Erasing Mathematics Failure Through the Learning Revolution

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65% school and college students failing math in the US.
Pursuing Mathematics Degrees.
Mathematics is broken, worldwide

- PISA 2012, Brazil
- 67% of students are low achievers
- 1.9% of students are resilient
A book for teachers and parents:

The Elephant in the Classroom
Helping Children Learn and Love Maths

JO BOALER
Brain Plasticity
When learning happens …

A synapse fires
Synapses change the structure of the brain, throughout life
A 9-year old girl

Had half her brain removed

She amazed doctors and scientists - within months she had recovered functions from the “missing” side of the brain. The “incredible plasticity” of the brain
A 3 week training program

- Changed the structure of the participant’s brains

National Institute of Mental Health
Brain research tells us:

- Every child can achieve at high-levels in mathematics in school, from elementary to high school
How important are the ideas students have about their own potential?

- Carol Dweck
- Students with a growth mindset believe that the harder they work the smarter they get
- Students with a fixed mindset believe that you are either smart or you are not
- Girls and STEM
7th grade students with a growth mindset outperform those with a fixed mindset in math.
PISA Data, 13 million 15-year-olds
Looking at mindset and mathematics strategies
Students who memorize are the lowest achieving students in the world

Brazil has higher numbers of students who memorize and higher numbers of students with a damaging fixed mindset than OECD average
Online Parent/Teacher Class (MOOC), summer 2013

How to Learn Math: An online class for teachers, parents, administrators.

8 lessons

First online course for which districts gave salary credit
Growth Mindset & Math

- An emphasis on speed and math facts turns students away from math from an early age
- Mistakes are when brains grow, we want students making mistakes and feeling good about it
- The math questions used in math classrooms communicate fixed messages about math. Tasks need to have the space inside them to learn
- Taught Through a Pedagogy of Open Engagement
- Included Videos of Teaching
- Design Tasks
- Interviews with experts – Carol Dweck, Sebastian Thrun
40,000 took the class (3 mill students) – over 1000 in Brazil
92% said ‘very’ or ‘extremely’ satisfied
68% stayed in course
95% said they would change their teaching as a result
Over 600 videos on youtube
The course transformed teaching, 30% grade increase
Taking the course “How to Learn Math” 2 years ago was a watershed in my life. My students are now LOVING math.

I am from India, since taking Jo’s MOOC my whole view of math has changed.

This is the best professional development I have ever participated in as a math teacher.
Strong beliefs in education

Effective professional development has to be
- Face-to-face
- Long term
- In schools

The new ideas from brain research are powerful enough to be learned through an on-line medium. We know what works; the problem is research knowledge is not getting into classrooms, until now.
How to Learn Math: For Students

6 interactive lessons designed to:
- Improve students’ relationships with math
- Encourage a growth mindset
- Show math as engaging, beautiful, relevant

Featuring undergraduate presenters, math in dance, tennis, juggling, soccer, nature
80,000 are taking the student class

- 79% very good/extremely good
- 72% have a stronger belief that they can do well in math & are armed with powerful math strategies
- Next month course will be released in Spanish
- 7000 students are taking it as part of a randomized controlled trail looking at achievement
- Many different users including K-12 schools and US submarines
The new movement to revolutionize math teaching and learning

YouCubed is a nonprofit providing free and affordable K-12 mathematics resources and professional development for educators and parents.

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- 82 countries
- In the last 3 months 400,000 teachers (25 million students)
As students complete each task, record the number sentence on the board.

For example,

\[ \begin{array}{c}
  12 \quad \text{yellow} \\
  + \quad 13 \quad \text{red} \\
  = 25
\end{array} \]

After students have thought about the carpet area-seating question and have provided a solution you can record names and have your carpet seating chart complete.

Deb says, "The students have fun looking at what they did and then realize math is all around us and in our lives everyday. And at the end I have a carpet seating chart complete."
Setting up Positive Norms in Math Class

By Jo Boaler

Here are 7 of my favorite messages to give to students in math class, and some suggestions from youcubed as to how to encourage them:

- Everyone can learn math to the highest levels
- Mistakes are valuable
- Questions are really important
- Math is about creativity and making sense
- Math is about connections and communicating
- Math class is about learning not performing
- Depth is more important than speed
Number sense is one of the most important areas of mathematics—but publishers and districts often encourage the opposite—the blind memorization of math facts. In this short paper we summarize some research evidence on the best ways for students to learn math facts, we also share some great activities to use in classrooms. I hope you find it helpful and can share it with administrators, district personnel and others.
The 8 educators whose ideas are challenging the future of education.
Implications

- Too much edTech goes around teachers
- We need to empower teachers, need to change teaching
- We have to change the messages teachers communicate to students about math
- We have to change the outdated teaching practices that produce math failure
- Technology’s greatest promise is in transforming teachers’ practices through the translation of research into practice