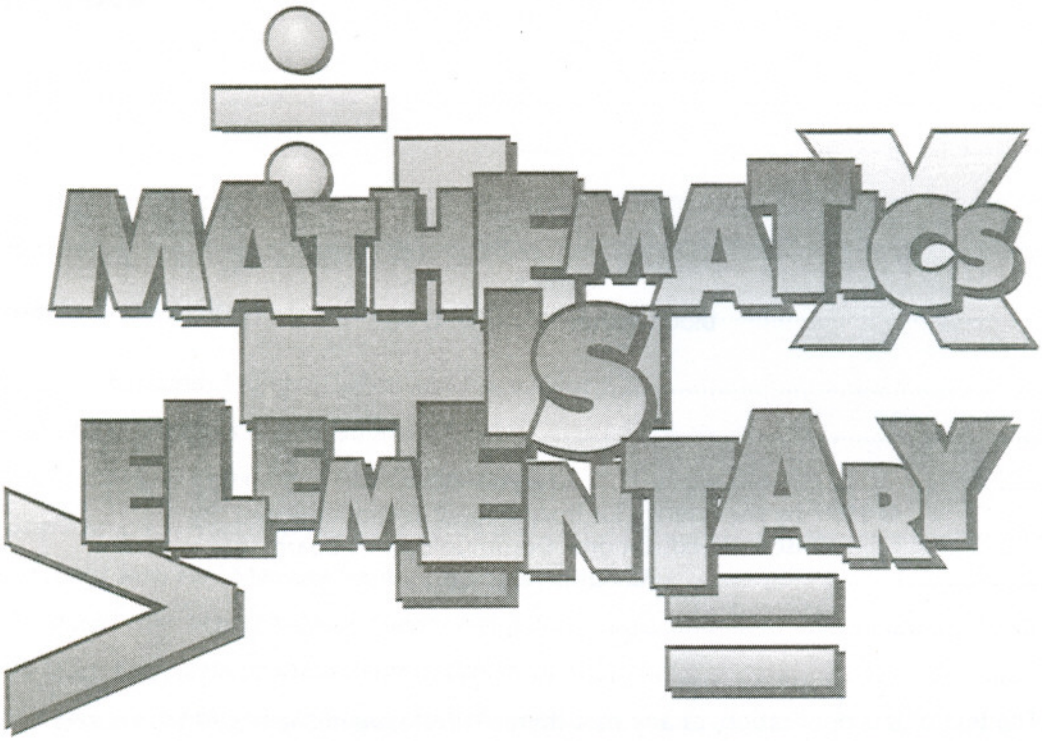
MATHEMATICS IS ELEMENTARY

TEACHER'S GUIDE

AIT
The Learning Source



TEACHER'S GUIDE

AGENCY FOR INSTRUCTIONAL TECHNOLOGY

and

WISCONSIN EDUCATIONAL COMMUNICATIONS BOARD

in collaboration with

WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION

AIT

WISCONSIN EDUCATIONAL
COMMUNICATIONS BOARD

AGENCY FOR INSTRUCTIONAL TECHNOLOGY
Box A
Bloomington, Indiana 47402

© 1997 by the Agency for Instructional Technology and the
Wisconsin Educational Communications Board.
All rights reserved.

The text of this publication, or any part thereof (exclusive of the blackline masters),
may not be reproduced in any manner whatsoever for any purpose
without prior written permission of the publisher.

ISBN: 07842-0814-X

Printed in the United States of America

Contents

Acknowledgments v
Program Matrix ..... vi-vii
Read Me! ix
WWW Address ix

Using ***Mathematics Is Elementary*** xi

Lesson 1—*What's a Thousand?* Number Sense and Place Value 3
Lesson 2—*What's Next?* Patterns and Relationships 9
Lesson 3—*What Is It Worth?* Operations and Computations 15
Lesson 4—*Is There Action in Fractions?* Number Sense and Fractions 21
Lesson 5—*How Long? How Far?* Measurement 27
Lesson 6—*How Much? How Many?* Measurement (Weight) 33
Lesson 7—*How Much Does It Hold?* Measurement (Volume) 39
Lesson 8—*What Shape Is It In?* Geometry and Spatial Sense 45
Lesson 9—*What Size Do I Need?* Geometry and Measurement 51
Lesson 10—*What's This When It Comes Together?* Geometry—Parts and Shapes, 3-D 57
Lesson 11—*How Can I Find Out?* Collecting and Using Data 63
Lesson 12—*Is It Likely?* Statistics and Probability 69
Lesson 13—*How Many Ways?* Algebra and Function 75

AGENCY FOR INSTRUCTIONAL TECHNOLOGY

INSTRUCTIONAL DESIGNER
Diana Lee, Ph.D.

EXECUTIVE PRODUCER
Frank Batavick

PROJECT MANAGEMENT SPECIALIST
Diane Sumner

EDITOR/WRITER
John D. Vollmer

WISCONSIN EDUCATIONAL COMMUNICATIONS BOARD

FORMATIVE EVALUATION CONSULTANT
Jacob Blasczyk, Ph.D.

EDUCATION ADMINISTRATOR
Ronald Unmacht

DIRECTOR, INSTRUCTIONAL PROGRAM DEVELOPMENT
Cynthia Nolen

PROJECT COORDINATOR
Marge Wilsman, Ph.D.
Director, Education Research and Evaluation

WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION

EDUCATIONAL PROGRAM COORDINATOR
Susan M. Grady

ASSESSMENT CONSULTANT
Rosemary Fitton

CONTENT CONSULTANT
Jodean Grunow

GENERAL LEARNING VIDEO

PRODUCER/DIRECTOR/WRITER
Larry Walcoff

PRODUCTION STAFF
Nick Kolias
Nancy Schlafer
Kristin Klinger
Chris Skruntz
Charles Ethridge

♦ ♦ ♦ ♦ ♦

SENIOR MATH CONSULTANT
Stephen J. Bloom, Ph.D.

GUIDE WRITING TEAM
Sheila Eller, Baker Demonstration School, Evanston, Ill.
Alison S. Claus, Lincolnshire, Ill., School District 103
Kimeri Swanson-Beck, National-Louis University, Evanston, Ill
Diane E. Deckert, Baker Demonstration School, Evanston, Ill.
Marlene Robinson, Baker Demonstration School, Evanston, Ill.

VIDEO DESIGN TEAM
Judy Fadness, Eau Claire, Wis., School District
Sue Gehn, Monona Grove, Wis., School District

♦ ♦ ♦ ♦ ♦

SPECIAL THANKS TO:
Djuna Coe, Dewey Elementary School, Evanston, Ill.
John Eller, Baker Demonstration School, Evanston, Ill.
Sheila Eller, Baker Demonstration School, Evanston, Ill.
Judy Fadness, Locust Lane Elementary School, Eau Claire, Wis.
Brenda Fujikawa, Marquette Elementary School, Madison, Wis.
Sue Gehn, Nichols Elementary School, Monona, Wis.
Rene Goepfrich, Willard Elementary School, Minneapolis, Minn.
Holly Kreiman, Dewey Elementary School, Evanston, Ill.
Dee Hannan, Dewey Elementary School, Evanston, Ill.

GUIDE DESIGNER/FORMATTER
Karla Dunn

MATRIX

Title	Overview
1. *What's a Thousand?* Number Sense and Place Value	Explores place values and how they are used.
2. *What's Next?* Patterns and Relationships	Focuses on recognizing and understanding patterns and relationships.
3. *What Is It Worth?* Operations and Computations	Explains computational techniques used to solve real-life problems.
4. *Is There Action In Fractions?* Number Sense and Fractions	Explores fractions and their everyday uses.
5. *How Long? How Far?* Measurement	Demonstrates linear measurement and nonstandard measuring tools.
6. *How Much? How Many?* Measurement (Weight)	Focuses on using nonstandard measuring tools to solve practical problems.
7. *How Much Does It Hold?* Measurement (Volume)	Explains volume; estimating and comparing volume.
8. *What Shape Is It In?* Geometry and Spatial Sense	Investigates the variety of two-dimensional shapes.
9. *What Size Do I Need?* Geometry and Measurement	Explores 2-D as it relates to area and capacity.
10. *What's This When It Comes Together?* Geometry—Parts and Shapes, 3-D	Demonstrates constructing and visualizing 3-D shapes.
11. *How Can I Find Out?* Collecting and Using Data	Focuses on the many ways of collecting and presenting data.
12. *Is It Likely?* Statistics and Probability	Investigates probability, prediction, and analyzing data.
13. *How Many Ways?* Algebra and Functions	Explores the many ways of solving for unknowns.

NCTM Standards	NAEP Strand
1–4, 6	1 Number Sense, Properties, and Operations
1–4, 13	1 Number Sense, Properties, and Operations
1–4, 7, 8	1 Number Sense, Properties, and Operations
1–4, 6, 12	1 Number Sense, Properties, and Operations
1–4, 10	2 Measurement
1–4, 5, 10	2 Measurement
1–4, 10	2 Measurement
1–4, 9	3 Geometry and Spatial Sense
1–4, 9, 10	3 Geometry and Spatial Sense
1–4, 9	3 Geometry and Spatial Sense
1–4, 11	4 Data Analysis, Statistics, and Probability
1–4, 11	4 Data Analysis, Statistics, and Probability
1–4, 6, 7, 8, 12, 13	5 Algebra and Functions

READ ME!

It is important to read the following section, *Using* ***Mathematics Is Elementary*** (and, if possible, to view the video of the same title), before teaching these lessons. **Mathematics Is Elementary** is an interactive curriculum resource. For best results, it requires some advance preparation and a familiarity with the Stop Point concept and working with groups in a collaborative learning environment. This publication and the "how to" video are your guides for success.

Please note that the blackline masters referred to in the lessons are to be found in a separate booklet in box #3 of the project components. Sample copies follow each lesson in a reduced format.

Mathematics Is Elementary on the Web!

AIT has developed an Internet resource on the World Wide Web. You can join other teachers as they share classroom hints and tips for teaching **Mathematics Is Elementary**. You may also post any questions about this series to the AIT on-line forum and they will be answered by our project consultant.

Our Web address:

http://www.ait.net

Using Mathematics Is Elementary

What it is; what it can do for you!

Mathematics Is Elementary is contextual learning in basic mathematics for grades 2–4. Contextual learning is the kind of learning that lasts. Students retain content far better when it relates to their own life experiences as taught through hands-on activities. This is especially true in math, where some abstract concepts may be difficult to grasp.

Video combined with contextual learning becomes a powerful classroom experience. Students respond very positively to video, and working in small groups allows students to engage in mutually reinforcing problem solving. Furthermore, the process of doing the same activities as shown in the videos gives teachers the opportunity to see and adapt the new instructional techniques and strategies featured in the on-screen demonstrations.

NCTM Standards and NAEP Strands

The curriculum standards from the National Council of Teachers of Mathematics (NCTM) and the National Assessment of Educational Progress (NAEP) Strands are utilized throughout this series. For ease of use, the videos are arranged according to the NAEP Strands:

PART 1

Number Sense, Properties, and Operations (Strand 1)
Program 1 : What's a Thousand? • Place Value
Program 2 : What's Next? • Patterns and Relations
Program 3 : What Is It Worth? • Operations and Computations
Program 4 : Is There Action in Fractions? • Number Sense and Fractions

Measurement (Strand 2)
Program 5 : How Long? How Far? • Linear Measurement
Program 6 : How Much? How Many? • Weight Measurement
Program 7 : How Much Does It Hold? • Volume Measurement

PART 2

Geometry and Spatial Sense (Strand 3)
Program 8 : What Shape Is It In? • 2-D Geometry
Program 9 : What Size Do I Need? • Geometry and Measurement
Program 10 : What's This When It Comes Together? • 3-D Geometry—Parts and Shapes

Data Analysis, Statistics, and Probability (Strand 4)
Program 11: How Can I Find Out? • Collecting and Using Data
Program 12 : Is It Likely? • Probability and Statistics

Algebra and Functions (Strand 5)
Program 13 : How Many Ways? • Algebra and Function

PART 3

Teacher Utilization Component
Using **Mathematics Is Elementary** • Professional Development Program
Teacher's Guide
Blackline Masters

Pause Points

Mathematics Is Elementary is an interactive resource. In each video there are two kinds of Pause Points. The first, a STOP SIGN, designates a place where the video should be stopped—either to discuss a problem that has been presented or to engage in the classroom activity for the lesson. There are also FREEZE FRAME pause points where the on-screen question is, "Were These Solutions Like Yours?" These are places where you may either stop the video completely, or use the pause button on the VCR or remote so that your students can present their answers and compare them with those presented on-screen.

Materials and Preparation

Since the activities are hands-on and depend on common manipulatives, each lesson requires teachers to collect simple materials beforehand (construction paper cut into certain sizes, empty plastic containers, etc.). In some cases you may want to ask parents to help out. Give your students a note in advance asking parents or caregivers to provide an item or two. It is a very good idea to read through each lesson ahead of time and preview the video.

Extended Activities

Each lesson provides suggestions for extended activities that will further enhance student learning. These include cross-curricular and writing activities. In addition, blackline masters are also provided (in a separate booklet in box 3) for each lesson. Some lessons require BLMs for the classroom activity (always numbered for the lesson; e.g., lesson 1 uses BLM 1-C and 1-D). ALL lessons also have BLMs for the take-home activities, which are designed to be done with a parent or other adult caregiver, thereby reinforcing the lesson and allowing the participation of an adult outside the classroom in the child's mathematics education.

Finally, there are suggested selections of children's literature related to lesson content in the teacher's guide for each lesson.

Assessments and Criteria for Scoring

Students must be able to understand and apply mathematical concepts to make informed decisions in daily life, and will eventually need many of these skills in order to enter into rewarding careers.

In the past, multiple-choice tests, true-false tests, or computational tests were used as the sole indicators of successful learning. **Mathematics Is Elementary** uses a more authentic approach known as performance assessment. Performance assessment encourages gathering information based on criteria that provide a more complete picture of what a student knows and is able to do. The purpose of the performance assessment system is to:

- provide clear expectations for student learning
- provide student achievement data relative to expectations
- provide feedback to students to assist in educational planning, and
- promote high quality curriculum and instruction.

Each lesson in this series guide has a section that provides performance assessment criteria for scoring that uses some or all of these categories (you are encouraged to either modify the criteria provided for each lesson or create your own):

Advanced Response: The response is distinguished in that it goes well beyond the criteria for a Proficient Response. It gives evidence of such characteristics as reflection upon work; insightful, creative approaches to the task; elegant communication using a variety of media; and sound reasoning.

Proficient Response: The response addresses all aspects of the task. It shows full application of appropriate knowledge and skills, and uses methods of communication that are appropriate to the subject area and task. The response is conceptually and mechanically complete, although an occasional minor mechanical error may be present.

Nearly Proficient Response: The response addresses most of the essential conditions of the task, but there is some evidence of misconceptions, or evidence of the application of inappropriate knowledge or skills. Communication is unclear or incomplete.

Minimal Response: The response addresses some of the essential conditions of the task. It gives evidence of major misconceptions and demonstrates very little evidence of correct usage of content knowledge or mechanical skills. Communication is unclear or incomplete.

Attempted Response: The response gives little evidence of addressing the task but meets none of the essential criteria.

In addition to classroom discussion and activities, presentation is an important part of the process. It provides students with an opportunity to organize their thoughts and explain their reasoning. Included below are some criteria for scoring presentation skills.

Presentation Criteria for Scoring

Advanced Response: Information is displayed correctly and neatly; explanation of results is clear, complete and well-organized. Related mathematical terms are used appropriately and correctly.

Proficient Response: Information is correctly displayed and explanation of results is clear and complete. Some of the related mathematical terms are used correctly.

Partially Proficient Response: Information is correctly displayed, but explanation is not clear or complete. Related mathematical terms are used but not all of them are used correctly or appropriately.

Minimal Response: Information is not correctly displayed and explanation is inadequate. Few or no mathematical terms are used.

Using Mathematics Is Elementary

The Video Guide

All of the video lessons in **Mathematics Is Elementary** were videotaped in actual classrooms with practicing teachers—not actors. This authentic, not staged, instruction presents teachers and students with whom everyone can relate.

In the Using **Mathematics Is Elementary** video, we join Alison Claus as she takes her class through program 4—Is There Action in Fractions? She uses the video and the activities creatively. BUT . . . she has prepared herself well. She has reviewed the objectives, key words and terms, and student prerequisites in the guide. She has prepared questions to ensure that her students know the concepts and language used in the lesson (suggestions are provided in the guide), and collected the class materials and made copies of the BLMs in advance.

She also explains to the class that she will be stopping the tape after they see the problems presented so that they can work on them themselves, in small groups. They will then view the solutions arrived at by the video students before presenting and comparing their own.

Each segment of the video has a specific role to play in drawing students into the learning process—the opening montage of the fractions program gives an overview of the topic, placing it in the context of target-aged children. The next section poses an interesting problem in fractions that will naturally lead into the group activity. Alison stops the tape at the first Stop Sign that appears on-screen and she and the class discuss, and then work on, the preliminary problem presented in the video—how to fairly divide four sandwiches among three children.

After they have worked out their solutions, the class watches how the on-screen students solved the problem. Next, Alison and her class watch the segment that presents the main classroom activity—TV teacher Sue Gehn shows her class a bag containing ten pieces of licorice. She poses the problem: Working in groups of four, how many ways can they find to divide the ten pieces fairly among the four of them? Alison stops the tape at the next Stop Sign, makes sure her class understands the problem, and sets them to work.

Using as many classroom materials as needed (paper and pencil, rulers, etc.), each group works on the problem. Alison circulates to answer questions and help them understand the challenge. She guides their thinking, without offering solutions herself, and encourages them to use mathematical language. Working as a group to pool their intellectual resources, the students soon develop cooperative skills.

When each group is ready, the class views the solutions reached by the students in the video. Then, at the "Were These Solutions Like Yours?" pause point, group representatives present their answers to the class. Then they get to divide the licorice!

As the video continues, we see further extensions of the topic. Three children and an adult are at a pizza shop. When their order arrives, they see that one pizza has been cut into four pieces and the other into sixteen pieces. Each person gets half a pizza, but one boy complains that he has only two pieces while his friend has eight! Is this fair? The video is stopped at this point so that the class can discuss the question and explore equivalence in fractions.

In the next segment, a boy is using a recipe to make his favorite treats, but his mother says he can make only one-third of a batch. At this point, without any pause point on the screen, Alison stops the tape and asks her class what one-third of each ingredient would be. *Teachers should feel free to stop the tape any time they wish to discuss a problem!*

In the last segment, the class views some examples of fractions in everyday life and are challenged to compile an action-fraction diary. The video suggests: *You Try It!* The final segment of each video uses a *You Try It* segment to suggest an extension of the video lesson.

The guides have extended activities, including cross-curricular and writing activities, that stretch each lesson well beyond the video. There are also blackline masters that involve parents or other adult caregivers in the learning process. The Using **Mathematics Is Elementary** video models how one student uses a BLM to explore fractions in the kitchen with his mother.

This series was designed to make contextual, small-group learning engaging and fun for both students and teachers. It is also designed to bring students and parents, and parents and teachers, closer together in the learning experience.

More AIT Resources to Physically, Mentally, and Scientifically Stimulate Young Minds

Head to Toe

Fifteen 15-minute health programs and a 56-page teacher's guide for Kindergarten–Grade 3

Build upon children's natural interest in how the body looks, works, breaks down, heals, and grows. Introduce the workings of the human body, and develop students' knowledge, attitudes, and practices needed for achieving and maintaining good health. Encourage prevention of risky health behaviors and reinforce existing positive health habits.

Looking from the Inside/Out

Fifteen 15-minute health/coping skills programs and a 112-page teacher's guide for Grades 3–5

Develop the knowledge, skills, and attitudes needed to understand and cope with emotions and feelings. Improve students' skills for making decisions, managing stress, communicating, and setting goals. Provide students with basic knowledge about human emotions and their universality, then support that knowledge by demonstrating the physical and social results of both positive and negative attitudes and habits. This is a new, updated version of AIT's 1974 Emmy award-winning series, ***Inside/Out***.

Science Is Elementary

Ten 15-minute science programs and a 56-page teacher's guide for Kindergarten–Grade 2

Channel young children's natural curiosity into hands-on explorations of science. Encourage students to investigate how science affects them every day and to apply scientific concepts across curriculum areas. Topics include plants, animals, water, light and shadows, sound, tools, magnets, air, weather, and soil and rocks.

To learn more about these or other AIT products and services, call an AIT customer service consultant or sales representative at 800-457-4509; FAX your request to 812-333-4278; or explore our World Wide Web site (AIT.Net) at http://www.ait.net.

Mathematics Is Elementary is a complete curriculum resource for grades 2-4, consisting of instructional video programs, comprehensive teacher's guide, blackline masters, and teacher utilization video. Each of the 13 classroom lessons combine interactive video segments, hands-on problem solving activities, and take-home student-parent exercises to meet NCTM Curriculum standards and the content strands of the National Assessment of Educational Progress for Mathematics.

PART 1

Number Sense, Properties, and Operations

Program 1: What's a Thousand? • Place Value
Program 2: What's Next? • Patterns and Relations
Program 3: What Is It Worth? • Operations and Computations
Program 4: Is There Action in Fractions? • Number Sense and Fractions

Measurement

Program 5: How Long? How Far? • Linear Measurement
Program 6: How Much? How Many? • Weight Measurement
Program 7: How Much Does It Hold? • Volume Measurement

PART 2

Geometry and Spatial Sense

Program 8: What Shape Is It In? • Two-Dimensional Geometry
Program 9: What Size Do I Need? • Geometry and Measurement
Program 10: What's This When It Comes Together? • 3-D Geometry—Parts and Shapes

Data Analysis, Statistics, and Probability

Program 11: How Can I Find Out? • Collecting and Using Data
Program 12: Is It Likely? • Probability and Statistics

Algebra and Functions

Program 13: How Many Ways? • Algebra and Function

PART 3

Teacher Utilization Component

*Using **Mathematics Is Elementary*** • Professional Development Program
Teacher's Guide
Blackline Masters
Online Access to Tips and Implementation Strategies

The Agency for Instructional Technology is a nonprofit U.S.-Canadian corporation whose mission is to foster learning through the development, acquisition, and distribution of quality electronic technology-based resources and services; and by providing leadership to the educational technology policy community.

AIT The Learning Source

AGENCY FOR INSTRUCTIONAL TECHNOLOGY
Box A, Bloomington, Indiana 47402-0120
800-457-4509 812-339-2203 FAX: 812-333-4278 WEB SITE: http://www.ait.net

The Wisconsin Educational Communications Board facilitates the cooperative acquisition, development, and use of instructional programs and distance education technologies. The ECB plans, develops, constructs, and operates statewide public radio, public television, and educational telecommunications systems.

WISCONSIN EDUCATIONAL COMMUNICATIONS BOARD
3319 West Beltline Highway
Madison, WI 53713-4296
608-264-9600 FAX: 608-264-9685 WEB SITE: http://www.wecb.org

©1997 Agency for Instructional Technology and Wisconsin Educational Communications Board. All rights reserved.

372-TG

ISBN 0-7842-0814-X
90000>
9 780784 208144

Printed in U.S.A.

MPS 78602