NAEP, The National Assessment of Educational Progress
“The Nation’s Report Card”
NAEP
“A Common Yardstick” - NCES.edu.gov

- Established in 1960
- The largest nationally representative and continuing assessment of what America’s students know and can do in various subject areas - mathematics, reading, science, writing, the arts, civics, economics, geography, U.S. history, and in Technology and Engineering Literacy (TEL)
- Administered uniformly using the same sets of test booklets across the nation = a common metric for all states and selected urban districts.
- Assessment stays essentially the same from year to year, with only carefully documented changes = a clear picture of student academic progress over time.

National Center for Education Statistics
What Does the NAEP Mathematics Assessment Measure?
- Students' knowledge and skills in mathematics
- Students' ability to apply their knowledge in problem-solving situations.

The NAEP frameworks
- The theoretical basis for the assessments
describe the types of questions that should be included &
how they should be designed and scored.
- with all NAEP frameworks, the mathematics framework was developed under the guidance of the National Assessment Governing Board.

NAEP
Content Areas and Complexity

Five Content Areas
- number properties and operations,
- measurement,
- geometry,
- data analysis, statistics, and probability, and
- algebra.

Complexity
- low complexity,
- moderate complexity, and
- high complexity
NAEP - Expert Panel Meeting
September 16-17, 2015 in Washington, DC
Between 1990 and 2015

- 1990
- Before 1997 CA Framework

What happened before 1990s in Math Education?

Any patterns in Math Education?
Math Education
Early 1950s to 1960s - “New Math”

- "New Math" period
  - In 1955, the College Entrance Examination Board - a Commission on Mathematics to investigate the "mathematic needs of today's American youth."
  - High school teachers, math educators, and mathematicians, issued a report with recommendations for
  - A curriculum to better prepare students for college, and produced a sample textbook for twelfth grade on probability and statistics.

A brief history of American K-12 mathematics education in the 20th Century by David Klein

A teacher giving a presentation to the class
Math Education
Early 1950s to 1960s - “New Math”

- In 1957, The U.S.S.R launched Sputnik, the first space satellite. - “humiliation to America”

- 1958 National Defense Education Act to increase the number of science, math, and foreign language majors, and to contribute to school construction.

A Brief History of American K-12 Mathematics Education in the 20th Century by David Klein
Math Education
Early 1950s to 1960s - “New Math”

- Yale University, to develop a new curriculum for high schools.
- Multiple Prestigious colleges and universities

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Math Education
1950s to 1960s - New Math

- Calculus was taught in high school for the first time
- Mathematicians were involved for the first time
- Mathematicians, teachers, etc. worked as a team
- And....
- USA landed on the MOON!!!!
Math Education
1950s to 1960s - New Math

criticisms on New Math
- Excessively formal
- Little attention to basic skills
- Little attention to applications of mathematics.
- Programs that included treatments of number bases other than base ten
- Relatively heavy emphases on set theory

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by David Klein
Math Education
1970s - back to the Basics

1970s

- New Math was dead
- The National Science Foundation discontinued funding programs
- "back to the basics" in mathematics
- "free schools"
- Open Education Movement - repetition of the 1920s

A Brief History of American K-12 Mathematics Education in the 20th Century by David Klein
Math Education
1980s - Prelude to National Standards

NCTM

- *An Agenda for Action* and *A Nation at Risk*.

- "Technology would make problem solving available to students without basic skills"

- because "The use of calculators has radically reduced the demand for some paper-and-pencil techniques."

A Brief History of American K-12 Mathematics Education in the 20th Century by David Klein
Math Education
1980s - Prelude to National Standards

NCTM

- "Team efforts in problem solving should be common place in elementary school classrooms,"
- encouraged "the use of manipulatives, where suited, to illustrate or develop a concept or skill."
- *An Agenda for Action* also called for "a wider range of measures than conventional testing."
The mathematics program must present to students problems that utilize acquired skills and require the use of problem-solving strategies. Examples of strategies that students should employ are: estimate, look for a pattern, write an equation, guess and test, work backward, draw a picture or diagram, make a list or table, use models, act out the problem, and solve a related but simpler problem. The use of calculators and computers should also be encouraged as an essential part of the problem-solving process. Students should be encouraged to devise their own plans and explore alternate approaches to problems. -NCTM
Parents in California were also alarmed by the mathematics programs their children were getting in school.

Before 1997 CA Standards were developed, California was ahead of the rest of the nation in implementing the approach to mathematics education envisioned in the NCTM Standards and An Agenda for Action.
Then....

California started working on our own CA Standards instead of continue following the NCTM Standards
NCTM President Gail Burrill used strong words in a letter to the president of the California Board of Education. She wrote, "Today's children cannot be prepared for tomorrow's increasingly technological world with yesterday's content...The vision of important school mathematics should not be one that bears no relation to reality, ignores technology, focuses on a limited set of procedures ...California's children deserve more."

A Brief History of American K-12 Mathematics Education in the 20th Century by David Klein
1997 CA Standards

- Professor Hung-Hsi Wu from UC Berkeley did a careful analysis of the California standards.
- Wu found numerous mathematical errors and lack of clarity and cohesion in the rejected standards.

A Brief History of American K-12 Mathematics Education in the 20th Century
by David Klein
Any patterns in Math Education

- Pendulum
- parent complaints about changes?
- After an average person graduates from college, how many years for the person to get married and have a school aged child(children)?
- Parents or unprogressive teachers’ complains… “What’s wrong with the way I learned math? We are all doing fine.”
The United States‘ Apollo11 Apollo was the first manned mission to land on the Moon, on 20 July 1969. There have been six manned U.S. landings between 1969 and 1972 and numerous unmanned landings,

with No soft landings happening from 22 August 1976 until 14 December 2013.

Wikipedia
Between 1996 and 2015

- 1996
- Before 1997 CA Standards Framework
Between 2000 and 2015

- 2000
- 3 Years after
- 1997 CA Framework

Between 2007 and 2015

▶ 2007
▶ 10 years after
1997 CA Standards Framework

National Center of Education Statistics:
http://nces.ed.gov
Between 2013 and 2015

2013

Many States have been implementing Common Core Standards

CA - Some districts started Piloting

Smarter Balanced

Procedure
Problem Solving
Critical Thinking
Application
Performance Task
NAEP
4th and 8th grade framework

- Although the frameworks are updated periodically, the mathematics content objectives for grades 4 and 8 have not changed, allowing students' performance in 2013 to be compared with previous years.

For 2005, the Governing Board adopted a new mathematics framework for grade 12 to reflect changes in high school standards and coursework.

Additional changes were made for the 2009 assessment to facilitate reporting on twelfth-graders' preparedness for post-secondary education and training.

NAEP Complexity

- Computations occur in all content areas.
- At grade 12, the measurement and geometry content areas are combined into one for reporting purposes to reflect the fact that the majority of measurement topics suitable for grade 12 students are geometric in nature. Students at grade 12 are provided with reference sheet containing selected formulas related to geometry, trigonometry, conic sections, interest rates, series, and combinations and permutations.

Number Properties and Operations

focuses on students' abilities to

- represent numbers, order numbers, compute with numbers, make estimates appropriate to given situations, use ratios and proportional reasoning, and apply number properties and operations to solve real-world and mathematical problems. This content area also addresses number sense—comfort in dealing with numbers—and addresses students' understanding of what numbers tell us, equivalent ways to represent numbers, and the use of numbers to represent attributes of real-world objects and quantities. At grade 4, the focus is on whole numbers and fractions; at grade 8, the focus extends to include rational numbers; at grade 12, the focus extends to include real numbers.

measurement

- understanding of measurement attributes such as capacity, weight/mass, time, and temperature as well as the geometric attributes of length, area, and volume. Students may be asked to select appropriate units and tools for measuring, to measure length with a ruler at all three grades, to measure angles with a protractor at grades 8 and 12, and to solve application problems related to units of measurement.

- At grade 4, the focus is on length, including perimeter, distance, and height.

- At grades 8 and 12, students are also expected to understand and demonstrate knowledge of volume and surface area. Knowledge of both customary and metric units is expected. Students may be asked to solve problems that require conversions between (with conversion factors given) or within systems of measurement.

Geometry

- This content area focuses on identification of geometric shapes and transformations and combinations of those shapes.
- By grade 4, students are expected to be familiar with simple plane figures such as lines, circles, triangles, and rectangles as well as solid figures such as cubes, spheres, and cylinders. They are also expected to be able to recognize examples of parallel and perpendicular lines.
- As students move to middle school and beyond, increased understanding should deepen of two- and three-dimensional figures, especially parallelism, perpendicularity, angle relations in polygons, congruence, similarity, and the Pythagorean theorem.
- Students at all grades are expected to show knowledge of symmetry and transformations of shapes and to identify images resulting from flips, rotations, or turns. Justifications and reasoning in both formal and informal settings are expected at grades 8 and 12.

Data Analysis and Probability

- This content area focuses on students’ skills in four areas:
  - data representation,
  - characteristics of data sets,
  - experiments and samples, and
  - probability.

Data Analysis and Probability

- median, range, or mode, and to compare sets of related data;
- at grades 8 and 12
- the impact of outliers and the line of best fit in a scatterplot.
- By grade 8,
- knowledge of experiments and samples
- bias in sampling and identify random versus random sampling;
Data Analysis and Probability

Grade 12

- Make inferences from sample results.

*the impact of outliers
Students at all grades are expected to use statistics and statistical concepts to analyze and communicate interpretations of data. Students may be asked to solve problems that address appropriate methods of gathering data, the visual exploration of data, ways to represent data, or the development and evaluation of arguments based on the analysis of data. Probability is assessed informally at grade 4 and more formally at grades 8 and 12.

Algebra

- This content area focuses on students’ understanding of patterns, relations, and functions; algebraic representation; variables, expressions, and operations; and equations and inequalities. At grade 4, students are expected to show knowledge of simple patterns and expressions; at grade 8, this knowledge extends to include linear equations; and at grade 12, it extends further to include quadratic and exponential equations and functions. Representational skills, such as students’ ability to translate between different forms of representation (e.g., from a written description to an equation), the ability to graph and interpret points located on a coordinate system, and the ability to use algebraic properties to draw a conclusion, are assessed in this area. Students may be asked to express relationships algebraically as number sentences, equations, or inequalities; manipulate algebraic expressions; or solve and interpret algebraic equations and inequalities that are grade-level appropriate.

Beginning in 2017, NAEP will begin administering technology-based assessments (TBA) for mathematics, reading, and writing, with additional subjects added in 2018 and 2019.

As NAEP moves into computer-based assessments, the assessment administration will remain uniform continuing the importance of NAEP as a common metric. Read more about the future of the NAEP assessment.
Common Core Standards and Beyond