



Helping Children Learn Mathematics Study Guide

First Session

The Five Strands (30 minutes including reading time)

Share Handout/Slide/Transparency #1 to cover where this report came from and who was involved. Explain that this book is a summary of the research synthesized in the more comprehensive book, *Adding It Up: Helping Children Learn Mathematics* that was published in 2001 by the National Research Council. The book is a mega analysis of the research about learning number concepts and skills. *Adding It Up* and the summary document, *Helping Children Learn Mathematics*, made be downloaded from www.nap.edu.

I. Have participants read the “**Introduction**” (pp. 3-7, omit red page for now) and discuss the following questions (use Handout/Slide/Transparency 5 or write on chart paper). :

1. Why does this booklet focus on number? What do the authors say about other areas of mathematics for elementary learners? (*p. 6*)
2. What do the authors say are some of the problems in the U. S. at the elementary level with the learning of mathematics? (*pp. 3-4*)
3. Which of the weaknesses in math education do you think occur at our school?

II. Have participants turn to **What Does It Mean to Be Successful in Mathematics?** (pp. 8-16).

Share Handout/Slide/Transparency #2 to present the twine as the definition of mathematical proficiency. Use Handout/Slide/Transparency #3 (and p. 9 of the book) to explain the 5 interdependent parts. Choose Plan A or Plan B to read and discuss this section.

Choice 1 All Read “ The Five Strands ” (pp. 10-16) Omit red pages for now	Choice 2 Jigsaw “ The Five Strands ” (pp. 10-16) Omit red pages for now
Discussion questions (have small groups discuss (Handout/Slide/Transparency 5): 1) Understanding Strand The authors say “Students who learn	Form groups of 5 participants. Each person in the group reads one of the strands and the shares 2 key insights with

<p>with understanding have less to learn because they see common patterns in superficially different situations.” (p. 10) Why do they say this? How do you think you could accomplish this in your work with students?</p> <p>2) Computing Strand Why do you think students struggle with computation? What is fluency and how does understanding assist fluent computing?</p> <p>3) Applying Strand Why is applying a concept or procedure a part of strong mathematical learning?</p> <p>4) Reasoning Strand The authors say “Reasoning is the glue that holds mathematics together.” (p. 14) How do people in your group encourage and support children in sharing their thinking?</p> <p>5) Engaging Strand In what ways can engagement be shown in mathematics and why is engagement an important part of mathematical proficiency?</p> <p>6) Wrap Up What statement or idea in this section did you find most intriguing?</p>	<p>the rest of their small group of 5.</p> <p>To wrap up the reading and discussions, record on chart paper 2 key points per strand suggested by various groups.</p>
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Second Session

“Integrating the Strands” (30 minutes including reading time)

Use Handout/Slide/Transparency #4 to share why student achievement is better if the strands are integrated rather than taught in isolations.

Have participants read **“Integrating the Strands of Proficiency” (pp. 16-23, including the boxed in sections but omitting the red page)** use Handout/Slide/Transparency 7).

Discussion Questions

1. The authors say “Developing the strands of proficiency individually is much harder than learning them together. In fact, it is almost impossible to master any one of

the strands in isolation.” (p. 17) What are some examples of this? What do people in your group think about this?

2. How can the strands be integrated in learning number combinations? (p. 18) Have people who have tried these strategies share their experiences.
3. How can the strands be integrated in learning proportional reasoning? (pp. 19-20)
4. The authors say it is a myth that students cannot do more challenging work until they have mastered basic skills. How does the example on p. 23 or the other examples in this section support the idea that the basics can actually be developed alongside other mathematical experiences? (p. 23+)
5. How have people in your group integrated the strands in teaching math?

Third Session

Frequently Asked Questions (20-30 minutes including reading time)

Form groups of 4-5 people.

Have each person in a group select a question from the list on page 5 and read the page indicated. (These are all the red pages.)

Each person should share 2 ideas for answering the questions with their small group. The group can add additional information or examples from their teaching that they think might also help answer this question.

Fourth Session

Changing School Mathematics (30 minutes including reading time)

Form small groups. Have participants read “**How Does school Mathematics Need to Change?**” (pages 25-33 omit red pages).

Have each group discuss the following questions in their groups (use Handout/Slide/Transparency 8):

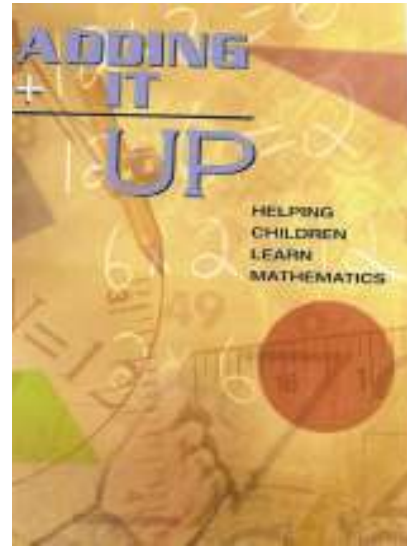
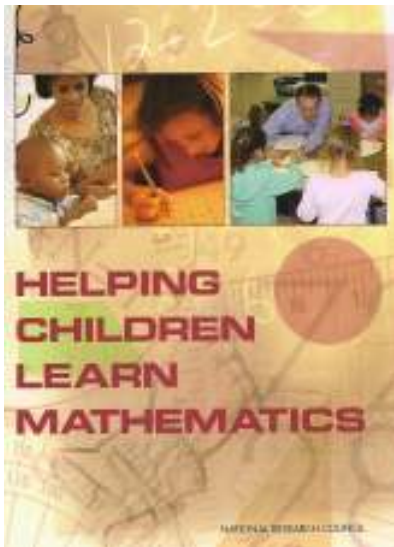
1. What is required in teaching for mathematical proficiency?
2. What strengths do we already have in teaching mathematics in our school?

3. Where do we most need to make improvements to help more students become proficient in mathematics and to deepen the learning of our highest achieving students?

Record the **strengths** and **improvements** needed on charts. Review the charts at the middle and end of the school year.

Have participants read **What Can _____ Do? (pp. 35-39)**

Have people share which points they think would be most helpful in developing our students' math skills and understanding.

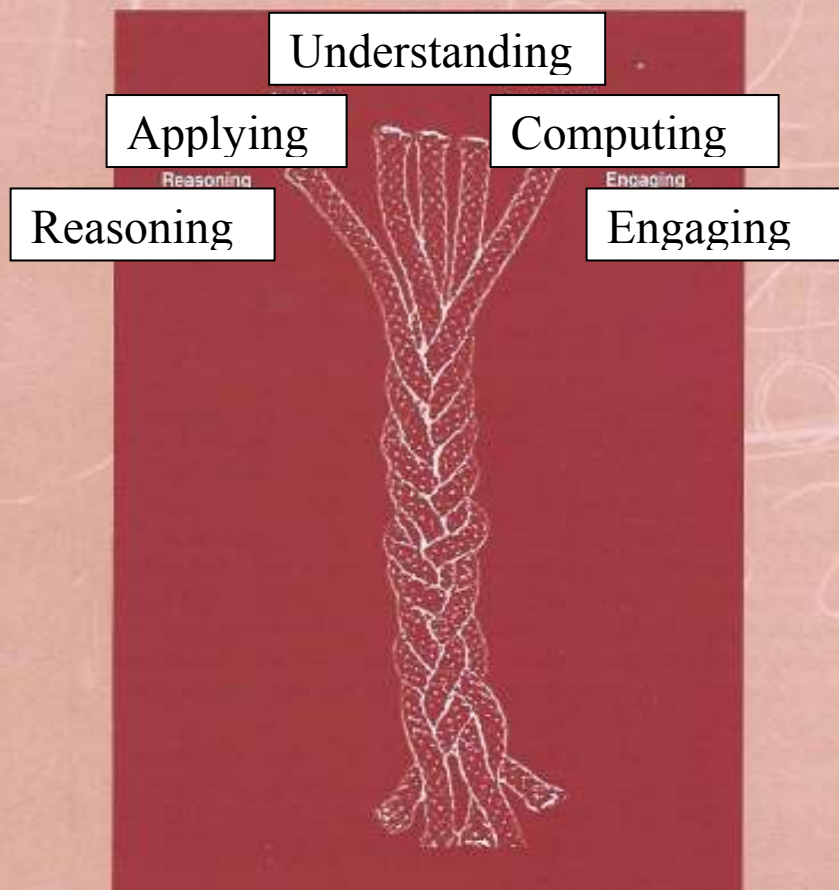


- Developed by multi-disciplinary group of scholars, educators, researchers, and administrators with differing views on school mathematics but a shared commitment to making it as effective as possible
- Researchers examined, debated and synthesized hundreds of research studies
- Focuses on learning number concepts, skills and processes across K-8
 - Number is the heart of pre-school, elementary and middle school mathematics
 - Source of many controversies
 - Most thoroughly investigated area
 - School mathematics also needs to give significant attention to algebra, geometry, probability and statistics
 - Number is used as an example of what might be done

Handout/Slide/Transparency 1

Mathematical Proficiency

Helping Children Learn Mathematics



Understanding

Comprehending concepts, operations and relationships – knowing what mathematics symbols, diagrams and procedures mean

Computing

Carrying out procedures like adding, subtracting, multiplying and dividing numbers flexibly, accurately, efficiently and appropriately.

Applying

Being able to formulate problems and to devise strategies for solving them using concepts and procedures.

Reasoning

Using logic to explain and justify a solution to a problem or to extend from something known to something not yet known.

Engaging

Seeing mathematics as sensible, useful and doable – *if* you work at it – and being willing to do the work.

Understanding • Computing Applying • Reasoning •Engaging

U.S. students need more skill and more understanding along with the ability to apply concepts to solve problems, to reason logically, and to see math as sensible, useful, and doable. Anything less leads to knowledge that is fragile, disconnected, and weak.

Developing the strands of proficiency individually is much harder than learning them together. In fact, it is almost impossible to master any one of the strands in isolation.

Understanding • Computing Applying • Reasoning •Engaging

**Discussion questions for:
“Introduction” (pp. 3-7)**

1. Why does this booklet focus on number? What do the authors say about other areas of mathematics for elementary learners?
2. What do the authors say are some of the problems in the U. S. at the elementary level with the learning of mathematics?
3. Which of the weaknesses in math education do you think might occur at our school?

Handout/Slide/Transparency 5

Discussion questions for: “The Five Strands” (pp. 10-16)

1. Understanding Strand

The authors say “Students who learn with understanding have less to learn because they see common patterns in superficially different situations.” (p. 10) Why do they say this? How do you think you could accomplish this in your work with students?

2. Computing Strand

Why do you think students struggle with computation? What is fluency and how does understanding assist fluent computing?

3. Applying Strand

Why is applying a concept or procedure a part of strong mathematical learning?

4. Reasoning Strand

The authors say “Reasoning is the glue that holds mathematics together.” (p. 14) How do people in your group encourage and support children in sharing their thinking?

5. Engaging Strand

In what ways can engagement be shown in mathematics and why is engagement an important part of mathematical proficiency?

6. Wrap Up

What statement or idea in this section did you find most intriguing?

**Discussion Questions for:
“Integrating the Strands of Proficiency”
(pp. 16-23, including the boxed in sections but omitting
the red page)**

1. The authors say “Developing the strands of proficiency individually is much harder than learning them together. In fact, it is almost impossible to master any one of the strands in isolation.” (p. 17) What are some examples of this? What do people in your group think about this?
2. How can the strands be integrated in learning number combinations? (*p. 18*) Have people who have tried these strategies share their experiences.
3. How can the strands be integrated in learning proportional reasoning? (*pp. 19-20*)
4. The authors say it is a myth that students cannot do more challenging work until they have mastered basic skills. How does the example on p. 23 or the other examples in this section support the idea that the basics can actually be developed alongside other mathematical experiences? (*p. 23+*)
5. How have people in your group integrated the strands in teaching math?

**Discussion Questions for:
How Does school Mathematics Need to Change?
(pp. 25-33 omit red pages)**

Have each group discuss the following questions in their groups:

1. What is required in teaching for mathematical proficiency?
2. What strengths do we already have in teaching mathematics in our school?
3. Where do we most need to make improvements to help more students become proficient in mathematics and to deepen the learning of our highest achieving students?