

Improving Mathematics Learning: Where Are We and Where Do We Need to Head?

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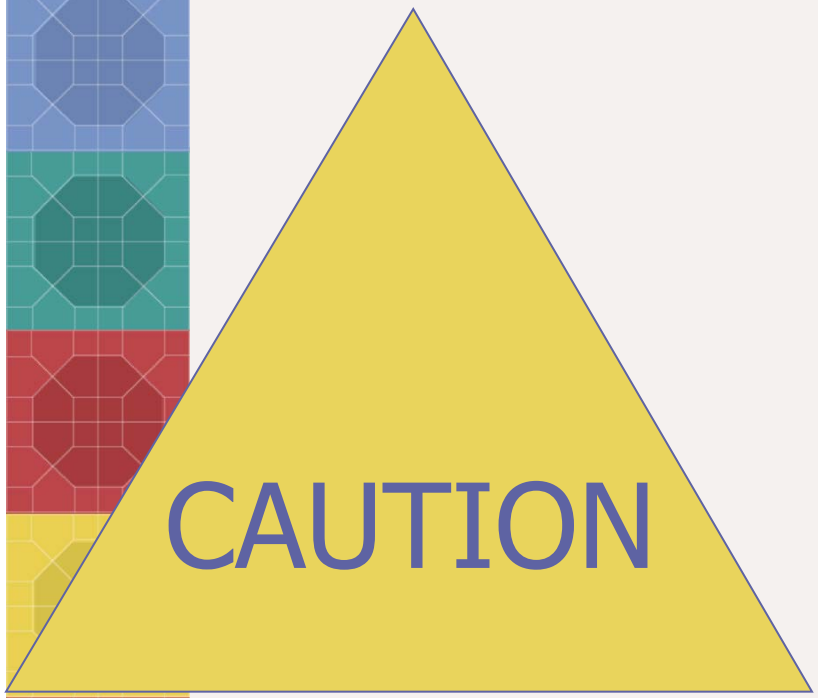
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- We've been here many times before.
- We keep gravitating to the same strategies.

Have we learned anything that can help us not go through this again?

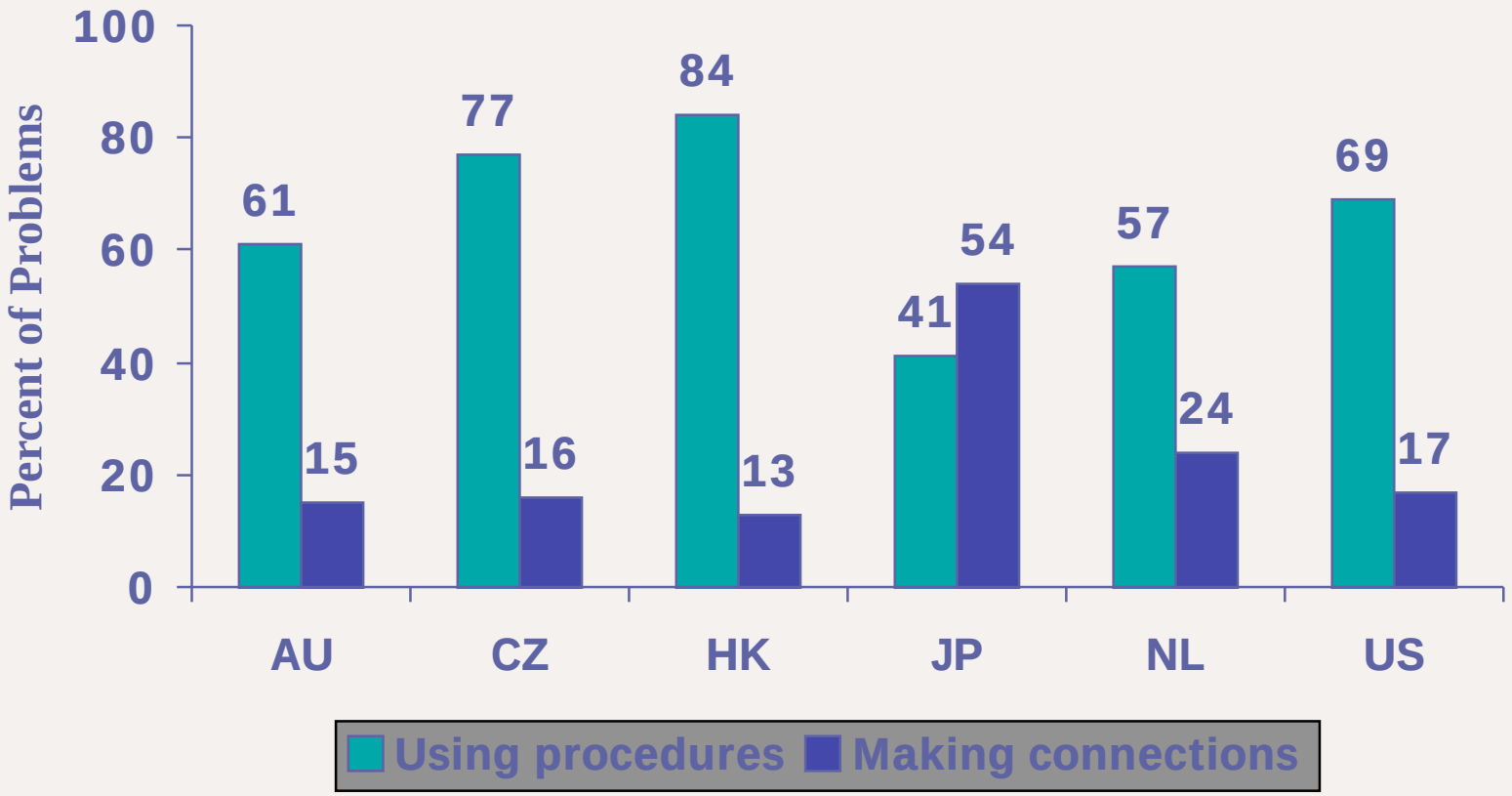
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1. Install a more challenging mathematics curriculum.
2. Recruit more mathematically-trained people to be teachers.
3. Lower the barriers for entry to teaching.
4. Pay teachers more to raise performance.

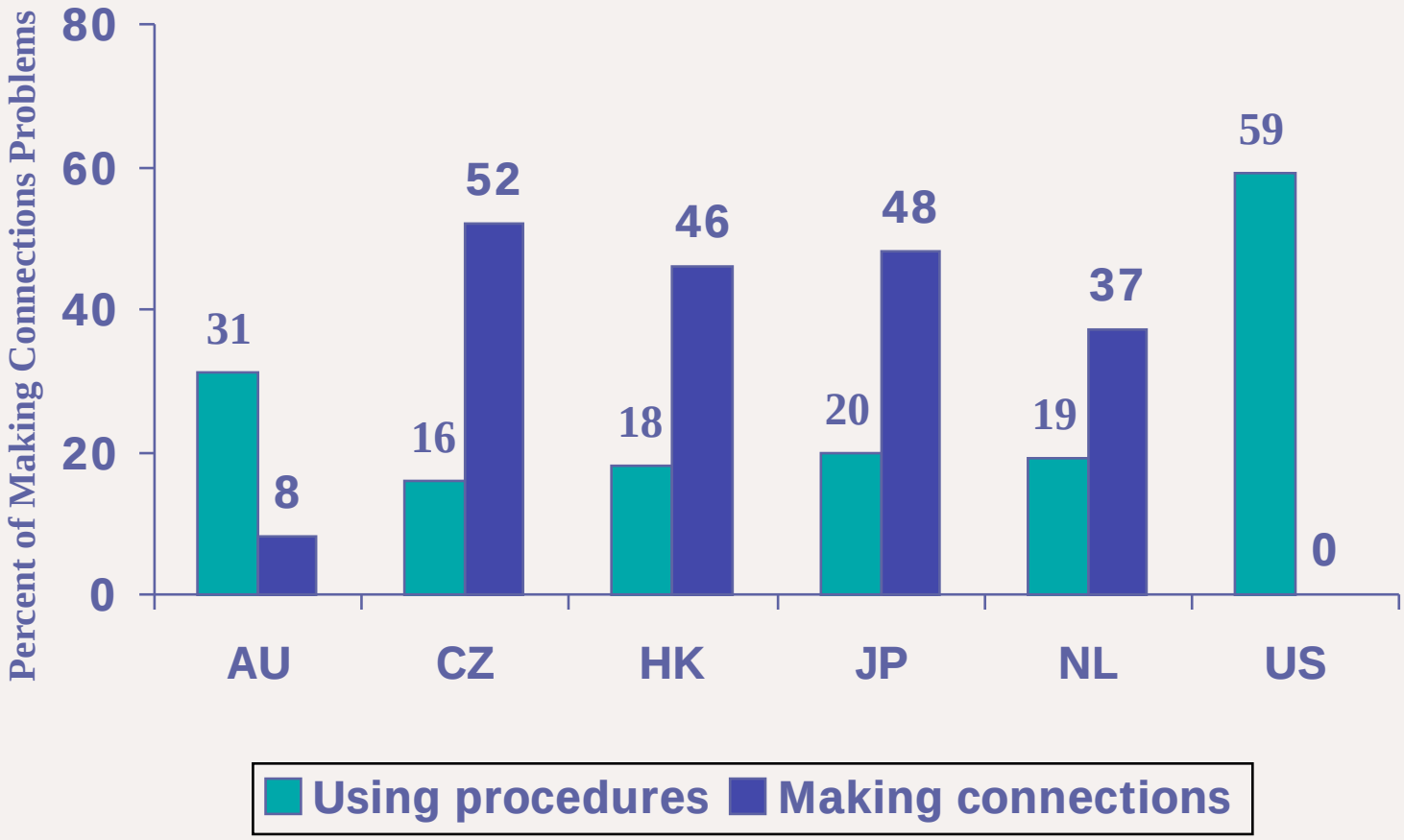
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Types of problems in the curriculum



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How challenging problems are worked on during lessons



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Knowing multiplication

Multiply:

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline \end{array}$$

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Knowing multiplication for teaching

How did students get each of these answers?

(a)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 405 \\ 108 \\ \hline 1485 \end{array}$$

(b)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 225 \\ 100 \\ \hline 325 \end{array}$$

(c)

$$\begin{array}{r} 49 \\ \times\ 25 \\ \hline 1250 \\ 25 \\ \hline 1275 \end{array}$$

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Would we do this in any other occupation or profession?

- Put untrained people to work, and in settings where skillful performance is most needed
- Allow standards of good practice to vary by income, race, or geography
- Believe that skillful performance depends on being smart and having common sense

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Teachers matter a lot

1. Persistent evidence that a large proportion of the variability in student achievement gains is due to who the teacher is
2. Less clear from the evidence exactly what it is about particular teachers that makes them more effective
3. For improvement: Need to know how more effective teachers differ from less effective ones and how to supply such teachers reliably to students

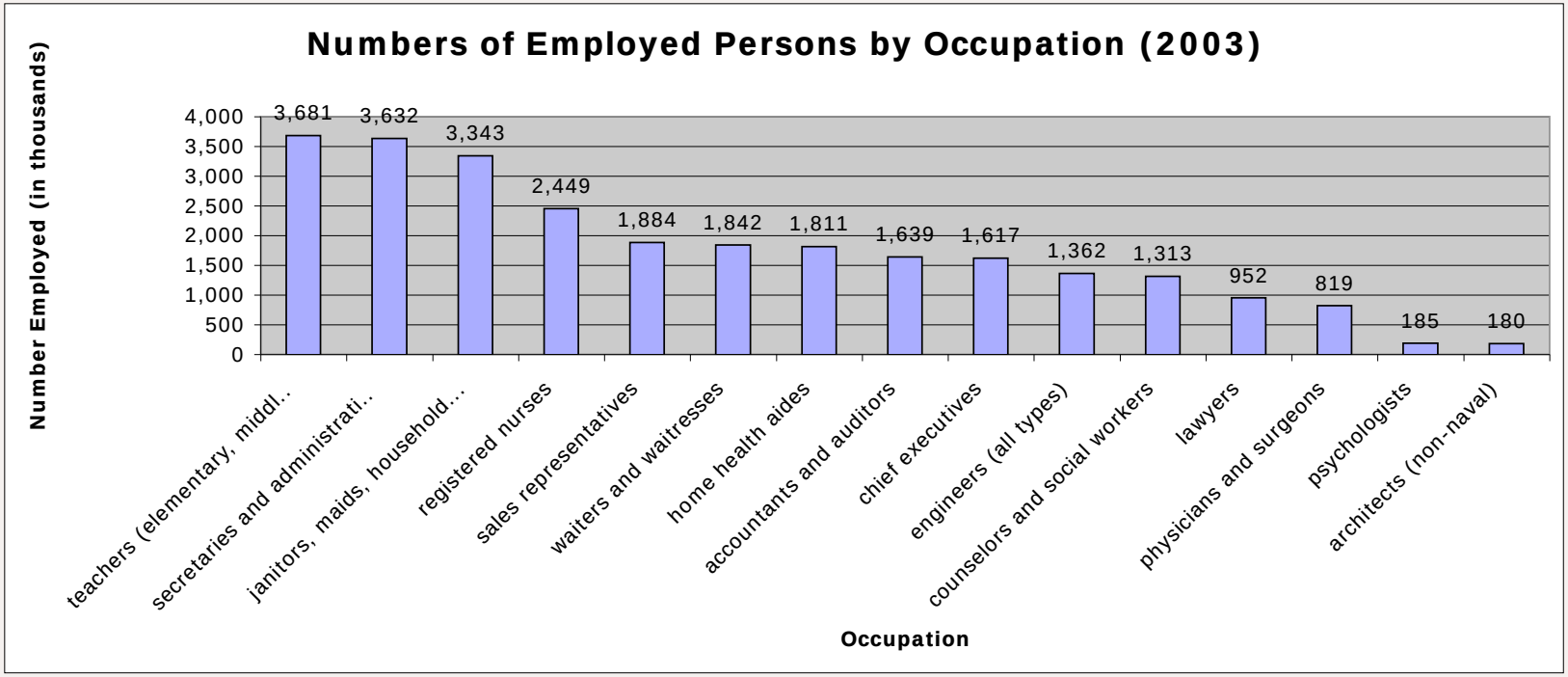
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How Big is K-12 Education? A Few Counts

- 50 million students in K-12 schools
- 90,000 schools
- 15,000 school districts
- 3.6 million teachers
- Per-pupil spending by state varies from about $6K - $14K

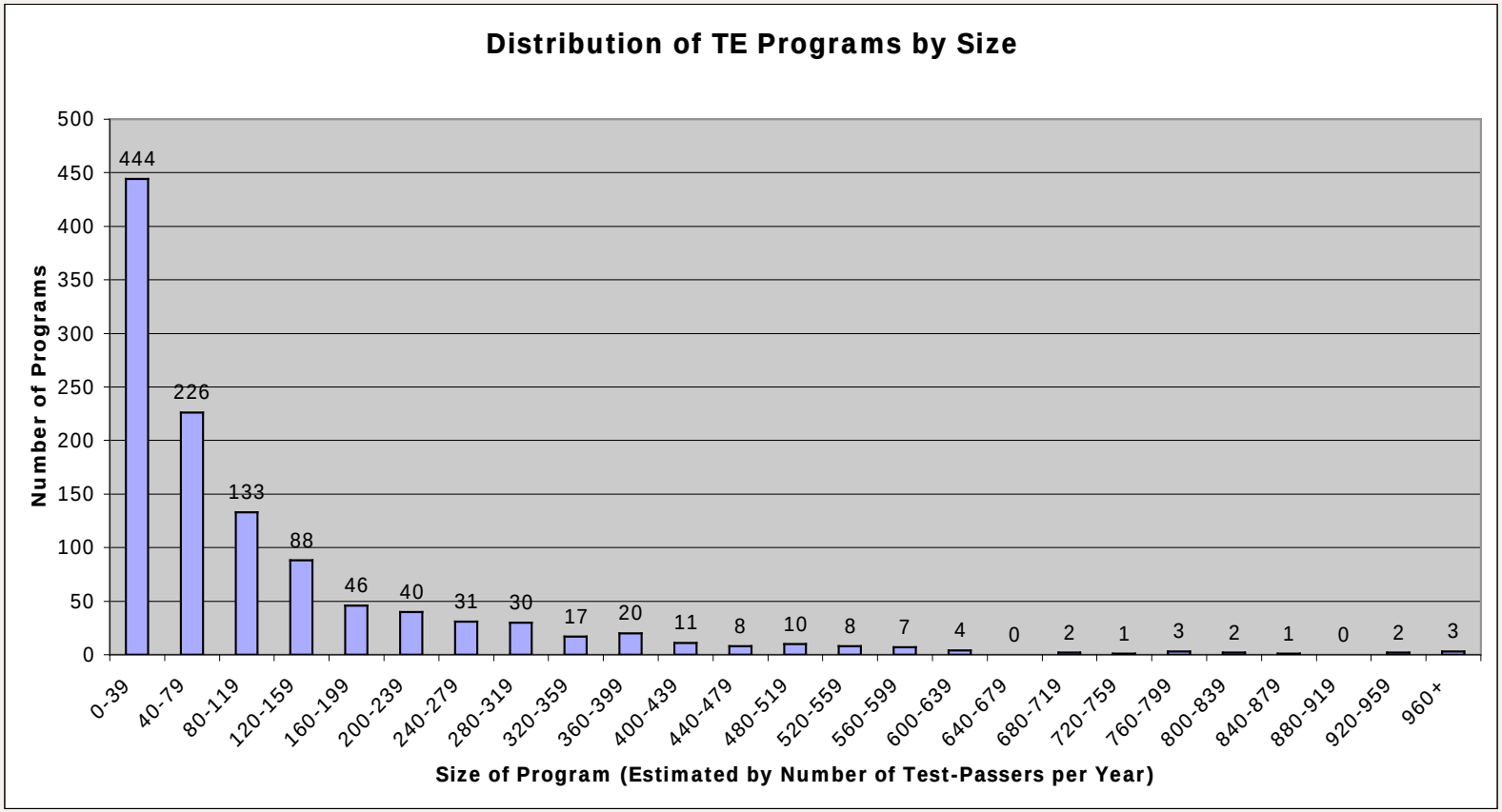
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The scale factor in education



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A non-system of professional education



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Lessons from success

1. Teaching is a professional practice that must be learned, and continuously developed. (e.g., Japan, China)
2. Improving students' learning requires a focus on instruction:
   - Provide sufficient detail
   - Provide for professional learning (and "unlearning") about content for teaching, about good student work and how to produce it with actual kids
   - Involve multiple stakeholders
   - Attend to coordination and incentives

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Where should we place our bets, given what we know (and what we don't)?

- Provide systematic professional training for successful practice
- Install sustained professional opportunities for continuous improvement, connected to the actual tasks of practice in settings
- Build a usable knowledge base for instruction
- Provide much more detailed instructional guidance
- Coordinate policy signals, curriculum, assessment, professional education

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