Equatio at the Nexus of Student Accommodations and the Modern Digital Shift in Higher Education

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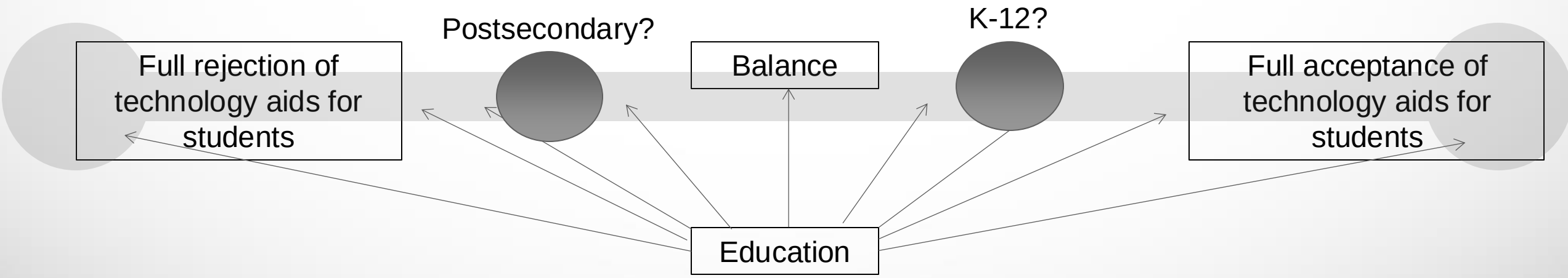
Outline

- Describing the nexus
- Value of technology for students with learning disabilities
- General challenges in math accommodations
- Equatio as an illustration
  - Short demonstration with Equatio
- Seemingly unstoppable advance of technology in education
- Mathematics skills over time in United States
- Finding the balance in technology for practical purposes

The Nexus

Education seems to be sitting at a juncture with a wide range of possible outcomes depending on how education incorporates the available digital technology:



Value of Technology for Disabilities

Can be divided into broad categories:

- Lesson
  - e.g., text-to-speech, recording lectures, copies of lecture notes
- Response (*this tends to be most difficult category*)
  - e.g., speech-to-text, questions read to student, calculators
- Setting
  - e.g., individual room/testing center,
- Timing
  - e.g., extra time

Some educators support modifications as well as accommodations*

*Source: Understood.org
https://www.understood.org/en/articles/common-classroom-accommodations-and-modifications

Math Accommodations Challenges

Can be difficult to meet *response* needs of students because:

- reading mathematics aloud involves mathematics vocabulary
- technology hasn't allowed for text-to-speech for those students with dyscalculia and sight impairments
- technology hasn't allowed for speech-to-text for those students with dysgraphia or similar impairments
- tension between learning mathematics effectively and technology undermining the learning process

Equatio

Note: This is not marketing for the product Equatio. The software is being used to emphasize the tension I am describing at this nexus.

- Screen reader can function on any Chrome page
- Text-to-speech for mathematics
- Speech-to-text for mathematics
- Handwriting to digital
- Photograph to digital
- Commonly used formulas in mathematics
- Calculator
- Desmos built into it

Debate/concerns at my college

The Modern Digital Environment

Learning management systems

- Even though face-to-face:
  - many classes exclusively accept online submissions -- note that this may be lead to consequences for institutions eventually
  - even the resources for students may be exclusively online

Rapid rise of online education!?

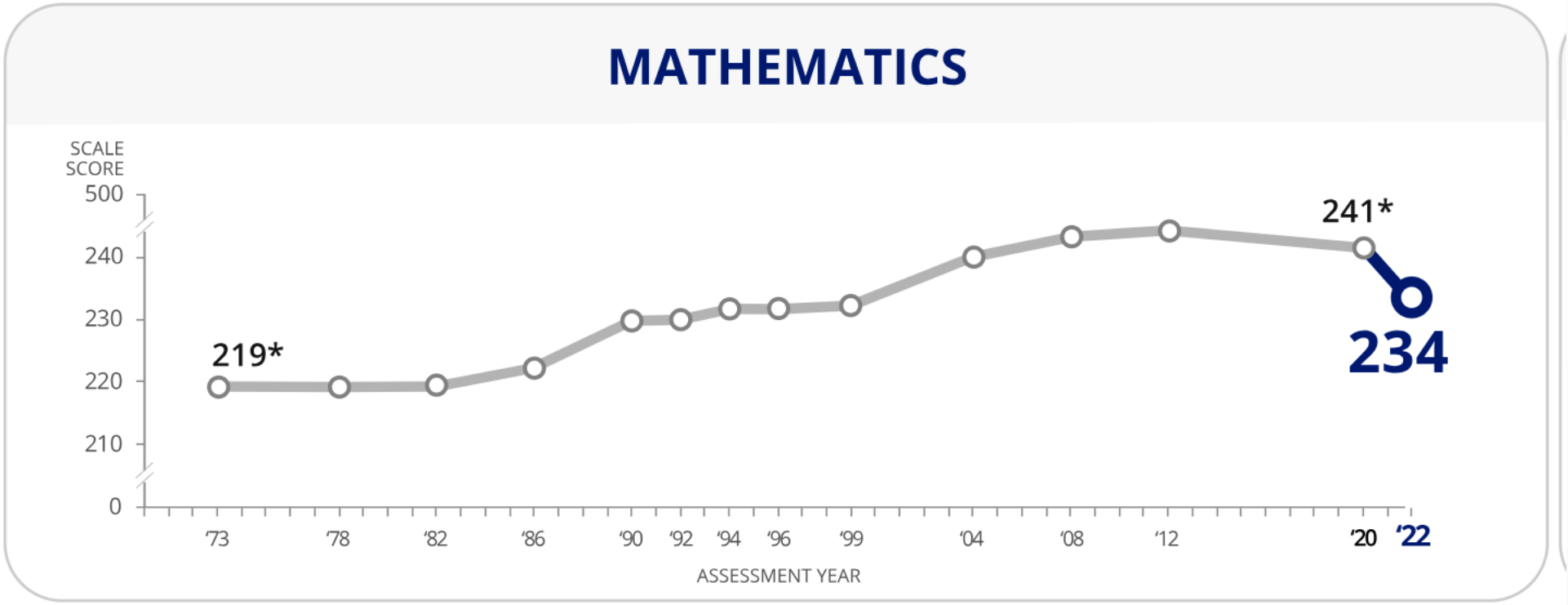
- *Forbes* predicts that the e-learning environment will grow up to 20% by 2030 (Carlton, *Forbes* online, 2024)
- However, *Inside Higher Ed* less certain the growth will continue, yet it is unlikely we will return to pre-COVID levels (Coffey, Inside Higher Ed, 2024).

Technology and Academic Development?

Mathematics proficiency has dramatically dropped since COVID

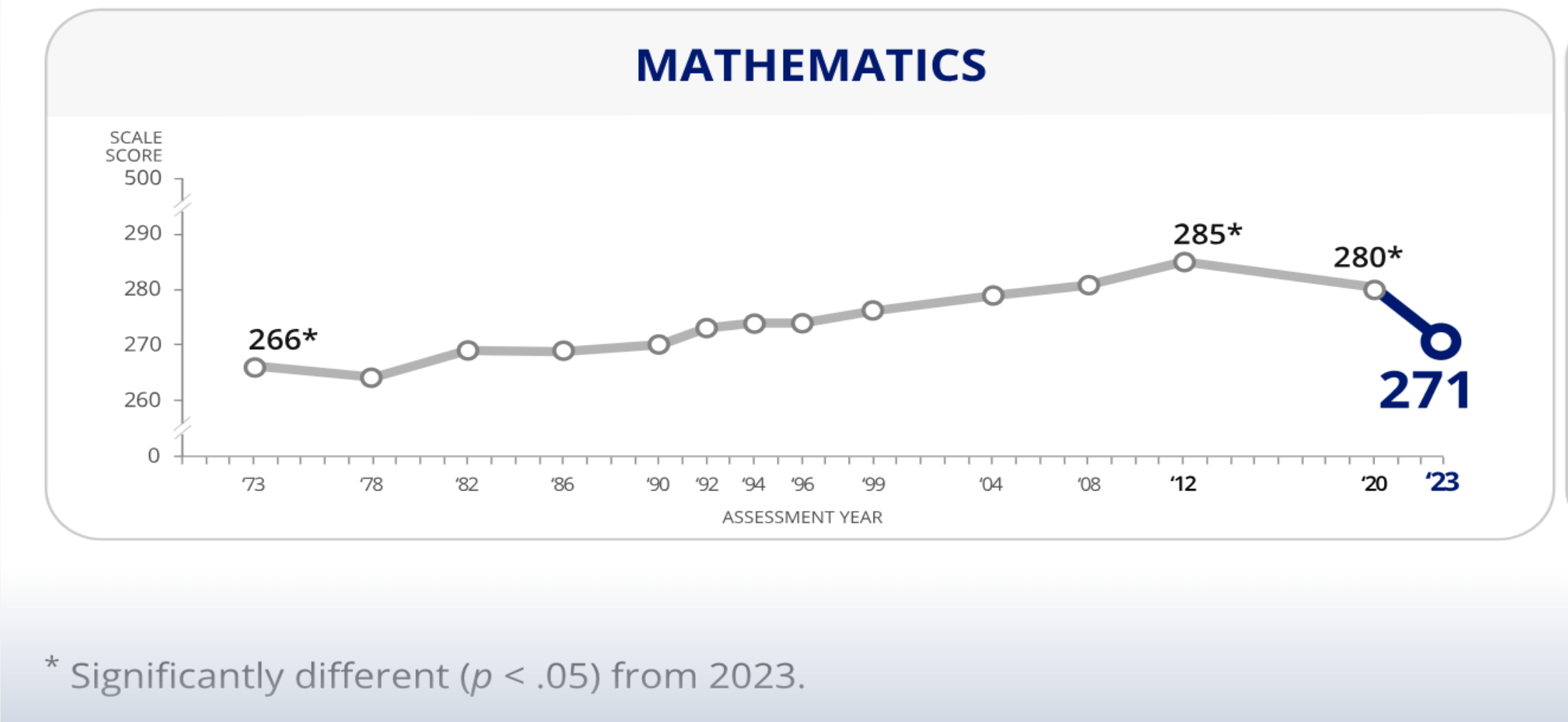
- NCES assessment of long-term trends (LTT) shows age 9 and age 13 students seriously affected by COVID
- NCES data on age 17 not available -- the age 9 and 13 data actually were generated with projects in response to COVID before the next cohort was to be assessed -- age 17 assessed in 2023-2024, so data on the way...

U.S. Department of Education (2023)
Age 9 students



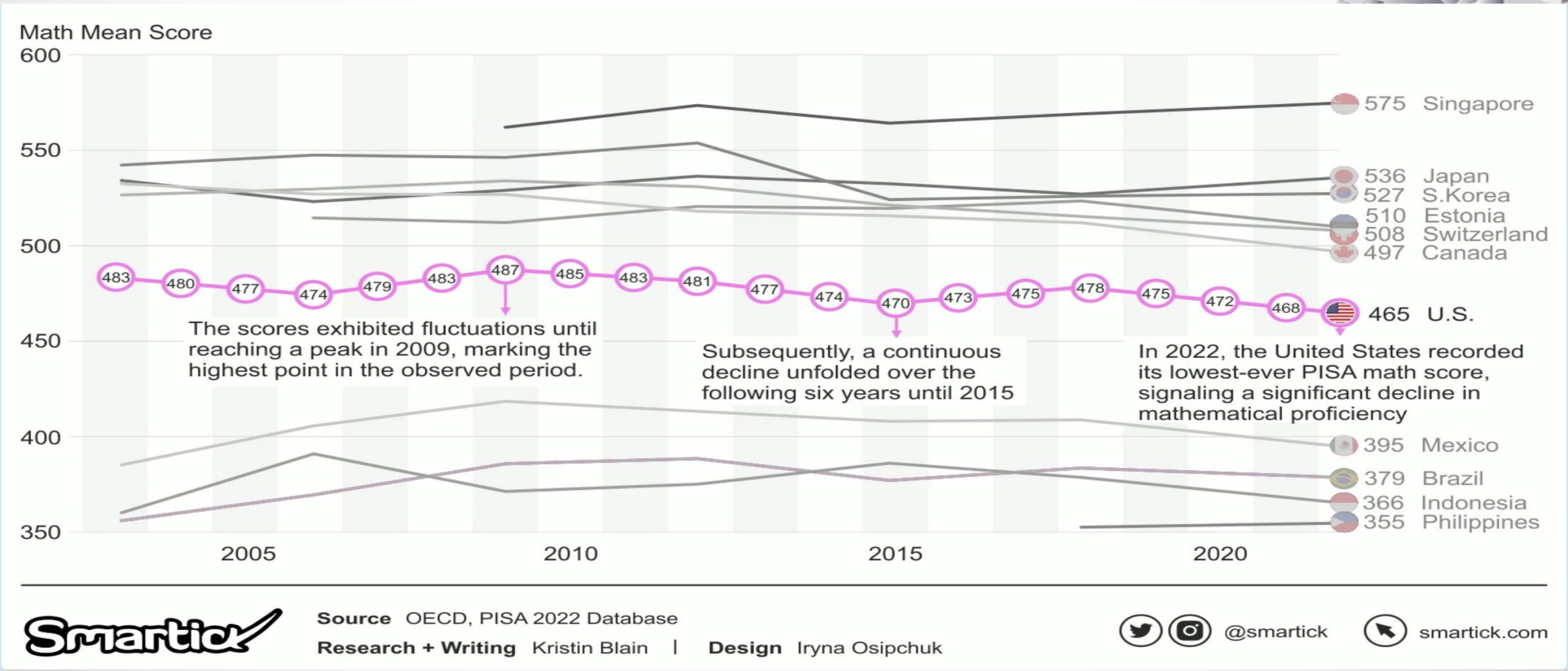
* Significantly different ($p < .05$) from 2022.

U.S. Department of Education (2024)
Age 13 students



* Significantly different ($p < .05$) from 2023.

Smartick (https://www.smartick.com/data/mathematics-across-borders-unveiling-patterns-in-pisa-scores-from-2003-to-2022/)



Smartick

Source OECD, PISA 2022 Database

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Maybe Educators and Technology...?

Educator comfort with math prior to secondary education

- education program in Texas for teachers
- https://www.utsa.edu/today/2020/07/story/community-math-project.html

“The goal in this program is two-fold. First, to offer supplemental enrichment and support activities in mathematics for children who might not normally have access to these experiences during the summer, and second, to give EC6 teacher candidates [known as math fellows] early and purposeful experiences with children in the practice of teaching and learning mathematics.”

Educator comfort with technology as well?

Technology for Practical Purposes

Is technology a bad idea after the fundamentals of mathematics are understood?

- Most advanced math, especially precalculus and calculus, is rarely used (less than 10% even for engineers, etc.) directly by people in careers -- but they need to understand what the software is doing

So, is it really all that important that students memorize every formula, every trig identity, and so on?

Sources

Carlton, G. (2024). 2024 online learning statistics. *Forbes* online. https://www.forbes.com/advisor/education/online-colleges/online-learning-stats/

Coffey, L. (2023). Students distancing from distance learning. *Inside Higher Ed*. https://www.insidehighered.com/news/tech-innovation/teaching-learning/2024/01/30/online-college-enrollment-continues-post-pandemic

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