. Suggestions for practice are included. For example, it is recommended that writing about math learning (that is, math journals) be encouraged as essential for linking language and mathematics.

4. Hiebert, J., and D. Wearne. "Links Between Teaching and Learning Place Value With Understanding in First Grade." *Journal for Research in Mathematics Education* 23, no. 2 (1992): 98-122.

Compares and contrasts alternative instruction and text-based instruction with regard to a series of lessons on place value. Conclusions are drawn as to the benefits and drawbacks of alternative, conceptually based instruction. A summary of this article can be found in the archives of the Learning and Mathematics Discussions on the Math Forum.

5. Hiebert, J., and D. Wearne. "Instructional Tasks, Classroom Discourse, and Students' Learning in Second-Grade Arithmetic." *American Educational Research Journal* 30, no. 2 (Summer 1993): 393-425.

Compares traditional and alternative Grade 2 math classrooms and provides results of the comparison that show positive gains with alternative instruction. The lessons observed focused on place value, and addition and subtraction with multiple-digit numbers, and suggested teaching these concepts so that the underlying mechanisms will be apparent to the children.

6. Leonard, B. "Get Moving in Math!" *Instructor* 94, no. 1 (August 1984) 74-76, 78.

Describes Math Lab, an alternative, conceptually based mathematics curriculum. Includes lessons for each conceptual level of instruction: concrete, semi-concrete, semi-abstract and abstract.

7. Madsen-Nason, A., and P. E. Lanier. *Pamela Kaye's General Math Class: From a Computational to a Conceptual Orientation*. Research Series No. 172. East Lansing, Mich.: Institute for Research on Teaching, College of Education, Michigan State University, 1986.

A three-year case study of a teacher's curriculum change and an analysis of the outcomes, including many positive results for the students. The implication is that focusing on fostering student understanding, rather than on skills alone, will produce students with more mathematical competence, higher levels of effort and improved attitudes regarding math. Some of the areas of focus are communication in the classroom, social issues that facilitate math learning and changes in curriculum to improve conceptual instruction.

8. Marshall, G. "A Changing World Requires Changes in Math Instruction." *Executive Educator* 12, no. 7 (July 1990): 23-24.

Outlines the Standards of the National Council of Teachers of Mathematics with recommendations regarding alternative instruction and assessment. As opposed to the other Standards-based article listed above, this article translates the Standards into practical applications, above and beyond the suggestions already included within the Standards. Some of the changes involve using software to increase challenges in math, cooperative learning formats and testing that go beyond the multiple-choice model.

9. National Council of Teachers of Mathematics. *Curriculum and Evaluation Standards for School Mathematics*. Reston, Va.: Author, 1989.

The Council's guide to reforming and improving math education. The emphasis is on conceptual, contextualized instruction and includes strong recommendations for moving away from traditional, noncomprehension-based drill-and-practice math instruction. An example of this change in focus might be teaching multiplication not as facts but as a system, in which the children construct the multiplication table on their own and in the process learn why it is that this table exists. The Standards contain guidelines, discussions about learning and practice and curricular recommendations for each grade level.

10. Peterson, P. L., et al. *Profiles of Practice: Elementary School Teachers' Views of Their Mathematics Teaching*. East Lansing, Mich.: Institute for Research on Teaching, College of Education, Michigan State University, 1991.

Examines a sample of schools from three states and evaluates elementary math teachers' goals and activities. Provides groupings for different teaching

styles (that is, teachers who use manipulatives frequently, teachers who rely only partially on the drill-and-practice technique and so on), with numbers of teachers per group and an analysis of the results.

**11. Remillard, J.** *Is There an Alternative? An Analysis of Commonly Used and Distinctive Elementary Mathematics Curricula.* Elementary Subjects Center, Series No. 31. East Lansing, Mich.: Institute for Research on Teaching, College of Education, Michigan State University, 1991.

A description and analysis of one math textbook and three alternative curricula for elementary math education. Findings show that the textbook emphasized computational skills and math facts, while the alternative curricula emphasized comprehension and application of math knowledge.

**12. Westbury, I, et al., ed.** *In Search of a More Effective Mathematics Education: Examining Data from the IEA Second International Mathematics Study.* Norwood, N.J.: Ablex, 1994.

A series of studies on new directions in mathematics education, including, for example, an article on successful teaching of problem-solving to Grade 8 students, and one entitled, "What Makes For Effective Math Instruction? Japanese and American Classrooms Compared," which brings an international perspective to the issue of alternative instruction.

**13. Winograd, K.** "Writing, Solving, and Sharing Original Math Story Problems: Case Studies of Fifth Grade Children's Cognitive Behavior." Paper presented at the annual meeting of the American Educational Research Association, Chicago, April 1991.

This paper examines different aspects of the process of children writing, solving and sharing math problems and the possibility of using this form of instruction as an alternative to purely text-based instruction. Findings indicate that having children create and share their own math word problems in small groups is a positive method of alternative instruction.

## Alternative, Performance-Based Assessment

**1. Baker, E. L.** "Issues in Policy, Assessment, and Equity." In *Focus on Evaluation and Measurement.* Vols. 1 and 2. Proceedings of the National Research Symposium on Limited English Proficient Student Issues, 1992.

An article that looks at the relationship between policy and alternative assessment, which is presented as a way to achieve more equity in education

(especially for limited English proficient—LEP—students). Major concerns include

- that LEP students are not being assessed because of a lack of tools suited to their needs,
- that LEP students are failing at assessments because of their lack of English abilities, and
- that LEP students are not getting the chance to learn.

Includes definitions and descriptions of alternative assessment methods that address these concerns. (For more on limited English proficiency issues, see the annotated bibliography by Kristen Lockwood.)

**2. Baron, J. B.** "SEA Usage of Alternative Assessment: The Connecticut Experience." In *Focus on Evaluation and Measurement.* Vols. 1 and 2. Proceedings of the National Research Symposium on Limited English Proficient Student Issues, 1992.

This article looks at state-level interest in alternative assessment and examines alternative assessment programs in Connecticut. Includes a discussion of the guidelines for effective performance-based assessment, and the problems of using this type of assessment with limited English proficient students.

**3. ERIC Clearinghouse on Information and Technology.** *Alternative Assessment and Technology.* ERIC Digest. ERIC Clearinghouse on Information and Technology, Syracuse NY, 1993. 4-194 Center for Science & Technology, Syracuse University, Syracuse NY, 13244.

Discusses performance-based and portfolio assessment, with an emphasis on the contribution of technology to these approaches. Provides an overview of the alternative assessment methods of the Center for Technology in Education (CTE) and examines the projects that CTE has run in various high schools. For example, students are asked to present projects they have done orally, answering questions, giving a presentation and defending their ideas. These presentations are then judged according to criteria such as clarity, coherence, responsiveness to questions and monitoring of listeners' understanding, which takes the place of traditional assessment.

**4. Hange, J. E., and H. G. Rolfe.** "Creating and Implementing Alternative Assessments: Moving Toward a Moving Target." Paper presented at the annual meeting of the American Educational Research Association, New Orleans, April 1994.

Findings from the first year of a study in which 22 Virginia teachers implemented alternative assessment techniques in their math classrooms. The results after a second year of study included

videotapes of how to run a workshop on implementing alternative assessment in classrooms.

5. Jorgensen, M. *Assessing Habits of the Mind. Performance-Based Assessment in Science and Mathematics*. ERIC Clearinghouse for Science, Mathematics and Environmental Education, 1994.

Describes and discusses methods, reasons and questions concerning performance-based assessment in textbook form for teachers to use while instituting performance-based assessment methods in their classrooms. (Available from ERIC/CSMEE, The Ohio State University, 1929 Kenny Road, Columbus, OH 43210.)

6. Mitchell, R. *Testing for Learning: How New Approaches to Evaluation Can Improve American Schools*. New York: The Free Press, 1992.

Discusses the idea that methods of assessment strongly influence methods of instruction and provides recommendations for change. Mitchell claims that teachers have been trained to teach to multiple-choice tests, and that this approach precludes an emphasis on understanding and connectedness of knowledge. If tests were different, she argues—meaning that tests should focus more on conceptual than on factual knowledge—then the way teachers teach could provide more of an emphasis on conceptual, contextualized knowledge.

7. Northwest Regional Educational Lab., Portland, OR. *Test Center. Math Assessment Alternatives*. Department of Education, Washington, D.C., 1992.

An annotated bibliography of alternative assessment related articles. Fifty-six references are included, covering both elementary and secondary education.

8. Office of Educational Research and Improvement (ED), Washington, D.C. "Science and Math Assessment in K-6 Rural and Small Schools." *Rural, Small Schools Network Information Exchange* 14 (Spring 1993).

Contains reprints of 31 journal articles and other papers concerning assessment (with an emphasis on alternative assessment) in rural and small schools. This collection also includes articles on portfolio assessment for teachers interested in that means of assessment.

9. Perrone, V., ed. *Expanding Student Assessment*. Alexandria, Va.: Association for Supervision and Curriculum Development, 1991.

A collection of essays on alternative assessment and new directions for change. The essays also

discuss the problems with current testing methods, and focus on the assessment issue from a classroom-based perspective. The major argument presented throughout the book is that evaluation strategies should more closely approximate what teachers and students are doing in the classrooms, and what is happening in the classrooms must focus on understanding and connection with knowledge, rather than on memorization of isolated facts. Therefore, methods such as multiple-choice tests are seen as deficient, and other means of assessment, such as graded presentations, might be more effective, given that they connect to what is happening in the classroom and encourage conceptual understanding of the material covered.

10. Ryan, P. *Teacher Perspectives of the Impact and Validity of the Mt. Diablo Third-Grade-Curriculum-Based Alternative Assessment of Mathematics (CBAAM)*. Far West Lab. for Educational Research and Development, San Francisco, 1994.

Examines teacher perceptions and activities following implementation of an alternative assessment program in California, and presents results and analysis. Teachers resequenced their curricula, introduced new content and emphasized educational processes more than they had prior to the program's implementation. Evidence was provided for the significant short-term impact of the program and the suggested long-term impact.

11. Shepard, L., et al. *Second Report on Case Study of the Effects of Alternative Assessment in Instruction. Student Learning and Accountability Practices. Project 3.1. Studies in Improving Classroom and Local Assessments*. Washington, D. C.: Office of Educational Research and Improvement (ED), 1994.

Three papers on the results of a comparison study of traditional and alternative assessment. The alternative assessment was performance-based, rather than involving traditional assessments which generally test for isolated facts rather than applied knowledge and student understanding of concepts. One study looks at alternative assessment in 13 Grade 3 classrooms, one looks at interviews with students in these classrooms, and one examines the work and roles of the teachers who participated in the study.

12. Smith, L., et al. *Assessment of Student Learning in Mathematics*. Columbia, S.C.: South Carolina Center for Excellence in the Assessment of Student Learning, College of Education, University of South Carolina, 1993.

Assessment in the mathematics classroom in light of modern goals for math education. Emphasizes alternative assessment and reviews different performance-based assessment methods including

- 1) open-ended questions,
- 2) mathematical investigations and projects,
- 3) writing activities in mathematics,
- 4) observations and interviews,
- 5) enhanced multiple-choice questions and
- 6) portfolio assessments.

The implication is that these are all positive means of assessment that are in line with conceptual

understanding and alternative instruction. Grading and scoring techniques are also discussed.

13. Williams, M. *Renewal that Fits: Preparing Educators for Reforming Schools, 1995.*

Discusses a program at Morehead State University in Kentucky that, among other things, provides training for teachers in performance-based assessment methods. The program was constructed to help public schools adapt to state-mandated educational reforms. Suggests that there might be a useful paradigm for teacher training in performance-based assessment methods. 1995. Available from EDRS.

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### Area of Triangle

Show, without the use of trigonometry, that the area of a triangle with sides  $a$ ,  $b$ ,  $c$  and angle at vertex  $A$  equal  $60^\circ$  is given by:

$$S = \frac{\sqrt{3}}{4} [a^2 - (b - c)^2].$$

If the angle at vertex  $A$  is  $120^\circ$ , then the area  $S$  of the triangle is given by:

$$S = \frac{\sqrt{3}}{12} [a^2 - (b - c)^2].$$

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