

American and Finnish Grade 8 Students *Cannot* Subtract Fractions.

Problem (TIMSS-2011 iv). Which shows a correct method for finding $1/3 - 1/4$?
A $(1 - 1)/(4 - 3)$ B $1/(4 - 3)$ C $(3 - 4)/3$ D $(4 - 3)/(3*4)$

Percentage of correct answers (D) for Grade 8 students:

U.S. students.	29%,
Finland	16%
Massachusetts ^v	44%
Singapore	83%

Sixth graders should be fluent in adding and subtracting fractions.
Students *not* fluent in adding fractions, are *not* ready for a rigorous Pre-Algebra course.

Grade 8 students, who *cannot* subtract fractions, will become at-risk students in a rigorous high school physics course. They are on track for remedial Algebra I, if not remedial Arithmetic, when they attend college.

Why do Singapore students excel in Math? It's the textbooks along with good teaching. Singapore Math textbooks are coherent and easy to understand; they were written in simple English for Singapore students for whom English was not their native language.

In sharp contrast, writers of American textbook have little training on how to write mathematics coherently, clearly, comprehensively, logically, accurately and precisely without being cryptic, vague, ambiguous, or obscure as well as how to distinguish a correct mathematical argument from an *incorrect or incomplete* mathematical argument. This is what jumped out at me when I was reviewing four Grades 4-7 Math textbooks series as a duly sworn official of the state of California.

2. Using The Exceptionally Good Singapore Mathematics Textbooks Results In Exceptional Learning.

Singapore Mathematics Texts & Guidance of a Mathematics Professor Jumped Scores at an Inner-city Title 1 School

Let's look at Ramona Elementary School's Grade 5 results on the California Standards Math Test for the three years before (2003-2005) and after (2006-2008) using Singapore Primary Mathematics Texts under the guidance of Mathematics Professor Yoram Sagher. (About three teachers in four chose to participate.):

Ramona Elementary School is an inner-city school (in the Los Angeles Unified District). “Ramona easily qualifies for federal Title 1 funds, which are intended to alleviate the effects of poverty. Nine of every 10 students at the school are eligible for free or reduced-price meals (FARM). For the most part, these are the children of immigrants, the majority from Central America, some from Armenia. Nearly six in 10 students speak English as a second language.” (The Los Angeles Times, March 9, 2008)

Scores at Ramona Elementary School (An Inner-City Title 1 School)

2003-2005: Percent of Students scoring Proficient and Advanced: **43%-56%**

2006-2008: Percent of Students scoring Proficient and Advanced: **71%-76%**

Before: Percent advanced: **15%-26%** Average Scaled scores (all students) **349- 378**

After: Percent advanced: **35%-43%** Average Scaled scores **395- 412**

North Middlesex School District Had Phenomenal Achievement, Even For Massachusetts ^{vi}:

Comparison of North Middlesex (NM) and State of Massachusetts Results

	Advanced		Proficient	
	NM	State	NM	State
1999	7%	9%	19%	15%
2005	57%	35%	30%	27%

The North Middlesex Regional School District ^{vii} credits its exceptional improvement on the Massachusetts Grade 10 Math test to its implementation and use of Singapore Mathematics textbooks in elementary and middle school, not to changes in its Grade 10 math program.

Credit goes to the use of Singapore Math together with Professional Development led by Richard Bisk, then Chair Mathematics Department at Worcester State College, who wrote: We were successful in North Middlesex because the teachers got Professional Development that improved their math understanding and they got to use good materials (Singapore Math) with their students.

Richard Bisk's view - start with a Professional Development course of 5-8 days that focuses on the math, with some discussion of implementation. Then provide follow-up support during the school year and in subsequent summers. Most teachers will say up front that they want the implementation knowledge and not the math as they don't

realize how their limited math background affects their ability to teach well. I've been fairly successful in convincing them that the math needs to come first.

3. Finland Beware – NOT Beware of Finland

Finland is wise enough to provide "daily hot meals; health and dental services; psychological counseling; and an array of services for families and children in need ^{viii}" Finland also closed most of its colleges of education, which channeled future teachers into the more effective programs. Yes, we should do all this because it makes good sense; not because Finland is doing it.

"Finnish engineering students [in college] have difficulty with fractions and simple algebraic expressions" is Section 5 of my report, **"What Does the International PISA Math Test Really Tell Us?"** by Jerome Dancis ^{ix} in the American Association of School Administrators Journal of Scholarship and Practice.

Excerpts:

Finland had often scored number 1 on the PISA Math exam. The U.S. has scored much lower. This has misled U.S. education policy wonks to suggest that our Math instruction is inferior to that provided to Finnish students and hence we should copy some aspects of Finland's education system.

Not so fast.

The article, **"The PISA Survey Tells Only A Partial Truth Of Finnish Children's Mathematical Skills"** ^x signed by 207 mathematics teachers in Finnish universities and polytechnics (universities of applied sciences) notes:

"in order not to fail an unreasonably large amount of students in the [university's] matriculation exams, recently the board has been forced to lower the cut-off point alarmingly. Some years, 6 points out of 60 have been enough for passing."

The article, **"Severe Shortcomings In Finnish Mathematics Skills"** ^{xi} states: "The polytechnic teachers of professional subjects are astonished at how poorly students can handle algebraic expressions and solve equations. The decreased mathematical skills of the students have forced [the teachers] to reduce the teaching material in those engineering courses that most heavily rely on mathematics. This is a serious matter taking into account the importance of engineering knowledge to the Finnish economy and welfare."

ⁱ The **Programme for International Student Assessment (PISA)** is a worldwide study by the [Organisation for Economic Co-operation and Development](http://www.oecd.org) (OECD) intended to evaluate educational

systems by measuring 15-year-old school pupils' scholastic performance on mathematics, science, and reading.

ii The Organization for Economic Cooperation and Development [OECD] consists of largely Western European Countries.

iii To get a sense of what PISA Level 5 requires, read this:

PISA QUESTION "Climbing Mount Fuji" (Level 5)

"The Gotemba walking trail up Mount Fuji is about 9 kilometres (km) long. Walkers need to return from the 18 km walk by 8 pm.

Toshi estimates that he can walk up the mountain at 1.5 kilometres per hour on average, and down at twice that speed. These speeds take into account meal breaks and rest times.

Using Toshi's estimated speeds, what is the latest time he can begin his walk so that he can return by 8 pm?"

The PISA description for this question is: "Calculate the start time for a trip given two different speeds, a total distance to travel and a finish time" ⁱⁱⁱ

Calculations:

$$\{\text{Speed down}\} = 2 \times \{\text{Speed up}\} = 2 \times 1.5 = 3 \text{ km/hour}$$

$$\{\text{Return Travel time}\} = \{\text{distance}\} / \{\text{speed}\} = d/s = 9/3 = 3 \text{ hours.}$$

$$\text{Since } \{\text{Speed down}\} = 2 \times \{\text{Speed up}\}; \quad \{\text{Time up}\} = 2 \times \{\text{Time down}\} = 2 \times 3 = 6.$$

$$\{\text{Start time}\} = \{\text{finish time}\} - \{\text{total travel time}\} = 8 \text{ PM} - (6 + 3) = 11 \text{ AM.}$$

iv TIMSS is an international set of good tests on mathematics and science.

v Much credit for Massachusetts high scores goes to Sandra Stotsky

Wikipedia: "While serving as Senior Associate Commissioner in the [Massachusetts](#) Department of Education from 1999 to 2003, she directed complete revisions of the state's preK-12 standards for every major subject that have been judged among the best in the country by independent experts for the Thomas B. Fordham Institute in two decades of reviews of state standards." Stotsky had the Massachusetts Math standards written (largely) by Mathematicians.

vi Data from presentation by North Middlesex to National Mathematics Advisory Panel

<http://www2.ed.gov/about/bdscomm/list/mathpanel/3rd-meeting/presentations/waight.mary.pdf>

vii North Middlesex Regional High School is the only high school in North Middlesex Regional School District

viii Education policy expert, Richard Rothstein has advocated this for years. Several cities have starting doing these worthy things in poor neighborhoods. In my county, it is called "Wrap around services".

ix Pages 31-42 at

http://www.aasa.org/uploadedFiles/Publications/Journals/AASA_Journal_of_Scholarship_and_Practice/JPS-Winter2014-FINAL.pdf

x Published in Helsingin Sanomat in February 17, 2005 Page 9

<http://www.matilde.mathematics.dk/arkiv/M29/M29tema.pdf>

xi <http://matematiikkalehtisolmu.fi/2005/erik/KivTarEng.html>