

Mathematical Mindsets:

Unleashing Students' Potential Through Creative Math, Inspiring Messages and Innovative Teaching

By Jo Boaler (Jossey-Bass, 2016)

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What is BookBits?

***This is THE MAIN IDEA's *first* BookBits – a much **shorter version** of the summaries I usually send. BookBits are just a few pages, share the **highlights of a book**, and include some **useful takeaways**. I would love to have **guests write a BookBits** about a book that has been particularly useful in their practice. If you would like to volunteer, I am happy to waive next year's subscription fee. Please send me an email: J.David-Lang@TheMainIdea.net. Thanks! --Jenn

What are the main ideas?

The main ideas of the book:

- ~ Too often, students fear math and have a distorted view of it. This results in a nationwide dislike of math and a widespread underachievement in it as well.
- ~ To counter these damaging views, this book shows teachers how to encourage students to develop a more positive *mathematical mindset*: math is reachable, enjoyable, and is about thinking and sense making.

We've heard a lot about the harmful effects of what Carol Dweck calls a fixed mindset. This is particularly detrimental in math. Brain research shows that with the right teaching and messages, all students can be successful in math. However, to change our students' math mindsets is not as simple as changing the words we use. We need to change the messages we send through our questions, the math tasks we assign, the way we group students, the feedback we give, how we address mistakes, and more. Boaler provides a bold vision of what mathematics education *should be*. She not only describes her philosophy, but she provides concrete guidance for transforming computation into rich mathematical tasks, making math more equitable, helping students develop a growth mindset, and approaching assessment in a more fruitful way. This is an important book that covers a lot of ground!

Jo Boaler is one of the best known math educators and is doing fabulous work to excite educators to teach math in a more inspirational way. She is a professor of math education at Stanford University but has also reached thousands of teachers through her MOOCs and other online courses. Her first book, *What's Math Got to Do With It*, showed teachers and parents how to make math both more enjoyable and more attainable for students.

Why would a school leader want to read this?

Even if you are not an expert in math, this book will help any leader understand why a more traditional approach to teaching math has been detrimental to so many kids. This book is about changing the *culture* of math classes and the leader sets the tone for the culture in the school. Even if you only have limited time, read a few chapters (I suggest Chapter 2 (The Power of Mistakes and Struggle), Chapter 5 (Rich Mathematical Tasks), and Chapter 9 which is an overview of the whole book, (Teaching Mathematics for a Growth Mindset)). This book is tremendously useful in helping with what to look for when observing math instruction. I would also buy this book for any math leaders in the school and have them do PD with their math team using the ideas in the book. Email Jenn for PD ideas to go with this book.

A Few Highlights

Below are four useful lists from the book. School leaders can use these to share with math teachers for discussion, to help math teachers with their planning (e.g., the first days back at school and making math tasks richer), and to help instructional leaders know what to look for when observing math instruction.

For Homework: 3 Better Questions Rather Than 40 Mindless Ones

1. What were the main math concepts you learned today?
2. What questions do you still have and if you don't have one, write a similar problem and solve it instead.
3. Describe a mistake or misconception from today's class and what you learned from it.

6 Ways Teachers Can Make Their Math Tasks Richer

1. Open tasks to include multiple pathways. (E.g., "You know the rule for 1 divided by $\frac{2}{3}$. Now *make sense* of your answer.")
2. Make it an inquiry task. (E.g., instead of find the area of a 12 by 4 rectangle, ask to find many rectangles with an area of 48.)
3. Ask the problem *before* teaching the method. (E.g., ask calculus students to find the volume of a lemon before teaching them how to find the area under a curve.)
4. Add a visual component. (Have students draw diagrams, pictures, or use objects like multilink cubes and algebra tiles.)
5. Make the floor low and ceiling high. (Give a problem all can solve but extend it by asking those who finish to create a new question that is similar but more difficult.)
6. Require students to convince others and reason. (Require that students provide more than just an answer on its own.)

5 Messages Math Teachers Should Explicitly Share with Students in the First Days of School

1. I believe in every one of them, there is no such thing as a math brain or a math gene, and I expect all of them to achieve at the highest levels.
2. I love mistakes. Every time they make a mistake their brain grows.
3. Failure and struggle do not mean that they cannot do math—these are the most important parts of math and learning.
4. I don't value students working quickly; I value their working in depth, creating interesting pathways and representations.
5. I love student questions and will put these onto posters that I hang on the walls for the whole class to think about.

The 7 Most Important Norms to Introduce, Post, and Reinforce All Year Long

1. Everyone can learn math to the highest levels.
2. Mistakes are valuable.
3. Questions are really important.
4. Math is about creativity and making sense.
5. Math is about connections and communicating.
6. Depth is much more important than speed.
7. Math class is about learning, not performing.

14 Additional Online Resources Mentioned in the Book

- Youcubed.org: This is Jo Boaler's website and it's chock full of resources – courses, math problems, videos, handouts, etc.
- For rich mathematical tasks, take a look at these other online resources: NCTM.org, Illuminations.nctm, mathforum.org, blog.mrmeyer.com, videomosaic.org, nrichmaths.org, estimation180.com, visualpatterns.org, numberstrings.com, and mathalicious.com. For manipulatives, see Geometry Pad, GeoGebra, and Tap Tap Blocks.