

## Content and Instructional Practices in *Math Sense*: What the Research Says

### Introduction

*Math Sense* is a math program designed for adult students. It is also appropriate for young adults. It covers math topics from whole numbers and basic operations through elementary data analysis, algebra, and geometry, and emphasizes developing number sense and solving problems. The series consists of four student books plus a comprehensive review book. Each of these five books has an accompanying teacher's resource guide. The series also includes a placement tool.

*Math Sense* is published by New Readers Press of Syracuse, New York. It was originally published in 1995–1997 with the title *Smart Solutions*. The revised edition, *Math Sense*, was published in 2003.

### What Adults Need to Know about Math

Adults need to master math content that includes computation; number sense; data analysis (including understanding charts and graphs); probability; measurement; algebra; and geometry. (Curry, Schmitt, & Waldron, 1996; Massachusetts Department of Education, 2001; National Council of Teachers of Mathematics, 2000). They also need to be able to estimate and use mental math and to know when it is appropriate to use these techniques. (Ginsburg & Gal, 1996).

*Math Sense* covers all these content areas. The student books are *Whole Numbers and Money*; *Decimals, Fractions, Ratios, and Percents*; *Measurement and Data Analysis*; and *Algebra and Geometry*. All the topics are recapped in *Comprehensive Review*.

Throughout the series, student book exercises and supplemental activities in the teacher's resource guides encourage the development of number sense—having an intuitive feel for numbers and being able to work flexibly with them. In addition, student frequently practice estimating and using mental math in real-life contexts, for example, deciding whether they have enough money to pay for items while shopping, using a map scale to estimate the length of a trip, or deciding whether an approximate or exact answer is needed in different situations.

Many adult students seek to pass the GED test in order to qualify for better jobs or further academic study. The current GED test in mathematics covers number relations, measurement, algebra, and geometry. It puts increased emphasis on data analysis; statistics; realistic, multistep problems; and problems based on charts, graphs, and other visuals. Test takers answer open-ended questions as well as multiple choice, and they use a scientific calculator—the Casio fx-260—on one part of the test. (GED Testing Service, 2003).

*Math Sense* covers all the content needed to pass the math GED. In addition, each student book includes instruction and practice in

- how to approach and solve multistep problems, set-up problems, and problems based on graphics
- how to mark answers to open-ended questions on the GED's scannable answer sheets

- how to use the Casio fx-260, including which functions and keys can be ignored while taking the GED

Unit reviews and posttests consist of GED-style problems and ask students to use calculators and to grid in answers.

Abundant research shows that adults use math frequently in both basic and more sophisticated ways (Schmitt, 2000). They need to recognize situations where they should apply their math knowledge (Kerka, 1995). To qualify for most jobs today, workers need computation and problem-solving skills. They need to be able to apply math in such areas as scheduling people and materials, budgeting, keeping records, making estimates, and creating and using computer spreadsheets. They also need to be able to work with other employees on these tasks and to communicate results (Secretary's Commission on Achieving Necessary Skills, 1991).

Throughout *Math Sense*, students continually practice applying math concepts and skills to such work-related tasks as calculating sales tax, keeping timesheets and payroll records, figuring out materials needed for a job, completing a spreadsheet, and using various formats (graphs, tables, etc.) to communicate data. Learning how math is applied in realistic situations helps prepare students to recognize such applications outside the classroom as well. Each student book unit also encourages practice in math communication, opening with a discussion topic, "Talk About It," and closing with small-group work, "Working Together." The teacher's resource guides also suggest many cooperative learning activities that help students communicate about math.

To function effectively as family members and citizens as well as workers, adults have to be able to use math to solve problems and to communicate. They need to understand and work with numbers and symbolic information; plan how to solve problems and perform other math tasks; accomplish the tasks and check the results; and communicate their results in various ways, including graphs, charts, and other mathematical representations (Stein, 2000).

*Math Sense* encourages students to apply math to tasks important to family and community participation, including balancing a checkbook, understanding nutrition information, tracking expenses and using a budget, interpreting news statistics and opinion polls, and dividing candy evenly among several children.

### **How Adults Learn Math Best**

Research literature repeatedly stresses the importance of helping students see how the math they are learning can be applied in their real lives. Making such connections helps students learn and retain math skills and concepts and also helps them develop confidence and have a more positive attitude toward learning math:

- Solving meaningful problems in real-life contexts will help students master and retain both math skills and math concepts (Ginsburg & Gal, 1996; Grouws & Cebulla, 2000; Curry, Schmitt, & Waldron, 1996). This approach can also boost the confidence of learners who are unsure of their math ability. (Curry, Schmitt, & Waldron, 1996).

Throughout the series, *Math Sense* allows students to practice using math concepts and skills on realistic problems like those they encounter at work, at home, and in the community. Specific examples are mentioned above and below.

- Teaching about data analysis, graphs, and probability is more effective when it is done in the context of work and other real-life applications (Curry, Schmitt, & Waldron, 1996; Massachusetts Department of Education, 2001).

*In Measurement and Data Analysis, Algebra and Geometry*, and the related sections of *Comprehensive Review*, students apply math concepts and skills to such realistic situations as diagramming the scene of a collision for an accident report, determining the cost of renting equipment for different amounts of time, keeping track of sales, reading and interpreting graphs in news reports, deciding what questions still need to be answered after listening to a sales pitch, and surveying customers about the proposed redesign of a store.

- Learning about measurement should include more than just using tools and doing calculations. It is helpful to discuss real-life issues such as knowing when exact vs. estimated measurements are needed and using measurement for solving problems (Curry, Schmitt, & Waldron, 1996).

*In Measurement and Data Analysis* and related sections of *Comprehensive Review*, in addition to reading measurements and doing calculations, students practice with real-life tasks such as estimating to judge the reasonableness of a calculated answer, choosing the most appropriate unit when measuring different objects, making phone calls to different time zones, choosing the most economical packaging for a product, and tracking a sick child's temperature.

- Students need to practice recognizing, understanding, and interpreting numerical information in news stories and other real-world contexts (Ginsburg & Gal, 1996).

*Measurement and Data Analysis* and related sections of *Comprehensive Review* include abundant examples and problems based on the way data is presented in news stories, government reports, product packaging, and other real-life situations. Several specific examples are noted above.

- Students will learn and retain algebraic concepts better and will have a more positive attitude toward algebra if instruction focuses on practical applications that students could use in real life (Curry, Schmitt, & Waldron, 1996).

*Algebra and Geometry* and related sections of *Comprehensive Review* consistently present instruction and practice with algebraic concepts in terms of such real-life applications as splitting a bill evenly, keeping score in a game, gaining and losing weight, calculating sales tax and shipping costs, enlarging a photograph, and purchasing equipment and supplies for a specific use.

Students often learn more effectively if they work on problems in groups (Ginsburg & Gal, 1996; Grouws & Cebulla, 2000; Curry, Schmitt, & Waldron, 1996). It is important that students learn to use math to communicate. Group work also lets them practice the teamwork skills that are expected in the workplace (Curry, Schmitt, & Waldron, 1996).

In *Math Sense*, each unit review concludes with an activity called “Working Together,” in which students work with a partner or small group to apply math skills and concepts to nonroutine problems or situations. The *Math Sense* teacher’s resource guides also include a variety of supplemental activities that encourage cooperative learning.

Basic computation skills should be taught not as ends in themselves, but as tools to use when solving problems. Other tools include number sense, estimation, mental math, and using calculators and other tools. (Ginsburg & Gal, 1996; Curry, Schmitt, & Waldron, 1996). Students should be encouraged to look for multiple solutions to complex problems (Ginsburg & Gal, 1996).

*Math Sense* has a strong focus throughout on math as problem solving. In every book, Problem Solver lessons provide techniques to help students tackle routine and nonroutine word problems. Occasional specially labeled problems require in-depth exploration of math ideas, asking students to explain, draw, find multiple solutions, or do something beyond just finding an answer. Supplemental activities in the teacher’s resource guides may challenge students to solve open-ended problems and find multiple solutions. Other activities encourage students to make reasonable guesses, draw conclusions, and explain their thinking, reflecting the way math is used in real-life problem solving.

Using calculators and other technological tools when appropriate allows students to tackle more complex problems and gives them practice with skills they will need on the job and elsewhere. In addition, using such technology in math class does not interfere with students’ developing basic computation skills (Ginsburg & Gal, 1996; Grouws & Cebulla, 2000).

Calculator instruction and practice is integrated throughout the *Math Sense* student books and the supplemental activities in the teacher’s resource guides. These lessons and activities may be used with a basic four-function calculator, but they also can provide an introduction to using the Casio fx-260, the scientific calculator used on the GED math test.

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