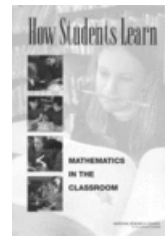


Update on References

How Students Learn: Mathematics in the Classroom

Adding It Up: Helping Children Learn Mathematics



How Students Learn: Mathematics in the Classroom

M. Suzanne Donovan and John D. Bransford, editors,
Committee on How People Learn:
A Targeted Report for Teachers

National Research Council

ISBN: 0-309-54802-0, 272 pages, 7 x 10, (2005)
This PDF is available from the National Academies
Press at: <http://www.nap.edu/catalog/11101.html>

Principle #1: Engaging Prior Understandings

1. Students come to the classroom with preconceptions about how the world works.

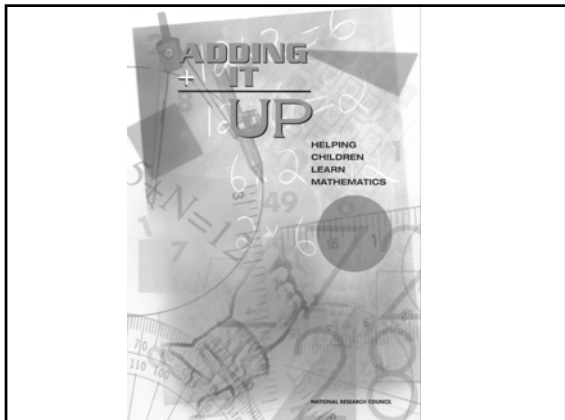
If their initial understanding is not engaged, they may fail to grasp the new concepts and information, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom.

Principle #2: The Essential Role of Factual Knowledge and Conceptual Frameworks in Understanding

2. To develop competence in an area of inquiry, students must
 - (a) have a deep foundation of factual knowledge,
 - (b) understand facts and ideas in the context of a conceptual framework, and
 - (c) organize knowledge in ways that facilitate retrieval and application.

Principle #3: The Importance of Self-Monitoring

3. A "metacognitive" approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving them.



Adding It Up: Helping Children Learn Mathematics

Jane Swafford, Bradford Findell, Jeremy Kilpatrick Editors;
Mathematics Learning Study Committee
National Research Council

ISBN: 0-309-50524-0, 480 pages, 7 x 10, (2001)
This PDF is available from the National Academies Press
at: <http://www.nap.edu/catalog/9822.html>

Strands of mathematical proficiency

1. *conceptual understanding* - comprehension of mathematical concepts, operations, and relations
2. *procedural fluency* - skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
3. *strategic competence* - ability to formulate, represent, and solve mathematical problems
4. *adaptive reasoning* - capacity for logical thought, reflection, explanation, and justification
5. *productive disposition* - habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

Recommendation 1

The integrated and balanced development of all five strands of mathematical proficiency should guide the teaching and learning of school mathematics.

Instruction should not be based on extreme positions that students learn, on one hand, solely by internalizing what a teacher or book says or, on the other hand, solely by inventing mathematics on their own.

Recommendation 2

Teachers' professional development should be high quality, sustained, and systematically designed and deployed to help all students develop mathematical proficiency.

Schools should support, as a central part of teachers' work, engagement in sustained efforts to improve their mathematics instruction.

This support requires the provision of time and resources.

Recommendation 3

The coordination of curriculum, instructional materials, assessment, instruction, professional development, and school organization around the development of mathematical proficiency should drive school improvement efforts.

Recommendation 4

Efforts to improve students' mathematics learning should be informed by scientific evidence, and their effectiveness should be evaluated systematically.
Such efforts should be coordinated, continual, and cumulative.

Recommendation 5

Additional research should be undertaken on the nature, development, and assessment of mathematical proficiency.