

Leading the Learning

Enhancing Math Teaching and Learning



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Standards for Mathematical Practice In a Nutshell

- 1. Make sense of problems and persevere in solving them.
 - Understand the process of solving problems
 - Know and apply strategies for solving problems
 - Have a positive attitude toward solving problems
- 2. Reason abstractly and quantitatively.

Recognize the link between symbols and real situations.

- Decontextualize to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own
- Contextualize to pause as needed during the manipulation process in order to probe into the referents for the symbols involved
- 3. Construct viable arguments and critique the reasoning of others.
 - Students can justify their answers and processes.
 - Students can effectively communicate their justifications through talk and
 - writing.
- 4. Model with mathematics.
 - Students can represent math ideas using pictures, diagrams, tables, charts...
 - Students can analyze math situations through models and draw conclusions.
- 5. Use appropriate tools strategically.
 - Students can decide when to use tools and which tools to use paper and pencil, concrete objects, spreadsheets, calculator, protractor, other technology.
- 6. Attend to precision.
 - Students can calculate accurately and efficiently.
 - Students can precisely communicate their mathematical thinking.
- 7. Look for and make use of structure.
 - Students can see the flexibility of numbers.
 - Students notice patterns and functions.
 - Students understand properties.
- 8. Look for and express regularity in repeated reasoning.
 - Students can discover shortcuts, rules, or generalizations.

What can we do?

- 1. Step back and let them think.
- 2. Give math a context and make connections between math ideas.
- 3. Make math visual. Let them see it, touch it, and move it.
- 4. Provide opportunities for talk and writing about math.
- 5. Watch, listen, and adjust our math instruction. Let our students guide us.

From Math in Practice, A Guide for Teachers

Then vs. Now: Examining Our Beliefs about Mathematics

My Ten Misinformed Beliefs about Math	Did you believe it then?	What happened in your math classroom to contribute to that belief?	Do you believe it now?
1.Practice makes perfect!			
2.Mastering calculations is the ultimate goal of mathematics.			
3. Math is about getting the right answer.			
4. Mathematics is a series of isolated skills.			
5.You must know basic skills before you can learn to solve problems.			
6.The first one finished wins!			
7.The best mathematicians can work calculations in their heads.			
8.The teacher's job is to tell us how to do math.			
9.Math is done in math class.			
10.Some people are good at math and some aren't.			

Why is change so difficult for math teachers?

- They often don't see the need for the change.
- The amount of change feels overwhelming. •
- There are strong habit patterns. •
- There is a fear of failure.

Our Goal: To Facilitate Change

Focus: What needs to change? Buy-in: Desire for change Roadmap: The tools to change

Agree or Disagree?

- 1) To be a good math teacher, you have to understand math content.
- 2) Most teachers have a solid understanding of math standards.
- 3) Good mathematicians make good teachers of mathematics.
- 4) Most teachers feel confident teaching math.



Know the Math

Content (understand skills and concepts bevond memorizing algorithms and shortcuts)

Examining Standards

For each standard below, what do students need to know and do?

MGSE1.G.3

Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.

MGSE2.OA.2

Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.

MGSE 2.NBT.5

Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

MGSE 3.0A.1

Interpret products of whole numbers, e.g., interpret 5×7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5×7 .

MGSE 4.NBT.5

Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

MGSE5.NBT.7

Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.

MGSE 6.NS.3

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

What if your teachers misinterpret the standards?

How might that impact task selection?

How might that impact laying the foundation for upcoming skills?

What if your teachers don't understand the mathematics deeply enough?

How might that impact their teaching?

A Look at Instructional Strategies Step Back and Let Them Think

Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.

Start with a Problem:

Brendan had 142 baseball cards in his collection.

His mom gave him a package with 10 more cards.

How many cards did he have in his collection then?

Model the Problem. Gather and record data. Observe and analyze the data.



Figuring Out the Rule

Repeat with other numbers. What do you notice? 142 235 421 648 783 152 245 431 658 793 What digit changes? Why? Predict: What is 368 + 10? Check your prediction with a model. Does this make sense? Explain. What is the rule?

Multiply a Single-digit Whole Number by a Multiple of 10 Problem:

Molly had 3 boxes of granola bars. There were 20 bars in each box. How many granola bars did she have? What operation could you use to solve this problem? What equation works with this problem? Explain.



Round a 3-digit Number to the Nearest Hundred



Explain why a fraction $\frac{a}{b}$ is equivalent to a fraction $\frac{n \times a}{n \times b}$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size.



What do these tasks have in common?

- Do you see evidence of the SMPs?
- What is the role of visuals?
- What is the role of math talk?

- How do they allow for formative assessment?
- How are these different from "I do. We do. You do."?

What questions should we ask?

How?

- Can you help me understand what you did?
- How did you solve it?
- How did you get that answer?

Focus: procedures

Why?

- Why do you think that?
- How could you prove that?
- Can you give me an example to support your thinking/prove your point?
- What can you tell me to help me understand why you chose that strategy?

Focus: conceptual understanding, justification





How does this compare to ...?

- How is this like...?
- How is this different from ...?
- When have you seen this before? Explain.
- How is this method like one you have used before?

Focus: comparison, connections

What do you notice?

- What did you observe happening?
- What do you notice about our data?
- What patterns do you see?

Focus: observations, inquiry

What is the big idea?

- What is the rule?
- Will it always work? Explain your thinking.

Focus: generalizing

Figuring Out the Rule



What did you learn?

- What did you learn today?
- What surprised you today?
- What questions do you have about the lesson?
- Where did you get stuck today? How did you get unstruck?

Focus: summarizing, reflecting, closure

Кеер	Let Go
Add	Modify

"It is good to host a dynamic speaker or a stimulating, thought provoking presentation for the entire faculty. It can be mind opening and exciting.

But, unless and until there is skilled follow up and continued nurturing of the energy and small and large steps of courage, little changes."

Why Professional Development Fails J. Berkowicz and A. Myers Education Week Blog, Jan. 14, 2018

Why Book Study?

- Gets teachers talking to each other
- Allows teachers to share their ideas about practice, respecting their knowledge
- Promotes reflection as teachers consider and debate the thoughts of the author
- Infusion of new ideas and perspectives (research, theory, insights, tasks)
- Opportunity to mull over concepts (ongoing over time)
- Introduces teachers to new books and authors and allows them to reread and continue to explore when study is done
- Opportunity to try ideas and reflect on their own practice

Books to Consider

Accessible Mathematics, Steven Leinwand (Heinemann, 2009)

Balancing the Equation, Matthew Larson and Timothy Kanold (Solution Tree, 2016)

Becoming the Math Teacher You Wish You'd Had, Tracy Johnston Zager (Stenhouse, 2017)

The Formative Five, Francis Fennell, Beth Kobett, Jonathan Wray (Corwin, 2017)

Introduction to Communication, Susan O'Connell (Math Process Standards Series, Heinemann, 2007)

Introduction to Problem Solving, Susan O'Connell (Math Process Standards Series, Heinemann, 2007)

Math in Practice: A Guide for Administrators, Susan O'Connell and John SanGiovanni (Heinemann, 2016)

Math in Practice: A Guide for Teachers, Susan O'Connell (Heinemann, 2016)

Mathematical Mindsets, Jo Boaler (Jossey-Bass, 2015)

Number Talks, Sherry Parrish (Math Solutions, 2014)

Principles to Actions, National Council of Teachers of Mathematics (NCTM, 2014)

Putting the Practices into Action, Susan O'Connell and John SanGiovanni (Heinemann, 2013)

Teaching Student-Centered Mathematics, John Van de Walle, K. Karp, L. Lovin, J. Bay-Williams (Pearson, 2013)

Exploring the Book

- 1. Read and reflect on your reading (maybe complete brief reflection sheets)
- 2. Come ready to discuss (preview the discussion questions)
- 3. Try ideas between sessions and bring samples to the group if you have any

Book Study on Social Media

Download the summer 2017 slow chat slides from the *Math in Practice* website at www.mathinpractice.com or from the *Math in Practice* Facebook page.

Observing Teaching Through Video Clips

Short video clips are available in the online resources of Math in Practice: A Guide for Teachers.

Math in Practice: A Comprehensive Coaching Resource A Framework to Guide Math Coaches

As a Math Coach/Specialist, you support the teaching and learning of math within your building. Undeniably, your responsibilities are varied and challenging. You may be asked to conduct professional development workshops, facilitate data meetings, lead book study groups, facilitate collaborative planning meetings, provide demonstration lessons, or organize schoolwide math events. You may be asked to support new teachers who are just beginning their career or to help teachers who are teaching math at a new grade level. You may be asked to increase teachers' understanding of math content, knowledge of math standards, or expertise with instructional strategies. You may be asked to work with teachers who lack confidence in their math abilities or those who may be resistant to trying new strategies. It is vital that you have ready resources at your fingertips to accomplish the many and varied responsibilities of a K-5 Math Coach.

How can Math in Practice support you in this role?

Math in Practice was designed to transform K-5 math teaching and enhance math learning. It is an 8-book set that contains a *Guide for Teachers, Guide for Administrators,* and grade-level books for grades K-5. Each book in this series has features that support the role of the Math Coach, and together they provide a wealth of resources to meet your varied needs.

Math in Practice: Guide for Teachers

The Introduction of this book explores the changes in teaching math from when we were students to now as teachers and promotes reflection on where we are in our journey to becoming the math teacher we truly hope to be! The remaining chapters discuss important instructional approaches that highlight the changes in teaching math and offer practical tips and suggestions for implementing each one.

- Chapter 1 Step Back and Let Then Think
- Chapter 2 Building Bridges Using Context and Connections
- Chapter 3 See it, Touch It, Move It
- Chapter 4 Talk About It, Write About It
- Chapter 5 Let Students Guide our Teaching

Feature	How a Math Coach Might Use It
The Introduction in the Guide	Have teachers read and discuss this chapter to identify where they might
for Teachers is a reflection on	be on this journey. How and why have they changed their instructional
the changes in K-5 math	practices in recent years?
teaching and where we are in	
the change process.	
Book study questions can be	Set up as a teacher book study using the questions at the end of each
found at the end of each	chapter to spark conversations and reflection about instructional
chapter.	practice.
Practical tips are found	These "tips" lists are perfect for sharing with teachers during PLCs,
throughout the chapters.	workshops, grade-level planning sessions, or individual coaching
	sessions. Find tips sheets on teaching through discovery, supporting
	problem solving, creating a climate conducive to math talk, using
	children's literature in math class, modifying math tasks, and much more.
Short video clips (in the online	The brief video clips are perfect for PD. A brief description and discussion
resources)	starter is included with each. Share a clip and then have teachers discuss

Following are some features of the *Guide for Teachers* that support your role as math coach:

	what they noticed (i.e., What types of questions did the teacher ask?
	What did they notice about student insights? What might they do
	differently and why? What would they suggest the teacher do next?).
Bibliography of children's	Share this annotated bibliography with teachers who want to connect
literature related to math	the math they are teaching to engaging stories. Discuss some of the ideas
content (in online resources)	on pages 71-75 to support the planning of lessons that integrate math
	and literature.

Guide for Administrators

The *Guide for Administrators* was written for school or district administrators and math coaches. This book provides tips and strategies for leading K-5 teaching and learning. It is filled with strategies and tips for enhancing your role as math coach and includes a wealth of online resources to make your job easier.

Chapter	"Don't Miss" sections for	How a Math Coach Might Use It
	Math Coaches	
1	Leading for Change (pp 14-	Read this section to reflect on why this change process is so
	17)	difficult for your teachers.
2	Gathering Insights About	Read this section for practical tips for walk-throughs and
	Math Teaching Through	coaching observations. See the online resources for lists of
	Observation (pp 27-44)	what to look for as you observe math teaching.
3	Analyzing Testing Data (pp.	Read this section for a step-by-step protocol for facilitating
	46-54)	discussions about school data and developing a school action
		plan. See the online resources for templates to identify
		contributing factors to the school data and recording the action
		plan.
3	Analyzing Students' Work	Read this section for a step-by-step protocol for facilitating
	(pp. 54- 61)	discussions about student work including discussions of
		students' observed strengths and needs, and implications for
		further teaching. See the online resources for sample
		constructed response tasks for grades K-5 as well as templates
		and questions to guide teacher discussions.
4	Exploring Professional	Gather tips for facilitating professional learning through small-
	Learning Options (pp. 68-	group meetings (e.g., collaborative planning, faculty study
	80)	groups, book study), for conducting demonstration lessons and
		co-teaching experiences, and for planning and conducting
		workshops. Explore the online resources to gather planning
		sheets, sample agendas, book study reflection sheets, a teacher
		needs assessment, and other PD planning resources.
5	Communicating with	Gather ideas for planning events that help parents understand
	Parents (pp. 110-115)	our vision of elementary mathematics including back-to-school
		nights, family math nights, math fairs, and many more. See the
		online resources for sample planning sheets, parent/child math
		calendars, and math fair ideas.
5	Frequently Asked Questions	Read this section to reflect on, and share with teachers,
	(pp. 116-124)	trequently-asked parent questions and how we might answer
		them. Included is a list of resources for developing parent
		programs.

Conclusion	Thinking Through the	A comprehensive series of questions to guide your
	Change/Making the Change	school/district's efforts to transform math teaching. Use these
	(pp. 125-129)	questions to prompt staff discussions or guide your reform
		efforts.

Math in Practice Grade-by-Grade Guides

The Math in Practice grade-level books offer a wealth of resources for teachers, but also have many features that support your role as math coach. These books, along with providing a wealth of grade-level specific lessons, formative assessments, and practice tasks, are perfect tools for guiding collaborative planning.

Feature	How a Math Coach Might Use It
About the Math	Each module begins with an About the Math section that gives a quick look at
	the math to be taught. This section includes examples and diagrams and
	discusses, in teacher-friendly terms, what is expected of students. This brief
	view of the math content and standards is a great way to start planning
	meetings.
Progressions Chart	Found in the About the Math section, this quick progression chart shows how a
	skill appears in the grade before and the grade after. You might highlight the
	importance of teachers knowing what comes before/after as they plan their
	grade-level lessons. What comes before might provide ideas for initial tasks that
	check for retention of key ideas from the prior year, and what comes after
	guides teachers to thoroughly prepare students for the complexity of the skill in
	the subsequent year.
Learning Outcomes	These simple "I can" statements sum up the skills/concepts and provide focus
	during teacher planning.
Ideas for Instruction and	You might look through the lessons in this section to discuss key elements of the
Assessment	lessons (hands-on and visual explorations, problem solving integrated with other
	skills, teacher questioning). Discuss and select formative assessments with
	teachers. Many of the formative assessments include some student work, so you
	can discuss what we would like to see and what types of responses demonstrate
	proficiency.
Additional Ideas for	Do teachers need ideas for continuing the learning with a small group of
Support and Practice	students who need more time? Do they need suggestions for getting students
	talking about the ideas? Would they benefit from finding engaging practice tasks
	that might take the place of traditional worksheets? This section provides lots of
	choice for support and practice.
Thinking Through a	One lesson in each module is titled "Thinking Through a Lesson". This lesson has
Lesson	additional support (coaching speech bubbles) to help teachers get a glimpse into
	the thoughts of the teacher who developed the lesson. These are great lessons
	to discuss with teachers!
Vocabulary Lists	These appear near the end of each module and highlight important content
	Vocabulary. Brainstorm ways to develop this language with students. You might
	refer teachers back to the Guide for Teachers (Chapter 4) for ideas on
	developing content vocabulary.
Table of Contents for	At the end of each module is a list of the online resources that relate to the
Unline Resources	activities in that module. Explore the resources with teachers. Are there any that
	might be modified to work more effectively with this group of students? Most
	Thes are in indicrosoft word to allow them to be easily customized.

Math in Practice as a Tool for Change

As a math coach, do you find yourself being pulled in different directions due to the varied needs of the K-5 math teachers with whom you work? While some need greater content knowledge, others would benefit from an understanding of progressions, while still others need support with changes to their teaching practice? Do you find that you just don't have enough time to do the many tasks you are charged to do? *Math in Practice* is filled with resources to make your job easier, from the *About the Math* sections of the grade-level books to the teaching tips found throughout the *Guide for Teachers* to the protocols and planning sheets in the *Guide for Administrators*. Both in the books and in the many online resources, you will find a wealth of tools to support you as you work to enhance your elementary math program.

Please become a part of the *Math in Practice* family by joining our *Math in Practice* Facebook group to gather and share ideas for teaching K-5 math.

For more information about the series, visit the *Math in Practice* website at <u>https://www.heinemann.com/mathinpractice/</u>.

Sort the following into 2 categories: "I did this a lot!" or "I don't remember much of this!"

Had discussions about how we got our answers and brainstormed other possible answers or approaches

Memorized facts and formulas

Listened to the teacher telling us how to do math

Were allowed to do our assignments with a partner

Talked about when we would use math outside of the classroom

Solved problems with other students (group problemsolving)

Used hands-on materials to visualize math ideas

Did worksheets

Did lots of computations in one sitting

Teacher Resource Books by Sue O'Connell Published by Heinemann (www.heinemann.com)

Math in Practice (www.mathinpractice.com)

This series is filled with lesson ideas, instructional strategies, practice tasks, and many online printable resources to make teaching K-5 math more meaningful and more fun. There is a book for each grade level K-5 that contains a wealth of grade-specific activities, as well as a *Guide for Teachers* filled with instructional strategies to support greater understanding of math concepts. A *Guide for Administrators* offers tips and strategies for math coaches/administrators. Visit the website at **www.mathinpractice.com** to view samplers, see videos, and learn more about the series.

Putting the Practices into Action - Implementing the Common Core Standards for Mathematical Practice K-8 with John SanGiovanni

The Standards for Math Practice are the heart and soul of the Common Core State Standards. This book explains each standard in teacher-friendly terms and highlights practical activities to make the standards come alive in classrooms. It contains PLC study group questions and online resources.

Mastering the Basic Math Facts for Addition and Subtraction Mastering the Basic Math Facts for Multiplication and Division

with John SanGiovanni

Through investigations, discussions, visual models, children's literature, and hands-on explorations, students explore the math operations, and through engaging, interactive practice achieve fluency with basic facts. A teacher-friendly CD filled with customizable activities, templates, recording sheets, and teacher tools simplifies your planning and preparation. Over 450 pages of reproducible forms are included in English and Spanish translation.

The Math Process Standards Series

Each book in this series is a practical guide for helping students refine their skills in the highlighted math process (problem solving, communication, reasoning, representations, connections). You will find specific teaching strategies and tips to help all students strengthen their skills. Included with each book is a CD filled with teacher tools and customizable student activities to allow you to change names, data, or spacing for a quick way to differentiate instruction within your classroom.

Introduction to Problem SolvingIntroduction to CommunicationIntroduction to RepresentationIntroduction to Reasoning and ProofIntroduction to ConnectionsIntroduction to Reasoning and Proof

All books in this series are available for Grades PK-2, Grades 3-5, and Grades 6-8.

Now I Get It: Strategies for Building Confident and Competent Mathematicians, K-6

Good teaching is the critical factor that helps students "get" math. This book is a practical handbook for the teaching of mathematics, with chapters addressing the teaching of problem solving, the use of manipulatives, differentiating instruction, effective teacher questioning, increasing math talk, and much more. The book includes a CD with over 100 pages of resources to support teachers including manipulative templates, math facts game templates, a bibliography of math-related literature, center ideas, math websites, problem-solving and writing tasks, and a variety of other practical resources.

For additional resources, visit www.qualityteacherdevelopment.com

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