Welcome
Thank you for joining the webinar

The Hawaii STEM Learning Strategy and Network:

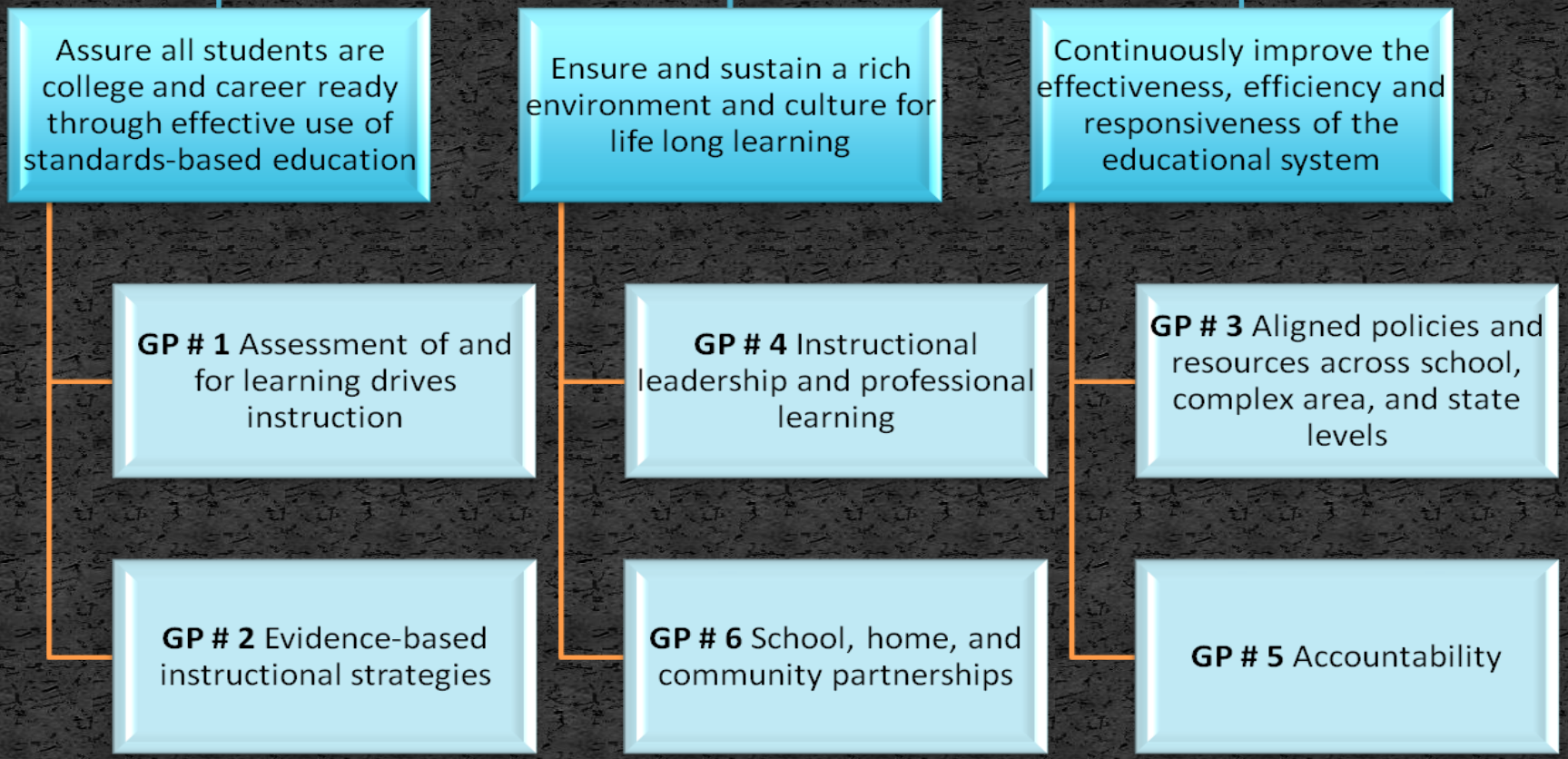
Standards of Mathematical Practice

The session will begin shortly.

Hawaii Department of Education
Office of Curriculum, Instruction and Student Support

Hawaii DOE's Strategic Plan

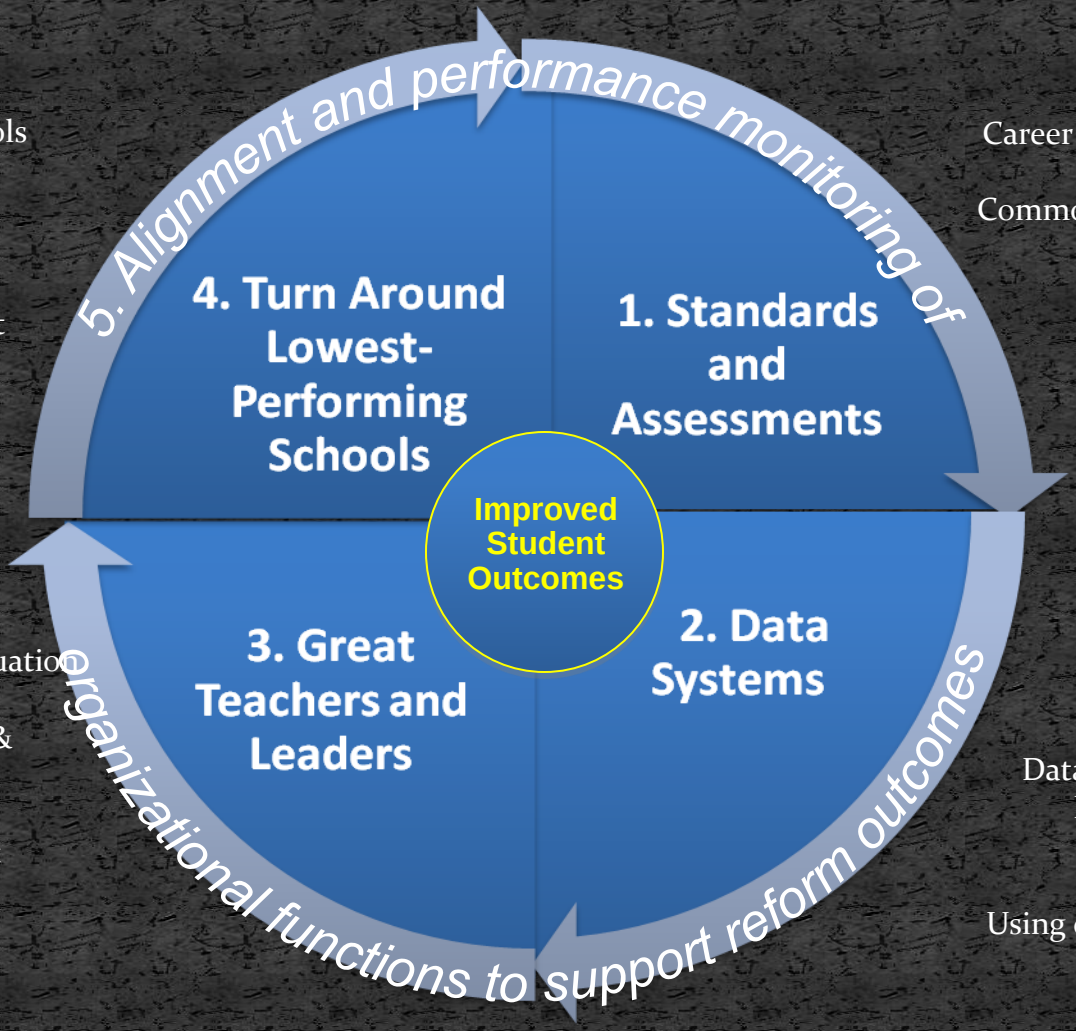
July 1, 2011- June 30, 2018



Hawaii's Five RTTT Pillars

Systems of Support to enable schools to do their best work – reprioritize and reorganize State resources; establish Human Resources Unit in Zones of School Innovation; automate

Focused support on lowest-performing schools
-
Zones of School Innovation
•Flexibility
•Great teachers and great leaders
•Remove barriers to learning



Common Core Standards
Career & College Ready Diploma
Curriculum Framework
Common Instructional Materials
Formative Assessments
Interim Assessments
Summative Assessments
STEM

Performance-based evaluation system
New Teacher Induction & Mentoring
Incentives
Leadership development
Alternative pathways

Data for School Improvement
Longitudinal Data System
Balanced Scorecard
Data Governance
Using data to inform instruction

The Hawaii STEM Learning Strategy and Network

Improving and advancing the character of
***S**cience, **T**echnology,*
***E**ngineering and **M**athematics*
education to prepare all students for the opportunities and challenges in our changing world.

What is STEM Education?

- STEM education integrates the study of science, technology, engineering and mathematics by using scientific inquiry and engineering design as unifying themes.

- It emphasizes innovation and the development of problem-solving, critical thinking and collaboration skills.

Goals of the Hawaii STEM LSN

- Transform and revitalize the teaching and learning of science and mathematics in grades K-12 by purposefully integrating technology and engineering with science and mathematics.
- Significantly increase the number of public school graduates who pursue or enter STEM-related careers or attain two- or four-year degrees in STEM fields.
- Increase STEM-foundational academic achievement and STEM learning opportunities for ***all*** students.
- Cultivate partnerships to expand and strengthen STEM education.

Why emphasize STEM Education?

- STEM is infused within every facet of our society and plays a major role in determining Hawaii's future viability.

- STEM education develops tomorrow's innovators who overcome the unforeseen challenges in health care, public safety, the economy, and the environment.

At its core, ***learning is about transforming information into knowledge.***

To instruct someone … is to teach
[the student] to participate in the process that makes possible the establishment of knowledge.

We teach a subject not to produce little living libraries on that subject, but rather to get students to think mathematically [or scientifically] for themselves … to take part in the process of knowledge-getting.

Knowing is a process, not a product.

--Lee Shulman

En·gi·neer·ing [en-juh-neer-ing] – noun

1. The art or science of making practical application of the knowledge of pure sciences..."

STEM Education is trans-disciplinary in nature, offering students the ability to use project-based learning to address real-world issues that affect their family, their community and their world.

--Teaching Institute for Excellence in STEM

Expected Outcomes

- Build an understanding of the standards for mathematical practice.
- Enhance skills in identifying the extent to which students exhibit the standards for mathematical practice.
- Generate ideas for how teachers can integrate the standards for mathematical practice with instruction to support student proficiency.

Let's do some math!

- On a sheet of paper, record the easiest way to find the sum of the numbers 1-20. Show or explain how you got your answer.

How did you solve the problem?

Solution 1

1+2=3+3=6+4=10+5=15+6
=21+7=28+8=36+9=45+10
=55+11=66+12=78+13=91
+14=105+15=120+16=136
+17=153+18=171+19=190
+20=210

Solution 2

9
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1

210

How did you solve the problem?

Solution 3

- Add the numbers 1-10

1+2+3+4+5+6+7+8+9+10=55

- For the numbers 11-20 add the number 1-10 again to represent the ones.

1+2+3+4+5+6+7+8+9+10=55

- Add the tens from the numbers 11-20

10+10+10+10+10+10+10+10+10+10=100

- Put them all together

55+55+100=210

Solution 4

Pair numbers together that add up to 21

1+20=21

2+19=21

3+18=21

4+17=21

5+16=21

6+15=21

7+14=21

8+13=21

9+12=21

10+11=21

Then multiply 21x10=210

Let's do more math!

- Record the easiest way to find the sum of the numbers 1-100

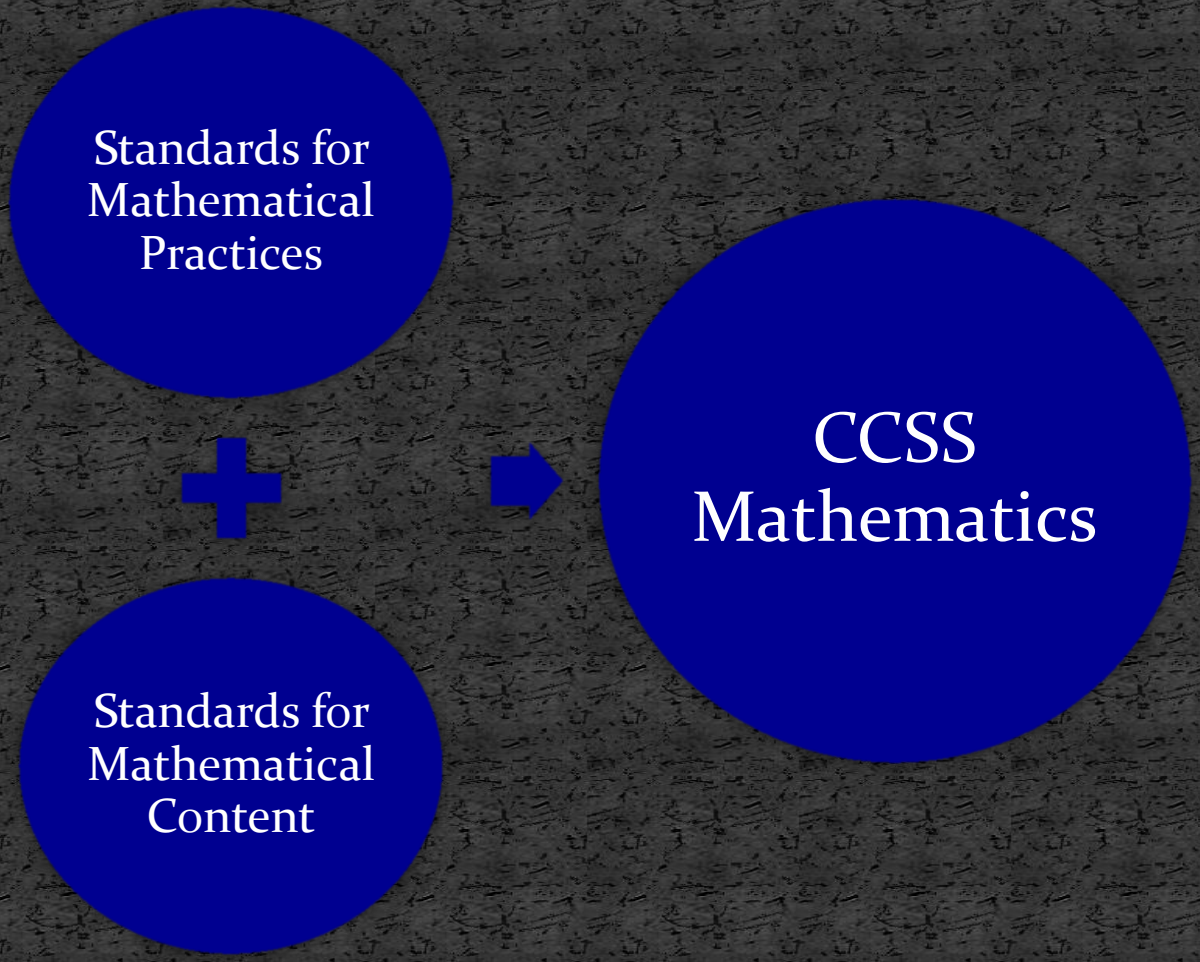
Let's do more math! Solution

- Use something similar to solution 4

$$1+100=101$$
$$2+99=101$$
$$3+98=101$$
$$\cdot$$
$$\cdot$$
$$\cdot$$
$$50+51=101$$

- There are 50 pairs of numbers that add up to 100 and one extra 50.
- 50x101=5050
- ***If you want to add consecutive integers 1-n, add the first and last integers together, then multiply the result by half the number of integers.***
- ***(N+1)(N/2)***

Common Core State Standards for Mathematics



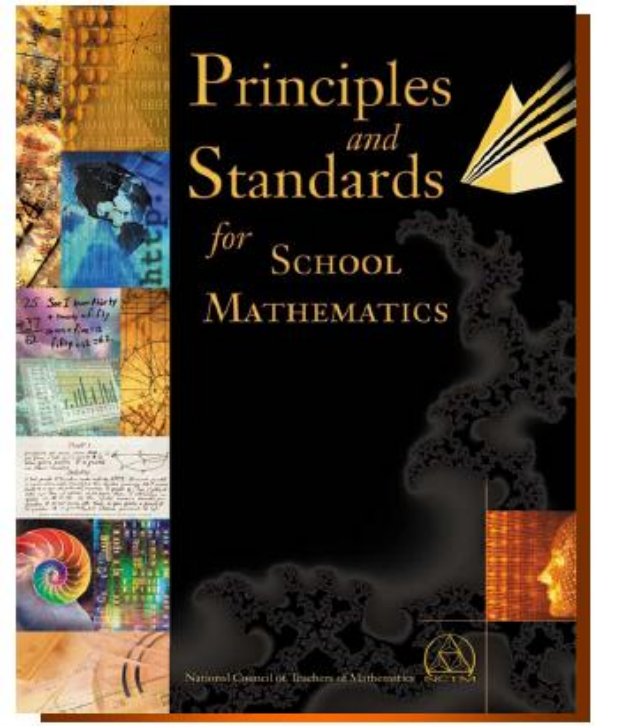
Standards for Mathematical Practice

*The Standards for Mathematical Practice describe varieties of **expertise** that mathematics educators at all levels should seek to develop in their students. These practices rest on important '**processes and proficiencies**' with longstanding importance in mathematics education.*

- Common Core State Standards for Mathematics, page 6

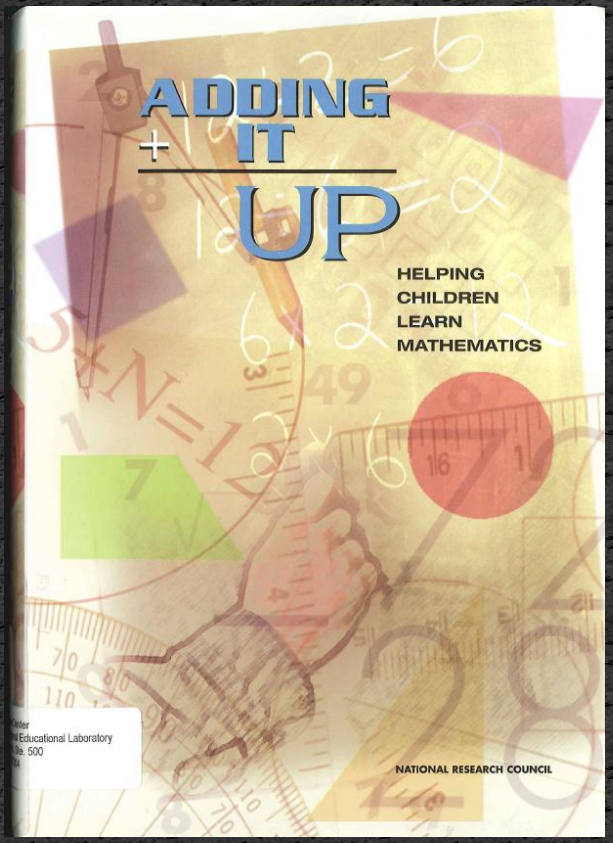
Draws from Two Sources

Principals and Standards for School Mathematics



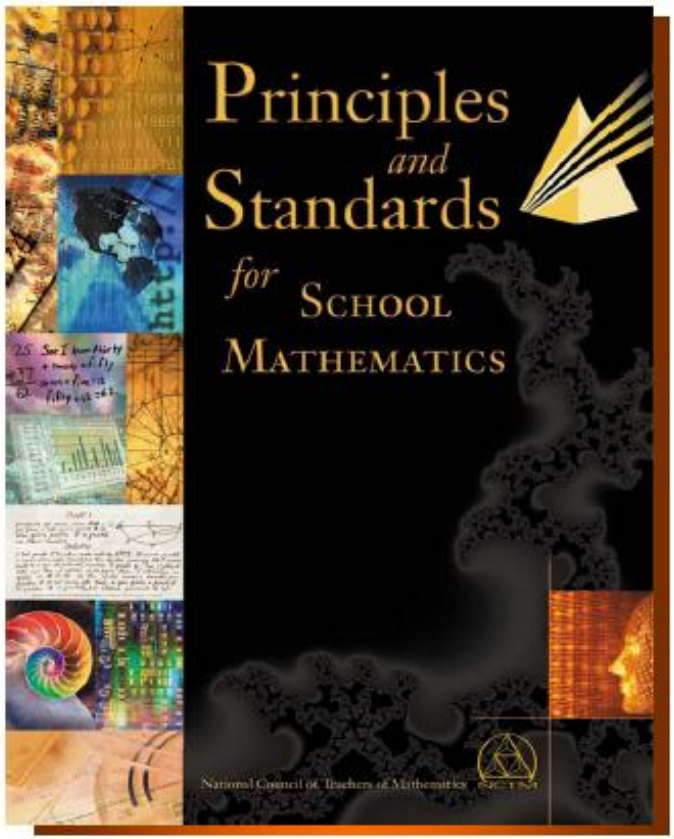
NCTM (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

Adding It Up



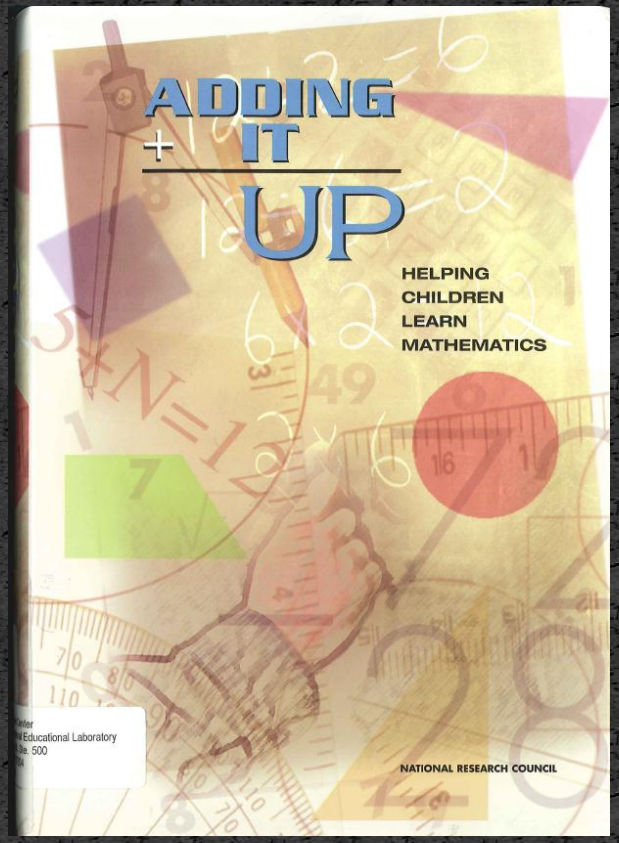
NCTM Process Standards

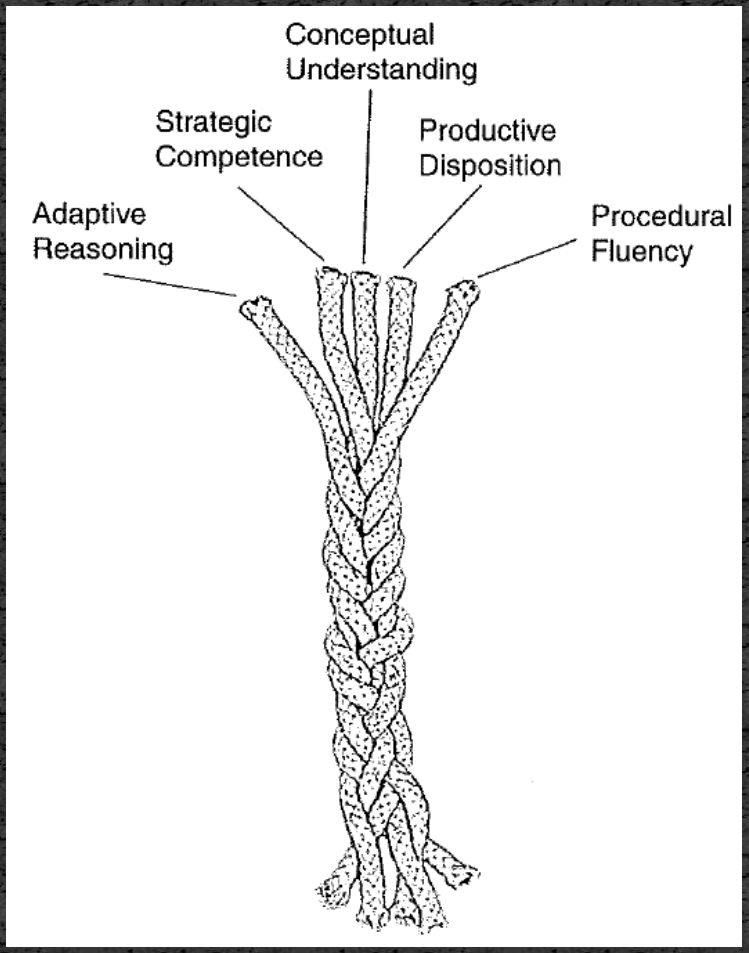
- Problem Solving
- Reasoning and Proof
- Communication
- Representation
- Connections



NCTM (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

Adding It Up: Strands of Mathematical Proficiency





The Standards for Mathematical Practice

1. *Make sense of problems and persevere in solving them.*
2. *Reason abstractly and quantitatively.*
3. *Construct viable arguments and critique the reasoning of others.*
4. *Model with mathematics.*
5. *Use appropriate tools strategically.*
6. *Attend to precision.*
7. *Look for and make use of structure.*
8. *Look for and express regularity in repeated reasoning.*

Grouping of Mathematical Practices

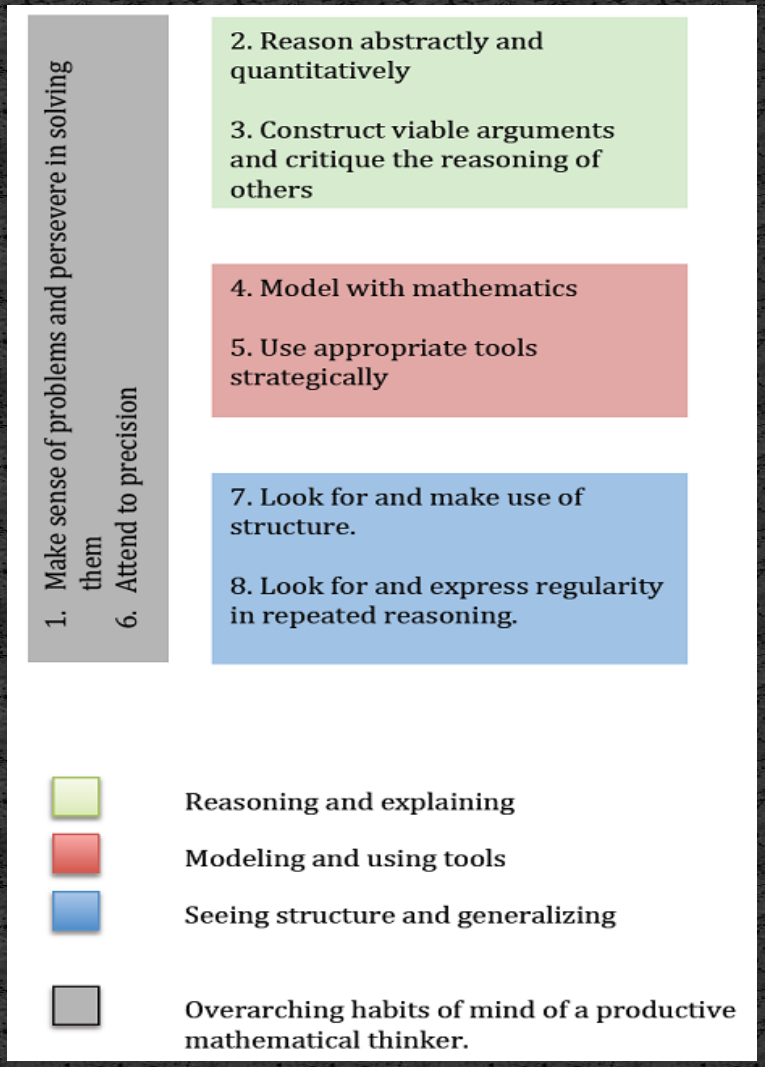
Overarching Habits of Mind of a Productive Mathematical Thinker

1. Make sense of problems and persevere in solving them
6. Attend to precision

Reasoning and Explaining

2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others

Adapted from (McCallum, 2011)



Grouping of Mathematical Practices

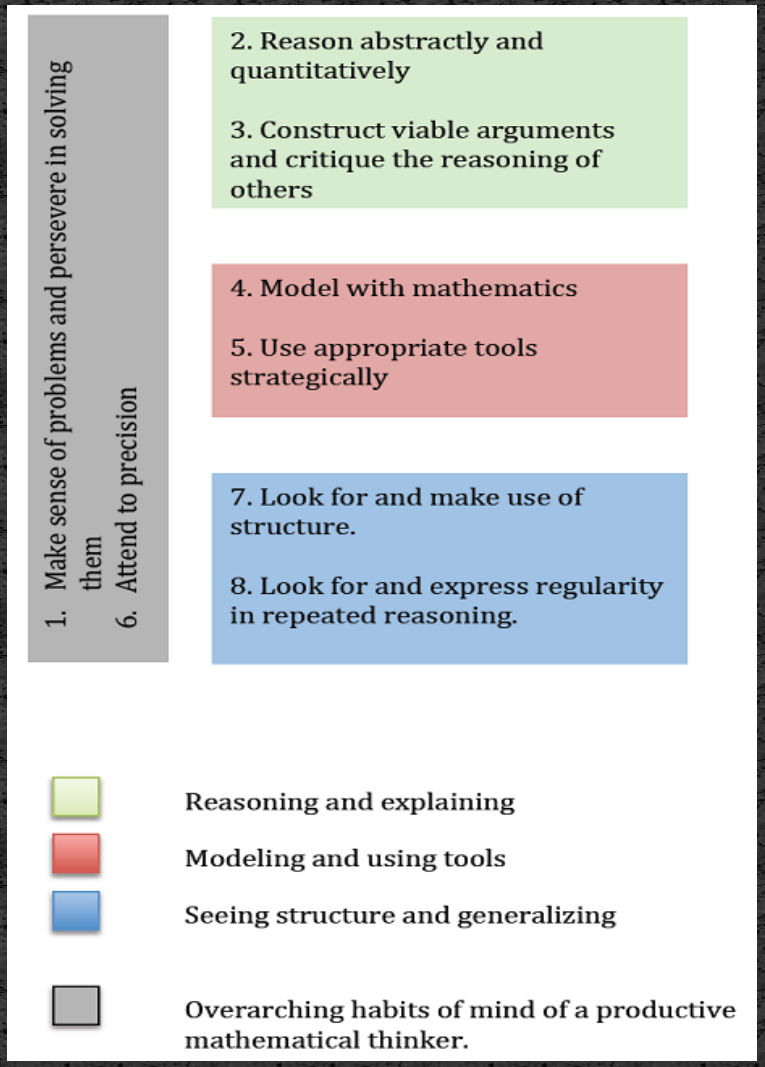
Modeling and Using Tools

4. Model with mathematics
5. Use appropriate tools strategically

Seeing Structure and Generalizing

7. Look for and make use of structure
8. Look for and express regularity in repeated reasoning

Adapted from (McCallum, 2011)



Mathematics Proficiency Matrix

Students:	Initial	Intermediate	Advanced
1a. Make sense of problems	Explain their thought processes in solving a problem one way.	Explain their thought processes in solving a problem and representing it in several ways.	Discuss, explain, and demonstrate solving a problem with multiple representations and in multiple ways.
1b. Persevere in solving them	Stay with a challenging problem for more than one attempt.	Try several approaches in finding a solution, and only seek hints if stuck.	Struggle with various attempts over time, and learn from previous solution attempts

Available Resources

- SMP Livebinder http://tinyurl/smplivebinder
- Inside Mathematics www.insidemathematics.org

Reflection

- On a scale of 1 (low) to 5 (high), to what extent is your school promoting students' proficiency for the SMPs?

Next Steps

- Build upon and extend connections between the SMPs and what you know of past standards (e.g. NCTM & Adding it up) as well as what you know about best practices.
- Phase in implementation. Get comfortable with 2 or 3, then try more.
- Purposefully modify/design instruction to engage students in the SMPs.

Contact Us

- STEM Resource Teachers: Eliza Akana, Linda Higashi, Charles Souza, & Eric Kam
- Educational Specialist for Science: Derrick Tsuruda
- Educational Specialist for Mathematics: Dewey Gottlieb