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## Adding It Up: Helping Children Learn Mathematics

National Research Council

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### DESCRIPTION

*Adding It Up: Helping Children Learn Mathematics*, by the National Research Council, calls for changes in curriculum, instructional materials, assessments, classroom practice, teacher preparation, and professional learning opportunities in an effort to improve mathematics teaching. Students from pre-kindergarten to grade 8 must learn to think mathematically and must think mathematically to learn. Mathematical proficiency, the term used for learning mathematics successfully, is described as having five components:

- Conceptual Understanding
- Procedural Fluency
- Strategic Competence
- Adaptive Reasoning
- Productive Disposition



Developing proficiency in teaching mathematics requires that teachers understand the mathematics they teach, how their students learn that mathematics, and how to facilitate that learning. Five parallel and related components of teaching for mathematical proficiency are described and will be a valuable resource for coaches and teachers. Helping teachers develop proficiency in teaching mathematics calls for schools to be organized so teachers are learners and professional development activities are focused on mathematical proficiency. Because proficiency with numbers is an important foundation in grades pre-K to 8 for building continued learning, one chapter is dedicated to exploring the mathematics of numbers. Specialists and teachers will find this chapter especially valuable in thinking and talking about what mathematical proficiency looks like in context.

### STAGE 1 LEADERSHIP DEVELOPMENT

*Adding It Up: Helping Children Learn Mathematics*, by the National Research Council, supports stage 1 leadership of those working to develop and model knowledge about instructional strategies that support the mathematical proficiencies. While no term can capture all aspects of what it means to learn mathematics successfully, mathematical proficiency describes the interwoven and interdependent strands of expertise, competence, knowledge, and facility in mathematics.

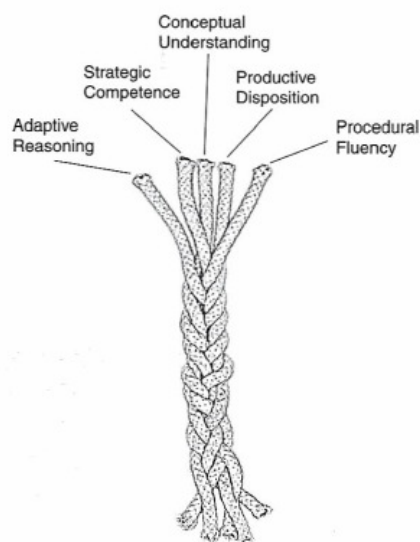
The five strands are described below:

- **Conceptual Understanding:** Comprehension of mathematical concepts, operations, and relations
- **Procedural Fluency:** Skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- **Strategic Competence:** Ability to formulate, represent, and solve mathematical problems
- **Adaptive Reasoning:** Capacity for logical thought, reflection, explanation, and justification
- **Productive Disposition:** The habit of seeing mathematics as sensible, useful, and worthwhile with a belief in diligence and one's own efficacy

The idea that the strands are intertwined has implications for how students acquire mathematical proficiency, how teachers develop that proficiency in their students, and how teachers develop the knowledge and skills to achieve that goal. Chapters 6 through 8 discuss the development of proficiency with:

- Whole Numbers
- Numbers including rational numbers, proportional reasoning, integers, negative numbers
- Extension of number concepts to algebraic thinking

Chapters 9 and 10 discuss teaching for mathematical proficiency and provide an examination of teaching that promotes learning over time so that it yields mathematical proficiency. Four classroom vignettes offer four distinct images of what mathematics instruction can look like and are followed by a discussion of the possibilities and risks of each approach.



**Intertwined Strands of Proficiency**