It Was The Best of Times, It Was The Worst of Times.

Mathematics Teaching and Learning in the United States.

Jo Boaler
Professor of Mathematics Education
Stanford University

Math is the subject..

- with the greatest difference between what we know works from research and what happens in classrooms
- with the greatest difference between the way experts define it and the way school children define it
- that *should* be one of the most useful for children's lives, but often it is completely inert

Math is also the subject with..

- Widespread underachievement (US ranks about 28/40 in international comparisons)
- "Savage inequalities"
- Widely hated by American children and adults - In an AOL news poll math was the most hated subject – twice as many voted for math as any other subject
- Declining interest, a 19% drop in math majors in 4 years
- Feared by millions of adults (and not only those who are unsuccessful in school)

An example of the scale of the problem:

- Nearly half of all college students in the US are attending 2-year colleges
- 70% of those are taking 'remedial' math
- Only 1 in 10 complete the courses – and college

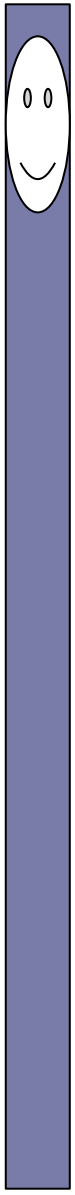
What is the problem?

narrow

Mathematics in the World

Mathematics used by Mathematicians

Mathematics in the World



Mathematics used by Mathematicians

Also a feature of US teaching

- Variety in school approaches, including pockets of excellence

- Huge controversies around math teaching proponents of 'traditional teaching' block school reforms – some schools offer 2 approaches

2 approaches

"Traditional"

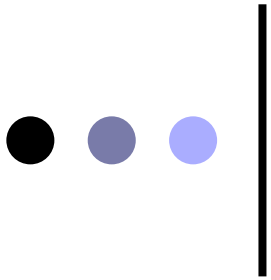
- Desks in rows
- Teacher demonstration of methods
- Students practice
- Technology? An OHP

Multi-dimensional

- Students work collaboratively
- Problem solving
- Adapt and apply methods
- Technology? Graphing calcs

The Traditional Approach

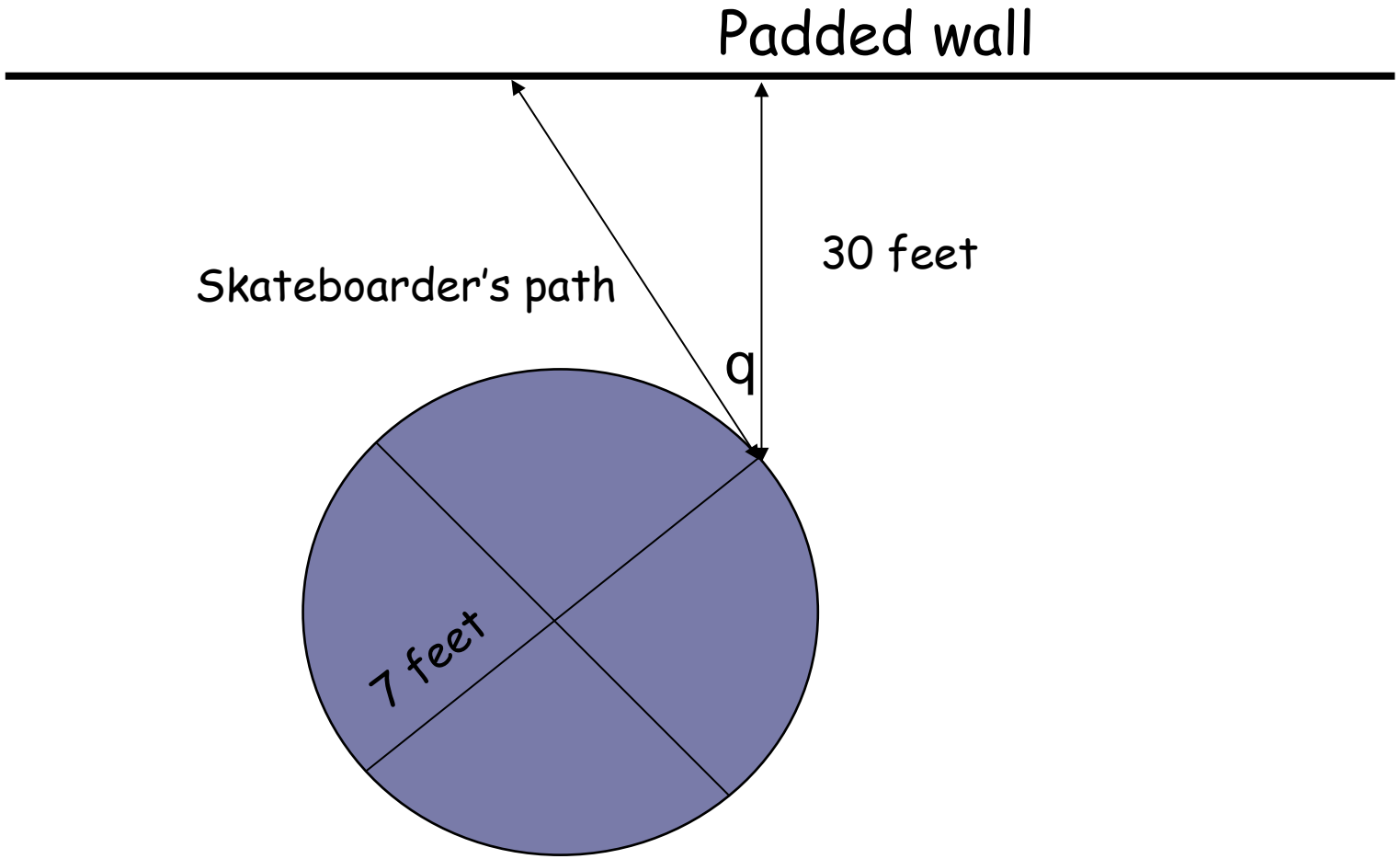
Question: How are the students engaging in mathematics?



The Traditional Approach

What does it take to be successful in math class?

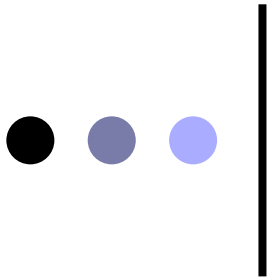
97% “Pay Careful Attention”



The platform has a 7-foot radius and makes a complete turn every 6 seconds. The skateboarder is released at the 2 o'clock position, at which time s/he is 30 feet from the wall. How long will it take the skateboarder to hit the wall?

The Multi-dimensional Approach

Question: What are these students learning?



The Multi-dimensional Approach

What Does it Take to be Successful in Math Class?

Asking good questions

Rephrasing Problems

Explaining Work

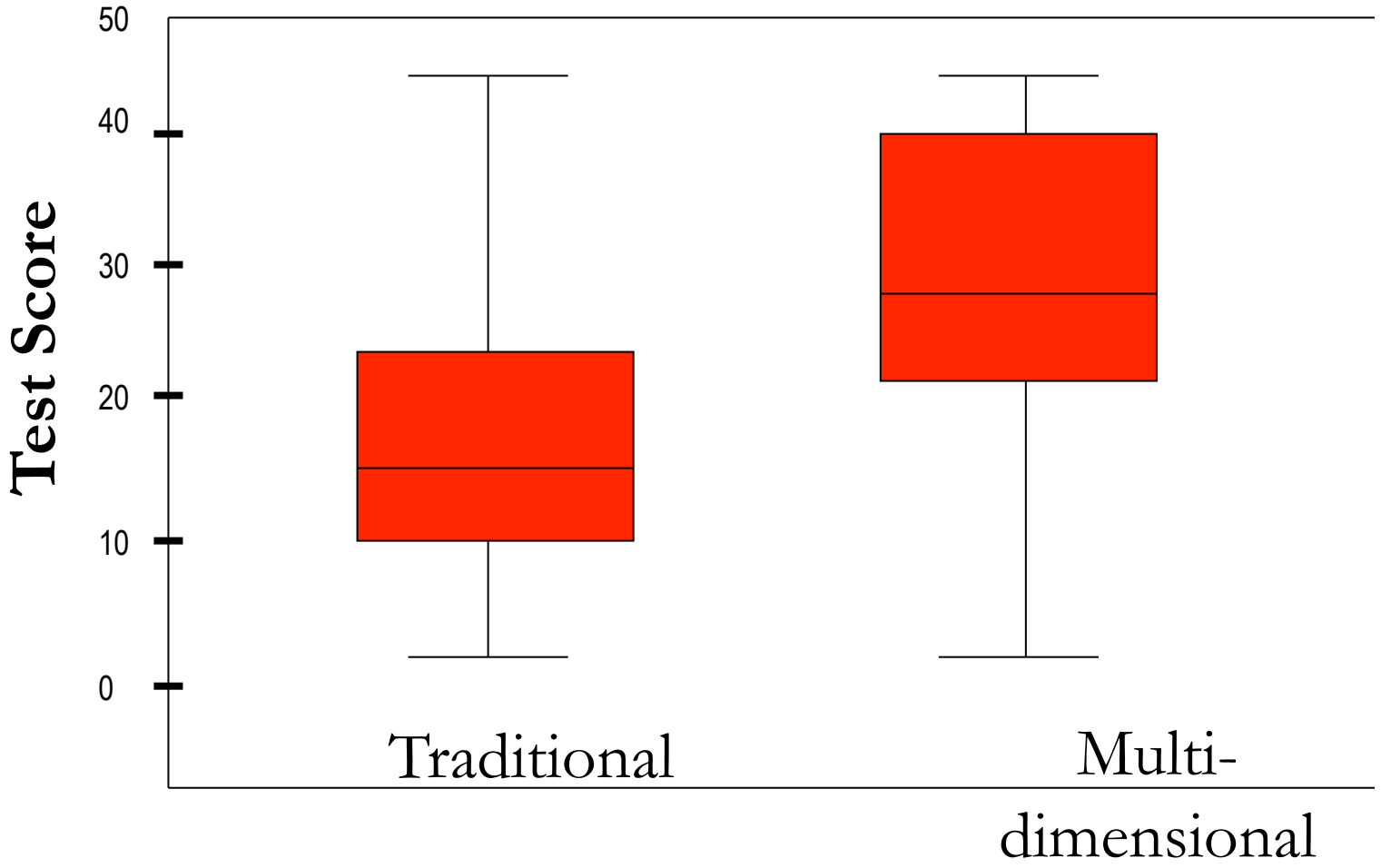
Being Logical

Justifying Work

Using Manipulatives

Many more students were successful because there were many more ways to be successful.

Year 2 Post-Assessment



Plans for mathematics in the future

Students who followed the multi-dimensional approach were 10 times more likely to take mathematics at university.

Math is really beautiful and has these patterns in it that are amazing. Most art is just made up of patterns anyway. And so I've written a lot of poems about it, and a lot of songs involving it. Poly-rhythms was one thing that kind of interspersed music and math for me—because it's like patterns that take multiple measures to repeat because they don't fit evenly over four bars, and it's exactly like a fraction because if you take a fraction high enough there's going to be common denominators. And so seeing how patterns can be interesting and, artistic. And math intersperses a lot for me that way.

(Toby, age 17)

Contacting me:

- Jo Boaler
- joboaler@stanford.edu
- http://ed.stanford.edu/faculty/joboaler

Laurent Schwartz ‘A Mathematician Grappling with his Century’

..I was always deeply uncertain about my own intellectual capacity; I thought I was unintelligent. And it is true that I was, and still am, rather slow. I need time to seize things because I always need to understand them fully. Even when I was the first to answer the teacher's questions, I knew it was because they happened to be questions to which I already knew the answer. But if a new question arose, usually students who weren't as good as I was answered before me. Towards the end of the eleventh grade, I secretly thought of myself as stupid. I worried about this for a long time. Not only did I believe I was stupid, but I couldn't understand the contradiction between this stupidity and my good grades. I never talked about this to anyone, but I always felt convinced that my imposture would someday be revealed: the whole world and myself would finally see that what looked like intelligence was really just an illusion. If this ever happened, apparently no one noticed it, and I’m still just as slow. (...)At the end of the eleventh grade, I took the measure of the situation, and came to the conclusion that rapidity doesn't have a precise relation to intelligence. What is important is to deeply understand things and their relations to each other. This is where intelligence lies. The fact of being quick or slow isn't really relevant. Naturally, it's helpful to be quick, like it is to have a good memory. But it's neither necessary nor sufficient for intellectual success.

A Timed Test of 50

Name: _____ Date: _____

Correct: ____/50

D	1	1	Fifty addition facts	THE MAD MINUTE

4 +8 = 12	2 +9 = 11	3 +7 = 10	6 +6 = 12	7 +4 = 11	3 +0 = 3	5 +5 = 10	9 +7 = 16	9 +6 = 15	7 +1 = 8
4 +6 = 10	6 +7 = 13	9 +9 = 18	8 +3 = 11	5 +6 = 11	9 +4 = 13	4 +9 = 13	9 +5 = 14	7 +2 = 9	5 +4 = 9
9 +1 = 10	8 +4 = 12	8 +5 = 13	7 +7 = 14	8 +9 = 17	4 +5 = 9	8 +8 = 16	8 +0 = 8	5 +9 = 14	3 +6 = 9
5 +8 = 13	5 +7 = 12	7 +9 = 16	3 +5 = 8	8 +2 = 10	7 +8 = 15	7 +5 = 12	8 +6 = 14	1 +8 = 9	6 +4 = 10
4 +7 = 11	7 +6 = 13	9 +8 = 17	8 +3 = 11	6 +8 = 14	6 +5 = 11	2 +6 = 8	6 +9 = 15	9 +3 = 12	2 +5 = 7

A book for the public: