



Incorporating Mathematical Mindsets

georgewoodbury.com/mindsets

AMATYC Session S017

Orlando, FL – November 15, 2018



Introduction: What Makes The Difference?

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Introduction

Jo Boaler:

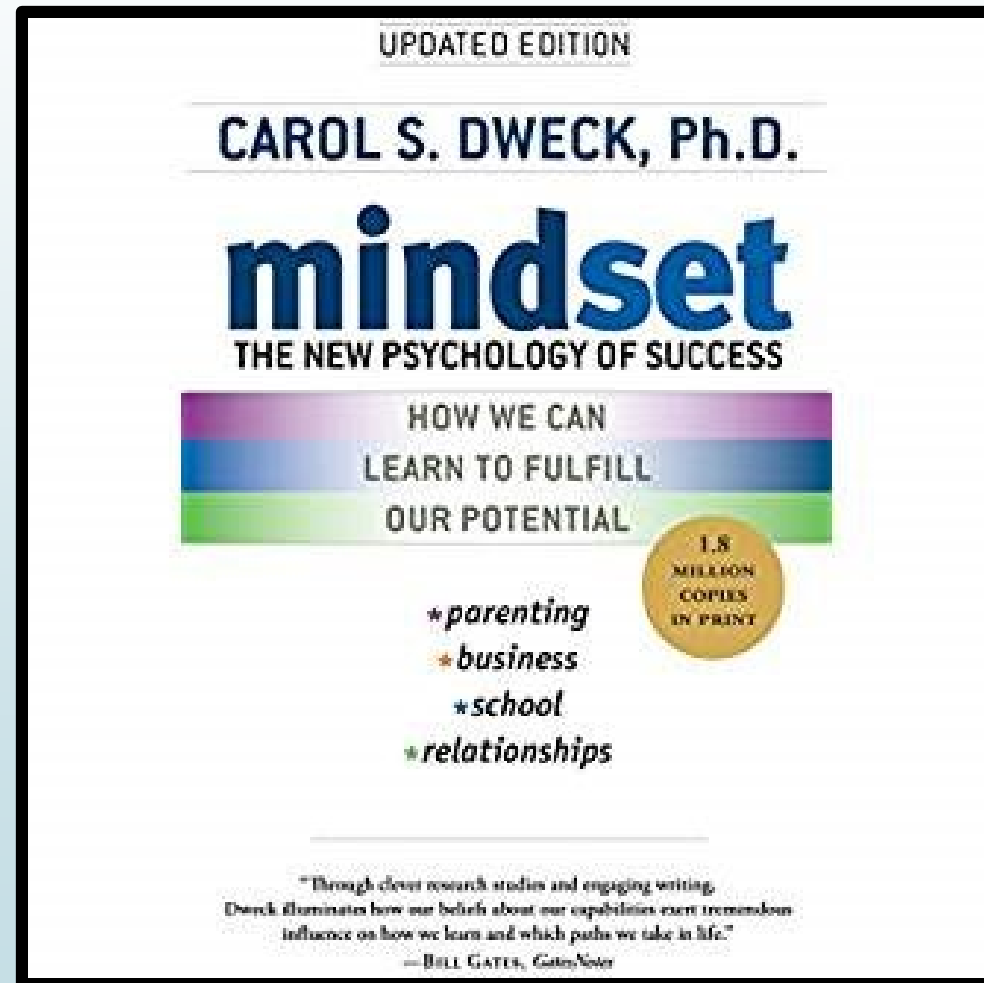
- ▶ A lot of scientific evidence suggests that the difference between those who succeed and those who don't is not the brains they were born with, but their approach to life, the messages they receive about their potential, and the opportunities they have to learn.



Books

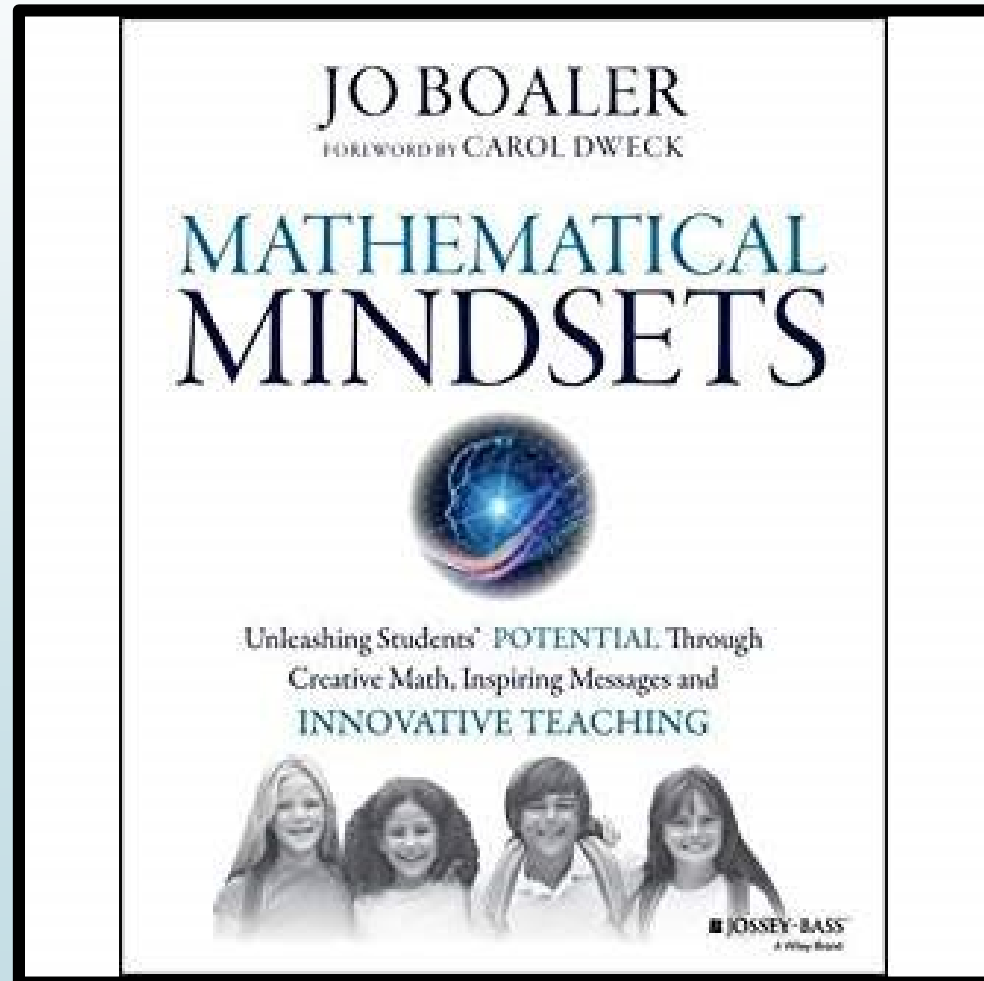
Carol Dweck

Mindset – The New Psychology of Success



Jo Boaler

Mathematical Mindsets





Definitions



Mindsets

- ▶ Mindsets are beliefs – beliefs about yourself and your most basic qualities (intelligence, talents, personality).
- Carol Dweck
- ▶ Are these fixed traits, or can you grow them over time?



Fixed Mindset

- ▶ People believe that their intelligence and abilities are fixed traits.
- ▶ Talent alone creates success—without effort.
- ▶ People in this mindset worry about their traits and how adequate they are. They have something to prove to themselves and others.



Growth Mindset

- ▶ People believe that their intelligence and abilities can be developed through hard work.
- ▶ Intelligence and talent are a starting point.
- ▶ This mindset creates a love of learning and resilience.

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Comparing the Two Mindsets - Goals

- ▶ Fixed:
 - ▶ Concerned how they'll be judged

- ▶ Growth:
 - ▶ Concerned with improving

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Comparing the Two Mindsets - Failure

- ▶ Fixed:
 - ▶ Failure is a setback

- ▶ Growth:
 - ▶ Failure is about not growing

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Failure/Setback

- ▶ Students with a fixed-mindset will reduce their effort, leading to lower achievement.
- ▶ Students with a growth-mindset will work harder, leading to higher achievement.
- ▶ These are self-perpetuating cycles, especially in math.

Persistence



Virgil Pierce

@virgil_pierce

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Replying to [@georgewoodbury](#) [@joboaler](#)

Life lesson, not just a math lesson, remember it is always confusing, intimidating, awkward, ... etc. until the moment it's not.

8:28 AM - 20 Feb 2018

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Comparing the Two Mindsets - Effort

- ▶ Fixed:

- ▶ Effort is a bad thing

- ▶ Growth:

- ▶ Effort is what makes you smart and talented

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Our Role

- ▶ Instructors are an important resource for students, and we have a great impact on student learning.

Our Role



Howie Hua

@howie_hua


Following



Replying to [@georgewoodbury](#)

I could write a whole essay on this. I think the most important is mindset. Before I do any math, I focus on their mindset. Ss won't learn if they already think they will forever be bad at math.

6:16 PM - 15 Feb 2018



Helping Your Students to Develop a Growth Mindset in Math



It's Not Easy

- ▶ Adopting a growth mindset is about changing your view and looking at things in a different way.

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Think/Pair/Share

- ▶ Give an example, in detail, of an area in which you once had low ability but now perform well.

Developing a Growth Mindset



Howie Hua

@howie_hua

Following



Replying to [@georgewoodbury](#)

I would mention their hobbies. Was there ever a time when they struggled? Of course! But if we learn from our struggles, we grow and become better. Same with math.

6:17 PM - 15 Feb 2018



Day One Survey Prompts

- ▶ Give an example, in detail, of an area in which you once had low ability but now perform well.
- ▶ List a mistake you made that taught you something.
- ▶ List a skill that you picked up that required a lot of practice.
- ▶ Tell me about a person that you saw learn how to do something you never thought that person could do.



Developing a Growth Mindset – Videos

Have your students watch a mindset video.

- ▶ Carol Dweck's TED talk
- ▶ Jo Boaler's TED talk
- ▶ YouTube mindset videos by Dave Paunesku

(I have YouTube links to the TED talks on the mindsets page on my website, as well as a link to a YouTube playlist of mindset related videos.)



Developing a Growth Mindset – Mindset Assessment

Have your students take a mindset assessment.

(I have a link to Carol Dweck's website that has an assessment you can use.)



Developing a Growth Mindset – Following Up

Carol Dweck:

- ▶ Is there something in your past that you think measured you?
- ▶ Focus on that thing.
- ▶ Now put it in a growth-mindset perspective.
- ▶ What did I (or can I) learn from that experience? How can I use it as a basis for growth? Carry that with you instead.



Developing a Growth Mindset – Following Up

- Consider having your students retake the mindset assessment to measure their progress.
- Give your students another of the prompts, but reframe it in terms of your class.



Misinterpretations

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Misinterpretations

- ▶ The focus is on effort, not on success.

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Misinterpretations - Effort

Carol Dweck:

- ▶ Perhaps the most common misconception is simply equating the growth mindset with effort. Certainly, effort is key for students' achievement, but it's not the only thing. Students need to try new strategies and seek input from others when they're stuck. They need this repertoire of approaches—not just sheer effort—to learn and improve.

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Misinterpretations

- ▶ Instructors using this approach are lowering standards.



Misinterpretations – Lowering Standards

Carol Dweck:

- ▶ Many educators think that lowering their standards will give students success experiences, boost their self-esteem, and raise their achievement.
- ▶ Well, it doesn't work. Lowering standards just leads to poorly educated students who feel entitled to easy work and lavish praise.
- ▶ Simply raising standards in our schools, without giving students the means of reaching them, is a recipe for disaster.

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Misinterpretations

- ▶ False Growth-Mindset



Messages

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Messages

- ▶ The messages we send to our students are so important.



“Not a Math Person”



“Not a Math Person”

- ▶ Teachers need to replace sympathetic messages such as “Don't worry, math isn't your thing” with positive messages such as “You can do this, I believe in you, math is all about effort and hard work.”
- Jo Boaler



Mistakes



Mistakes

Jo Boaler

- ▶ I love mistakes. Every time they make a mistake their brain grows.
- ▶ Failure and struggle do not mean that they cannot do math—these are the most important parts of math and learning.

Mistakes



Denise Nunley

@nunleymath

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Work hard at reminding your students that mistakes mean you are learning.

9:49 AM - 18 Feb 2018

Mistakes



Carrie Tomc

@rsdk5math

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Mistakes are good. You learn from them and grow.

4:23 AM - 16 Feb 2018



Believe in Your Students

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Believe in Your Students

Jo Boaler:

- ▶ I believe in every one of them, that there is no such thing as a math brain or a math gene, and that I expect all of them to achieve at the highest levels.
- ▶ I have always known how important it is that students know their teacher believes in them.

Believe



Matt Salomone

@matthematician

Following



Believe in every student long enough for them to believe in themselves. 👍



Speed



Speed

Jo Boaler:

- ▶ Misconceptions about math: that math is a subject of rules and procedures, that being good at math means being fast at math, that math is all about certainty and right and wrong answers,
- ▶ It is also important to realize that the speed at which students appear to grasp concepts is not indicative of their mathematics potential.



Praise



Praise

- ▶ Praise growth-mindset, effort-based qualities rather than fixed-mindset, talent-based qualities.
- ▶ When you tell a student “You are smart” ...
- ▶ Try using “Your hard work is paying off!”

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Praise

Carol Dweck:

- ▶ Students were given a nonverbal IQ test. After they finished half were praised for their ability (“That’s a really good score. You must be smart at this.”), and half were praised for their effort (“That’s a really good score. You must have worked really hard.”).



Praise

Carol Dweck:

- ▶ The ability-praised students rejected a challenging new task that could expose their flaws and call their talent into question. 90% of the effort-praised students wanted a challenging new task they could learn from.
- ▶ The performance of the ability-praised students dropped on a second test, while the performance of the effort-praised students improved.



In the Classroom



Changing Student Perceptions of Math

Keith Devlin:

- Students will typically say it is a subject of calculations, procedures, or rules. But when we ask mathematicians what math is, they will say it is the study of patterns; that it is an aesthetic, creative, and beautiful subject.



Reasoning

Jo Boaler:

- ▶ What is the point of explaining their work if they can get the answer right? My answer is always the same: Explaining your work is what, in mathematics, we call reasoning, and reasoning is central to the discipline of mathematics.



Reasoning

Jo Boaler:

- ▶ They realize they have to use their own minds—thinking, sense making, and reasoning. They stop thinking their task is just to repeat methods, and they realize their task is to think about the appropriateness of different methods.
- ▶ When students think their role is not to reproduce a method but to come up with an idea, everything changes.



Reasoning

Jo Boaler:

- Reasoning also gives students access to understanding.
- Reasoning had a particular role to play in the promotion of equity, as it helped to reduce the gap between students who understood and students who were struggling.
- It is fairly easy to convince yourself or a friend, but you need high levels of reasoning to convince a skeptic.

Reasoning



Rob Eby math dude

@RobEbymathdude

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For me, it means my students understand from the get-go that it is about communication of the thought process, not just "the right answer"

1:31 PM - 15 Feb 2018



Conclusion



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