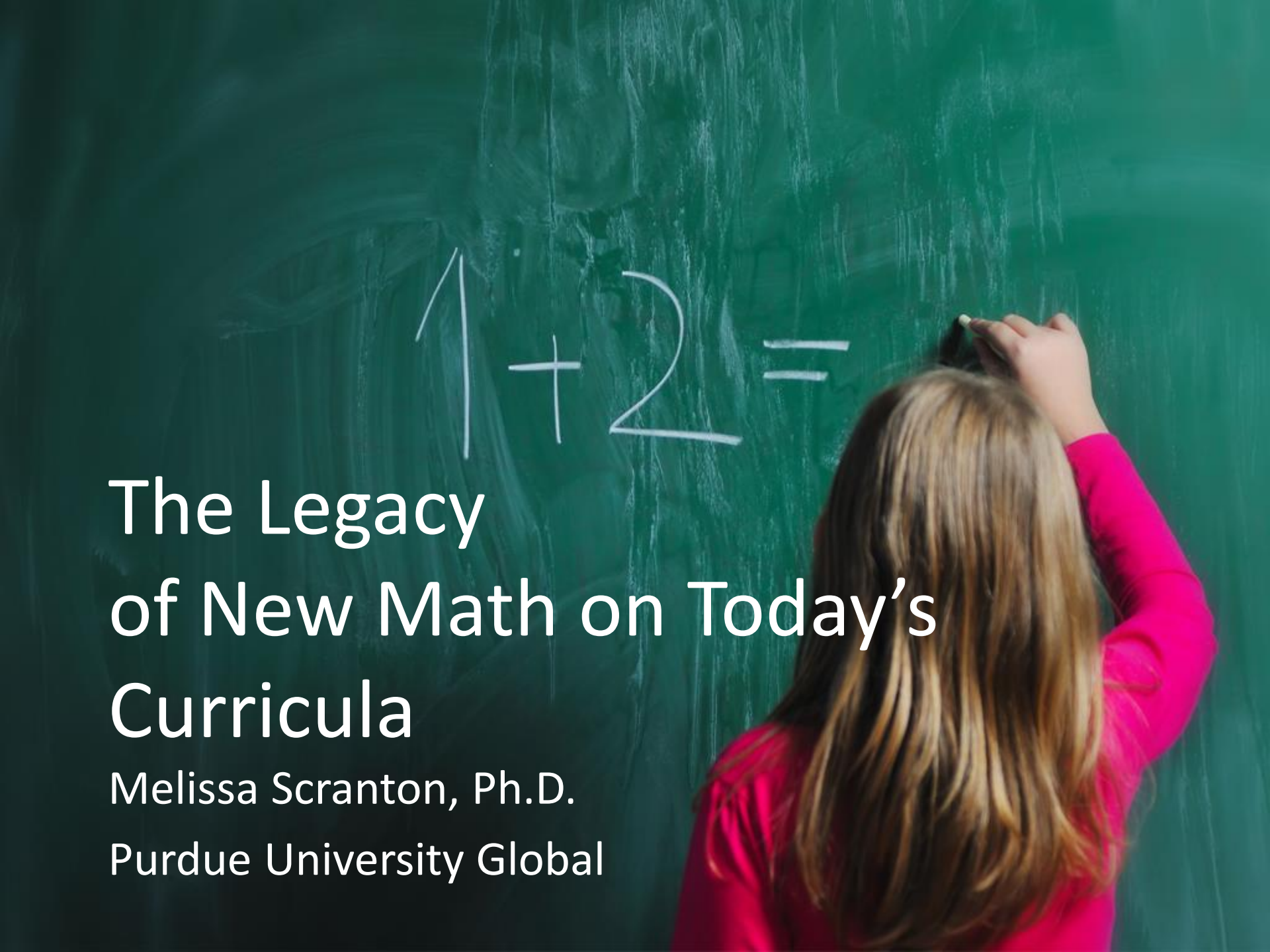


The Legacy of New Math on Today's Curricula

Melissa Scranton, Ph.D.

Purdue University Global

New Math of the 1950s and 60s

- CEEB Commission on Mathematics 1959 report
- Soviet Launch of Sputnik in 1957
- National Defense Education Act of 1958
- Paradigm Shift in Mathematics Education
- New Math focus on Conceptual Understanding of Mathematics rather than Rote Memorization
- Discover, Deduction, and Limited Drill

What Did New Math Look Like?

Bases other than 10	Sets	Different Number Representations
Discovering Hidden Patterns	New Language	Reasoning Solution Before Rule
Diagrams Boxes Frames	Matrices	Properties of Arithmetic

1951

Max Beberman

University of Illinois Committee on School Mathematics (UICSM)

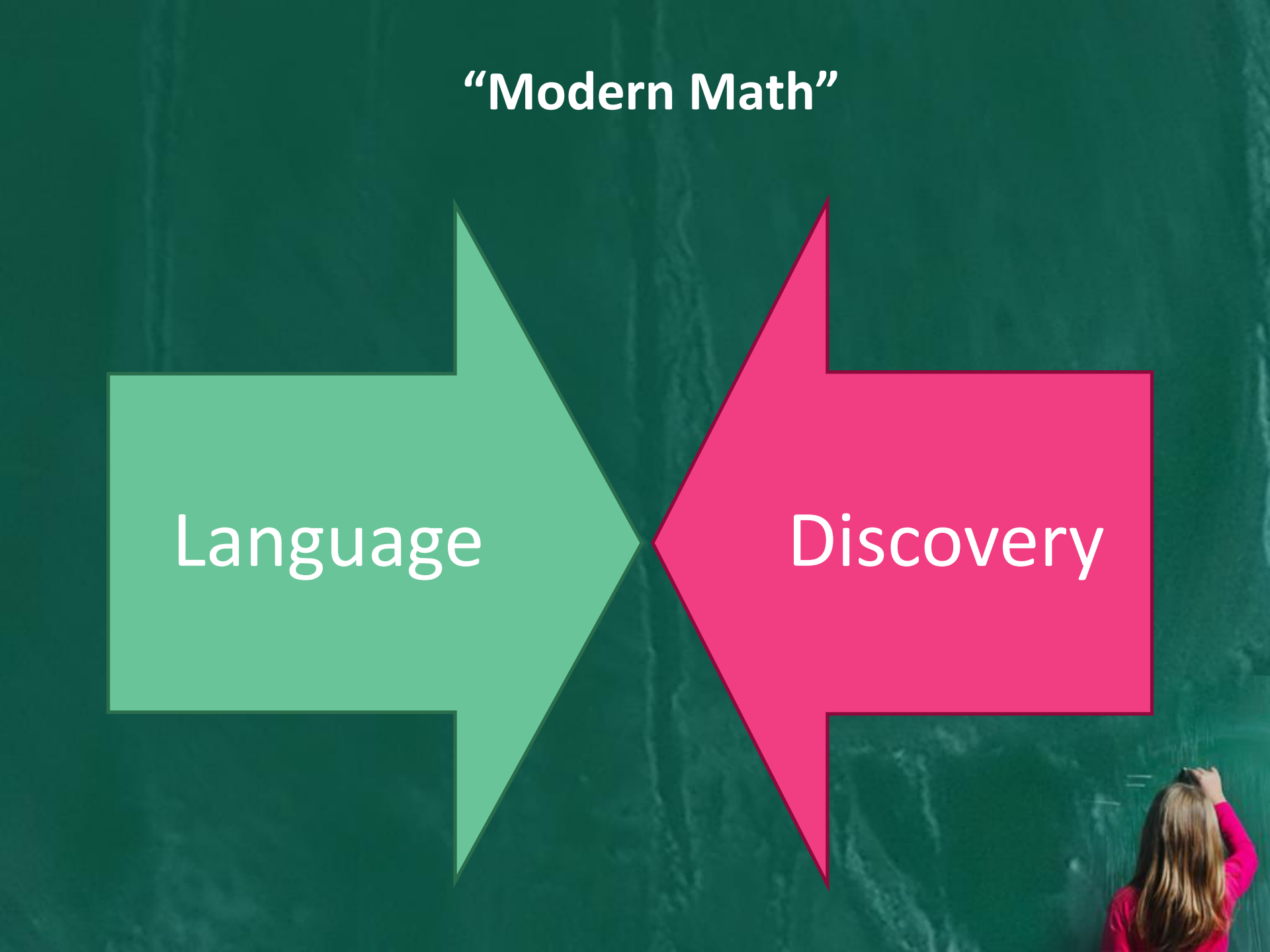
1957 & 1958

Edward Begle

School Mathematics Study Group (SMSG)

Beberman and Begle promoted a complete conceptual overhaul of math instruction. "Mathematics should be taught as a language, he said. And like language, it should be considered a liberal art, a key to clear thinking, and a logic for solving social as well as scientific problems" (Miller, 1990).

“Modern Math”



New math quickly won wide acceptance. 50% of all high schools were using New Math as their curriculum by 1965 (Miller, 1990).

At its peak, 85% of all elementary and secondary schools had adopted New Math (Miller, 1990).

PUBLIC SENTIMENT

Image copyright Charles Schulz.

Frustration

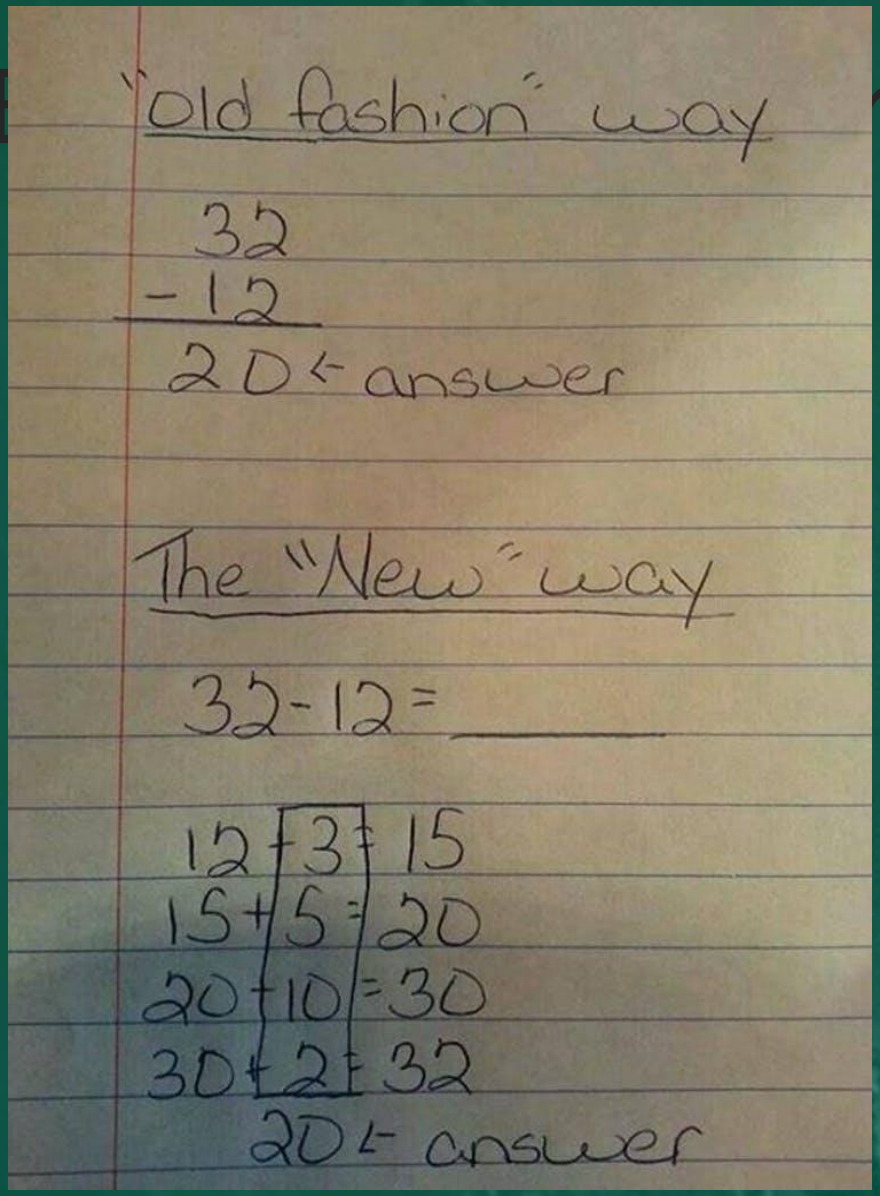
- Ridiculed and deemed a failure by the general public.
- Tom Lehrer spoofed with song New Math.
- Parents didn't understand children's homework.
- Teachers not trained on how to implement and instruct the new method.
- Implementation inconsistent.


NEW
HOO
HOO
MATH

What happened to New Math? Where did it go?

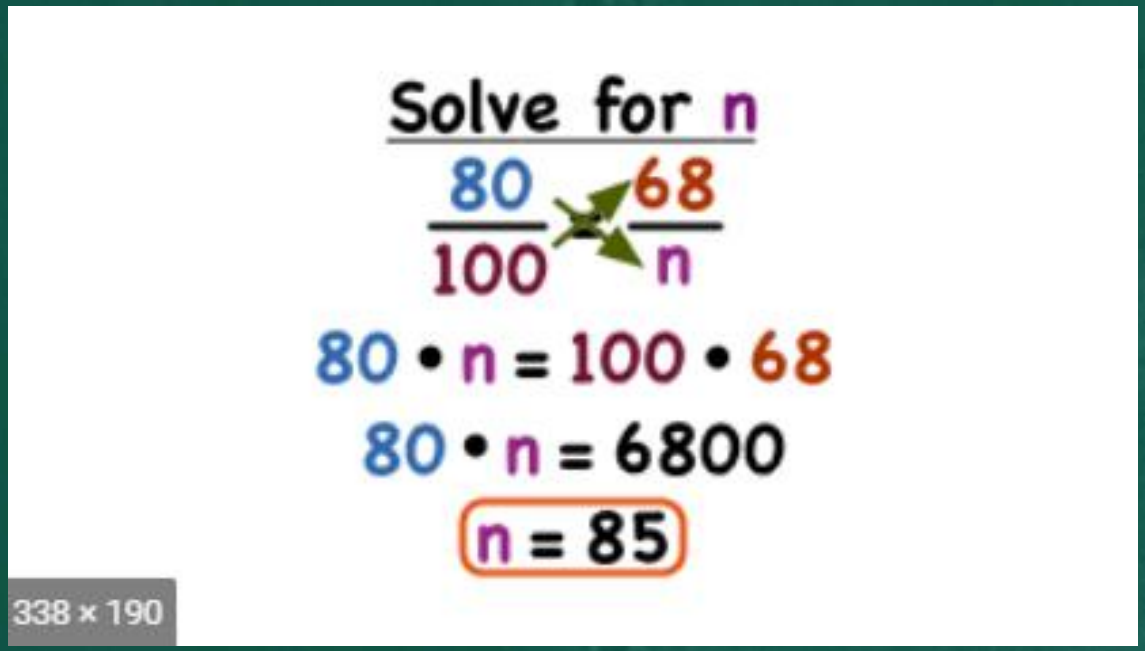
40 years later… Enter Common Core

1	National Learning Objectives
2	Adopted by 45 states within a few months.
3	No set curriculum – List of concepts
4	Multiple Strategies Encouraged
5	Frustration among students and parents



https://theconversation.com/the-common-core-is-todays-new-math-which-is-actually-a-good-thing-46585

Traditional Instruction on Proportions



https://virtualnerd.com/algebra-1/linear-equations-solve/ratios-proportions/proportion-examples/proportion-cross-multiply-example

Modern Instruction on Proportions

Common Core

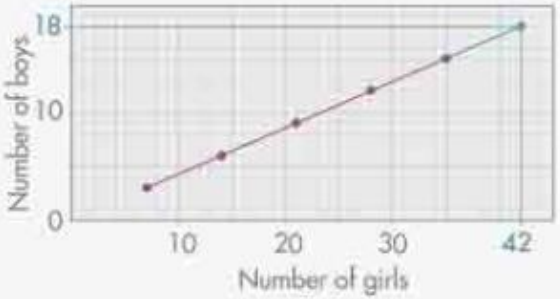
Ignoring the special case of finding an unknown numerator or denominator, Common Core math focuses instead on the concept of proportionality. It moves away from rote procedures like cross-multiplying, allowing students to demonstrate understanding of a new concept and learn how it connects with other areas of math.

Problem: The ratio of boys to girls in a class is 3:7.
Use this ratio to create a table with four equivalent ratios.

Boys	3	3 × 2 = 6	3 × 3 = 9	3 × 4 = 12	3 × 5 = 15
Girls	7	7 × 2 = 14	7 × 3 = 21	7 × 4 = 28	7 × 5 = 35

Solution: Write the ratio as a fraction and create a table with equivalent fractions. Understand that multiplying the numerator and denominator of a fraction by the same number produces a new fraction that equals the original fraction.

Problem continued: Plot the pairs of resulting values on a coordinate plane to visualize the relationship. Using this slope, how many boys are in a class with 42 girls?

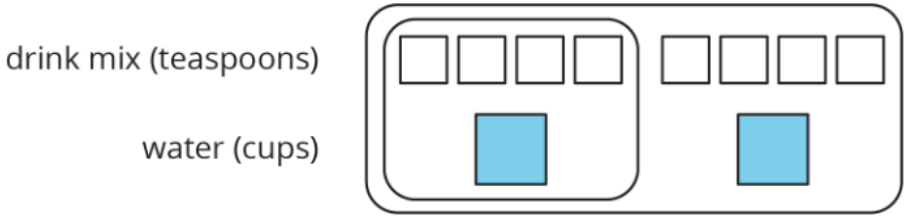


Solution: Use the strategy of drawing auxiliary lines (blue) for solving the problem.

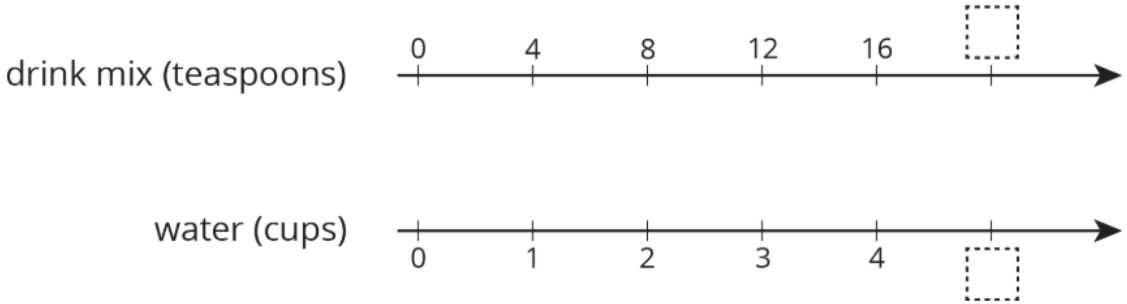
MIZUSHIMA. H, & READING (2016). https://www.wired.com/2016/10/meet-new-math-unlike-old-math/

6.2: Drink Mix on a Double Number Line

The other day, we made drink mixtures by mixing 4 teaspoons of powdered drink mix for every cup of water. Here are two ways to represent multiple batches of this recipe:



Expand Image



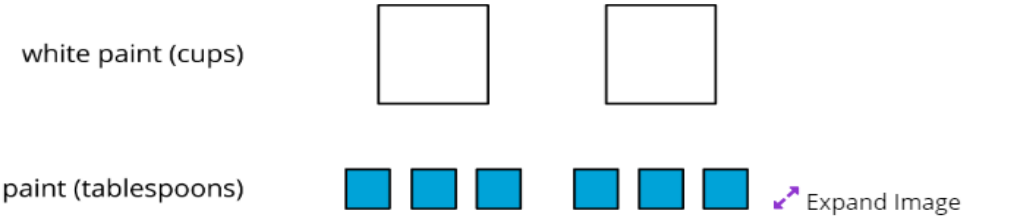
Expand Image

1. How can we tell that $4 : 1$ and $12 : 3$ are equivalent ratios?
2. How are these representations the same? How are these representations different?
3. How many teaspoons of drink mix should be used with 3 cups of water?
4. How many cups of water should be used with 16 teaspoons of drink mix?
5. What numbers should go in the empty boxes on the **double number line diagram**? What do these numbers mean?

Illustrative Mathematics, Grade 6, Learn Zillion, https://curriculum.illustrativemathematics.org/MS/students/1/2/6/index.html

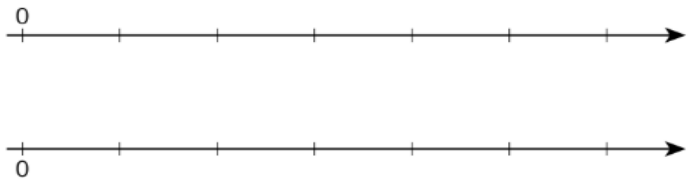
6.3: Blue Paint on a Double Number Line

Here is a diagram showing Elena's recipe for light blue paint.



Expand Image

1. Complete the double number line diagram to show the amounts of white paint and blue paint in different-sized batches of light blue paint.



Expand Image

2. Compare your double number line diagram with your partner. Discuss your thinking. If needed, revise your diagram.
3. How many cups of white paint should Elena mix with 12 tablespoons of blue paint? How many batches would this make?
4. How many tablespoons of blue paint should Elena mix with 6 cups of white paint? How many batches would this make?
5. Use your double number line diagram to find another amount of white paint and blue paint that would make the same shade of light blue paint.
6. How do you know that these mixtures would make the same shade of light blue paint?

Illustrative Mathematics, Grade 6, Learn Zillion, https://curriculum.illustrativemathematics.org/MS/students/1/2/6/index.htm

7.2: Visiting the State Park

Entrance to a state park costs $6 per vehicle, plus $2 per person in the vehicle.

1. How much would it cost for a car with 2 people to enter the park? 4 people? 10 people? Record your answers in the table.

number of people in vehicle	total entrance cost in dollars
2	
4	
10	

2. For each row in the table, if each person in the vehicle splits the entrance cost equally, how much will each person pay?
3. How might you determine the entrance cost for a bus with 50 people?
4. Is the relationship between the number of people and the total entrance cost a proportional relationship? Explain how you know.

Illustrative Mathematics, Grade 7, Learn Zillion, https://curriculum.illustrativemathematics.org/MS/students/1/2/6/index.htm

A rabbit and turtle are in a race. Is the relationship between distance traveled and time proportional for either one? If so, write an equation that represents the relationship.

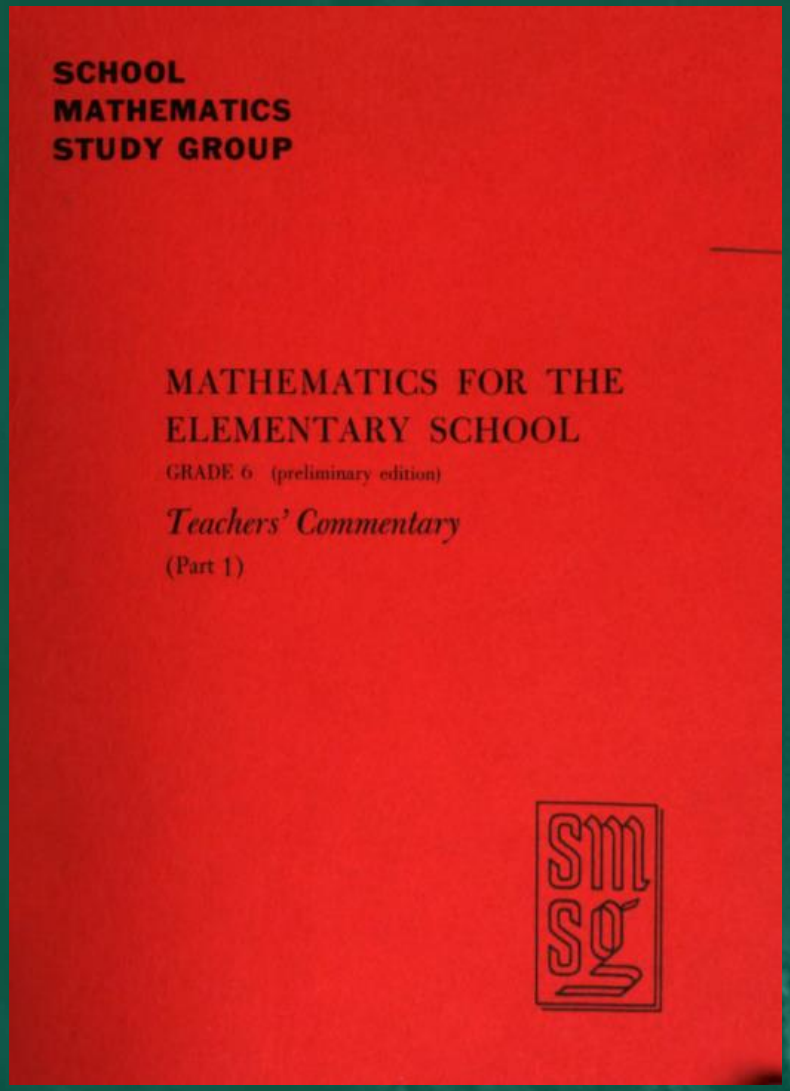
Turtle's run:

distance (meters)	time (minutes)
108	2
405	7.5
540	10
1,768.5	32.75

Rabbit's run:

distance (meters)	time (minutes)
800	1
900	5
1,107.5	20
1,524	32.5

Illustrative Mathematics, Grade 7, Learn Zillion, https://curriculum.illustrativemathematics.org/MS/students/1/2/6/index.htm



School Mathematics Study Group. (1962). *Mathematics for the elementary school: grade 6.* (Preliminary edition) [Stanford Calif.: Leland Stanford Junior University.

Mathematics for the Elementary School

Grades 4-6

Below is a complete list of the units for each of the three text books published in the 1961-1962 school year.

Grade 4

EA 101-Concept of Sets

EA 102-Numeration

EA 103-Properties and Techniques of Addition and Subtraction, I

EA 104-Properties of Multiplication and Division

EA 105-Sets of Points

EA 106-Properties and Techniques of Addition and Subtraction, II

EA 107-Techniques of Multiplication and Division

EA 108-Recognition of Common Geometric Figures

EA 109-Linear Measurement

EA 110-Concept of Fractional Number

Grade 5

EB 111-Extending Systems of Numeration

EB 112-Factors and Primes

EB 113-Extending Multiplicati and Division

EB 114-Congruence of Geometri Figures

EB 115-Addition and Subtracti of Fractional Numbers

EB 116-Measurement of Angles

EB 117-Area

EB 118-Ratio

EB 119-Review Exercises

Grade 6

EC 121-Exponents

EC 122-Multiplication of Fractional Numbers

EC 123-Side-Angle Relationships of Triangles

EC 124-The Integers

EC 125-Coordinates

EC 126-Division of Fractional Numbers

EC 127-Volume

EC 128-Organizing and Describing Data

EC 129-Working With Numbers and Numerals Review

EC 130-Sets and Circles

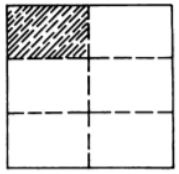
School Mathematics Study Group. (1962). *Mathematics for the elementary school: grade 6. Page 9.* (Preliminary edition) [Stanford Calif.: Leland Stanford Junior University

Using Diagrams to Explain Concepts

FINDING PRODUCTS

The product of $\frac{1}{3} \times \frac{1}{2}$ may be found from a diagram of a unit square.

Unit square A has a $\frac{1}{3}$ by $\frac{1}{2}$ region shaded. Its measure is $\frac{1}{6}$ of the unit square.



A

We can say

$$\frac{1}{3} \times \frac{1}{2} = \frac{1}{6}.$$

The product of fractions like $\frac{1}{3} \times \frac{1}{4}$, $\frac{1}{2} \times \frac{1}{5}$, and $\frac{1}{4} \times \frac{1}{8}$ may be found without drawing diagrams each time. We know that

$$\frac{1}{3} \times \frac{1}{4} = \frac{1}{3 \times 4} = \frac{1}{12}$$

$$\frac{1}{2} \times \frac{1}{5} = \frac{1}{2 \times 5} = \frac{1}{10}$$

$$\frac{1}{2} \times \frac{1}{b} = \frac{1}{2 \times b}$$

$$\frac{1}{a} \times \frac{1}{3} = \frac{1}{a \times 3}$$

$$\frac{1}{a} \times \frac{1}{b} = \frac{1}{a \times b}$$

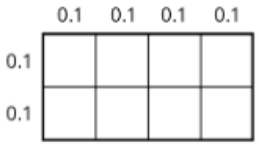
School Mathematics Study Group. (1962). *Mathematics for the elementary school: grade 6, p. 68.* (Preliminary edition) [Stanford Calif.: Leland Stanford Junior University

Using Diagrams to Explain Concepts

6.3: Using Area Diagrams to Reason about Multiplication

1. In the diagram, the side length of each square is 0.1 unit.

   a. Explain why the area of each square is *not* 0.1 square unit.



Expand Image

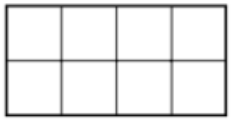
   b. How can you use the area of each square to find the area of the rectangle? Explain or show your reasoning.

   c. Explain how the diagram shows that the equation $(0.4) \cdot (0.2) = 0.08$ is true.

2. Label the squares with their side lengths so the area of this rectangle represents $40 \cdot 20$.

   a. What is the area of each square?

   b. Use the squares to help you find $40 \cdot 20$. Explain or show your reasoning.



Expand Image

3. Label the squares with their side lengths so the area of this rectangle represents $(0.04) \cdot (0.02)$.

   Next, use the diagram to help you find $(0.04) \cdot (0.02)$. Explain or show your reasoning.

Expand Image

Illustrative Mathematics, Grade 6, Learn Zillion, https://curriculum.illustrativemathematics.org/MS/students/1/5/6/index.

Shifts

Shift in Content

From 1900 – 1969 basic arithmetic accounted for 85% of math instruction. By 1999 this percent had decreased to 64% (Baker, et al, 2010)

Shift in Pedagogy

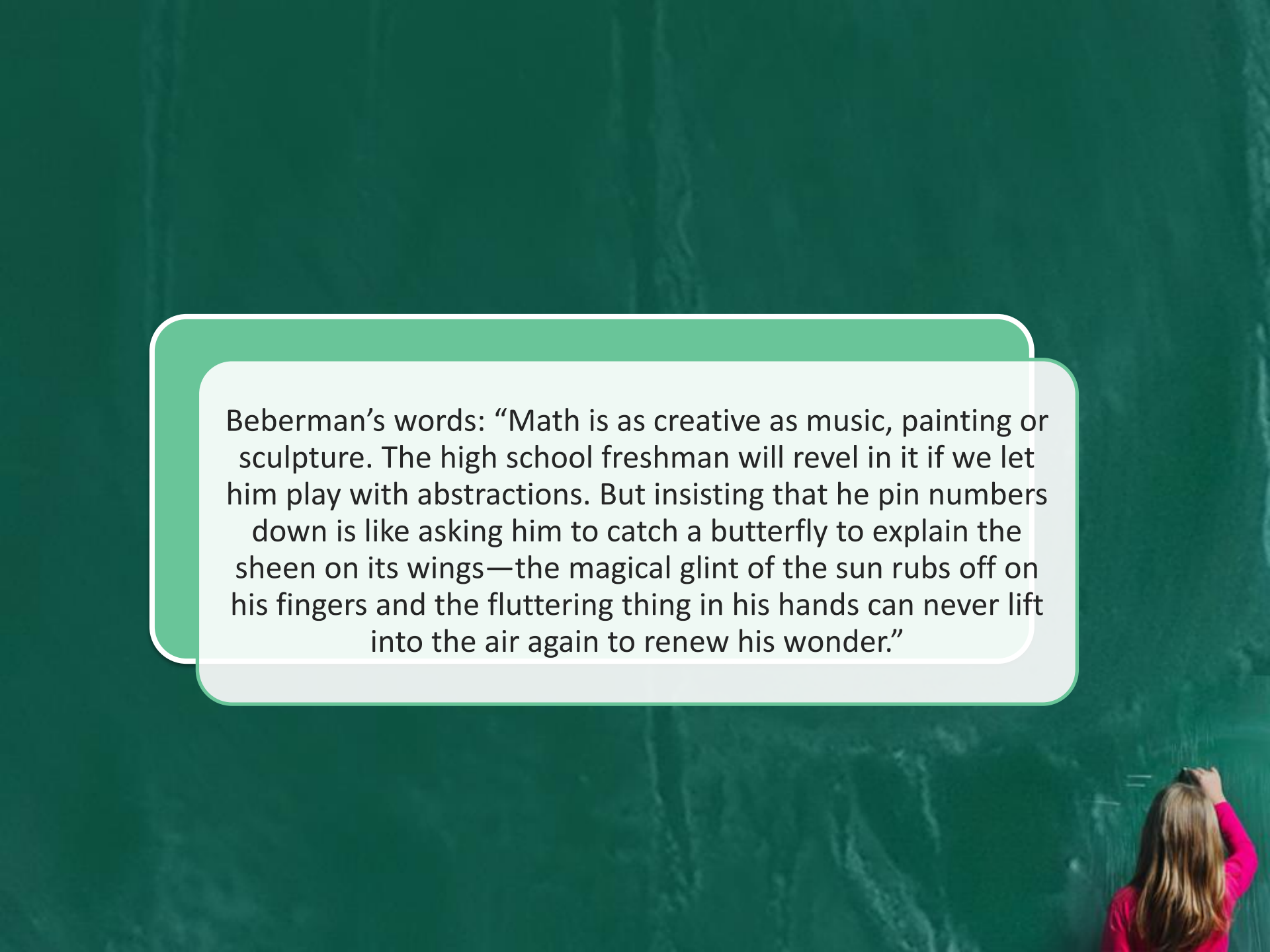
Teach students to think like mathematicians.

Inquiry Method

(Mizushima, 2016)

Common Core Mathematics Standards

Beberman’s words: “Math is as creative as music, painting or sculpture. The high school freshman will revel in it if we let him play with abstractions. But insisting that he pin numbers down is like asking him to catch a butterfly to explain the sheen on its wings—the magical glint of the sun rubs off on his fingers and the fluttering thing in his hands can never lift into the air again to renew his wonder.”



Do you have any questions?

References

Baker, D., Collins, J., Knipe, H., Leon, J., Cummings, E., Blair, C., & Gamson, D. (2010). One Hundred Years of Elementary School Mathematics in the United States: A Content Analysis and Cognitive Assessment of Textbooks From 1900 to 2000. Journal for Research in Mathematics Education, 41(4). Retrieved from https://www.nctm.org/Publications/journal-for-research-in-mathematics-education/2010/Vol41/Issue4/One-Hundred-Years-of-Elementary-School-Mathematics-in-the-United-States_-A-Content-Analysis-and-Cognitive-Assessment-of-Textbooks-From-1900-to-2000/

Hartnett, K. (2017, June 3). Meet the New Math, Unlike the Old Math. Retrieved November 8, 2019, from https://www.wired.com/2016/10/meet-new-math-unlike-old-math/.

Klein, D. (2003). A Brief History of American K-12 Mathematics Education in the 20th Century. Retrieved November 7, 2019, from https://www.csun.edu/~vcmth00m/AHistory.html.

How Do You Solve a Proportion Using Cross Products? (n.d.). Retrieved November 5, 2019, from https://virtualnerd.com/algebra-1/linear-equations-solve/ratios-proportions/proportion-examples/proportion-cross-multiply-example.

Illustrative Mathematics®, 6-8 curriculum. LearnZillion. Retrieved November 4, 2019, from https://learnzillion.com/resources/294896

Miller, J. W. (2019, November 1). Whatever Happened To New Math? Retrieved November 8, 2019, from https://www.americanheritage.com/whatever-happened-new-math-0.

Mizushima, H. (2016). LearnZillion Illustrative Mathematics®, 6-8 curriculum. Retrieved November 4, 2019, from https://learnzillion.com/resources/294896.

Palko, M. (2019, April 18). Education Reform is the new New Math. Retrieved November 10, 2019, from https://www.washingtonpost.com/news/monkey-cage/wp/2014/06/16/education-reform-is-the-new-new-math/.

(n.d.). Retrieved from https://www.youtube.com/watch?v=UIKGV2cTgqA&feature=youtu.be.

SMSG. (1962). *A Guide to the School Mathematics Study Group Records, 1958-1977.* Texas Archival Resources Online. doi: https://legacy.lib.utexas.edu/taro/utcah/00284/cah-00284.html

Strong, T. (n.d.). Retrieved November 4, 2019, from http://tomstrong.org/quotes/q_B.html.