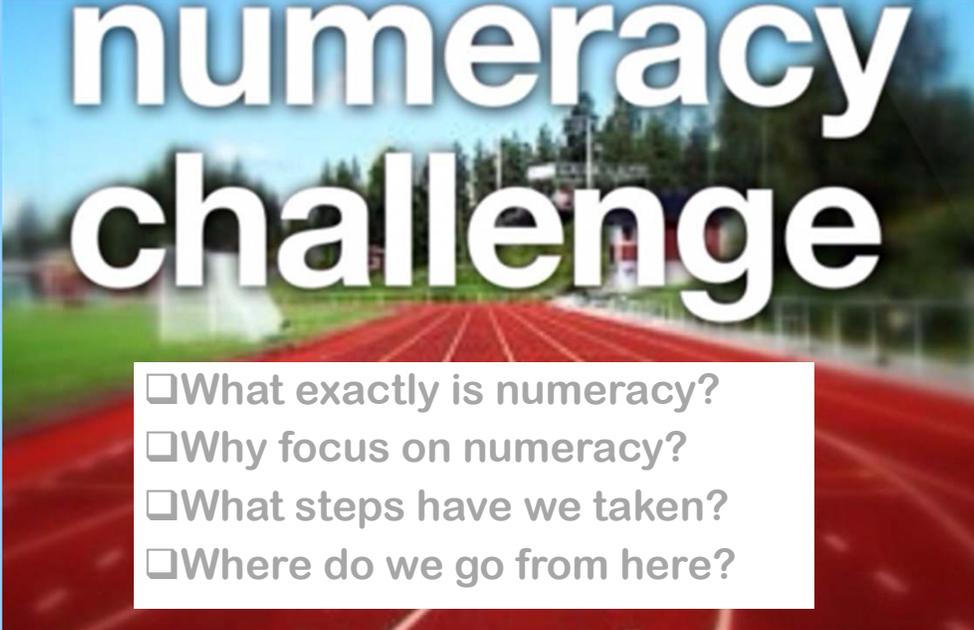


Supporting the Whole Child Through **NUMERACY**

GaDOE Curriculum Leaders' Conference
September 27, 2017

Let's take a few moments now to examine numeracy as a means of supporting the whole child. A recent NPR article reports that being literate with numbers and math is becoming increasingly important in modern society. We are challenged with preparing our students for that society, so today I'd like to begin to tackle that challenge with some leading questions about numeracy.

numeracy challenge



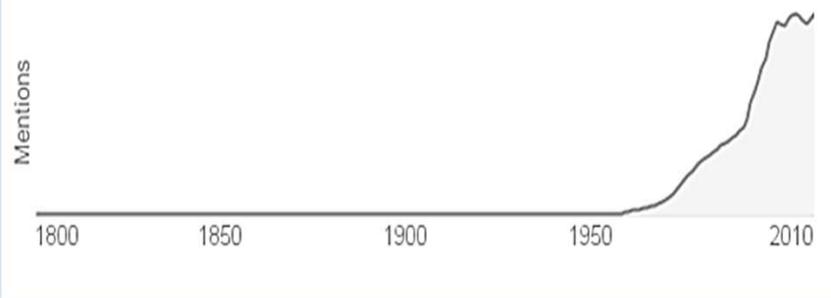
- What exactly is numeracy?
- Why focus on numeracy?
- What steps have we taken?
- Where do we go from here?

[This Photo](#) by Unknown Author is licensed under [CC BY-ND](#)



So what exactly is numeracy?

Use over time for: numeracy



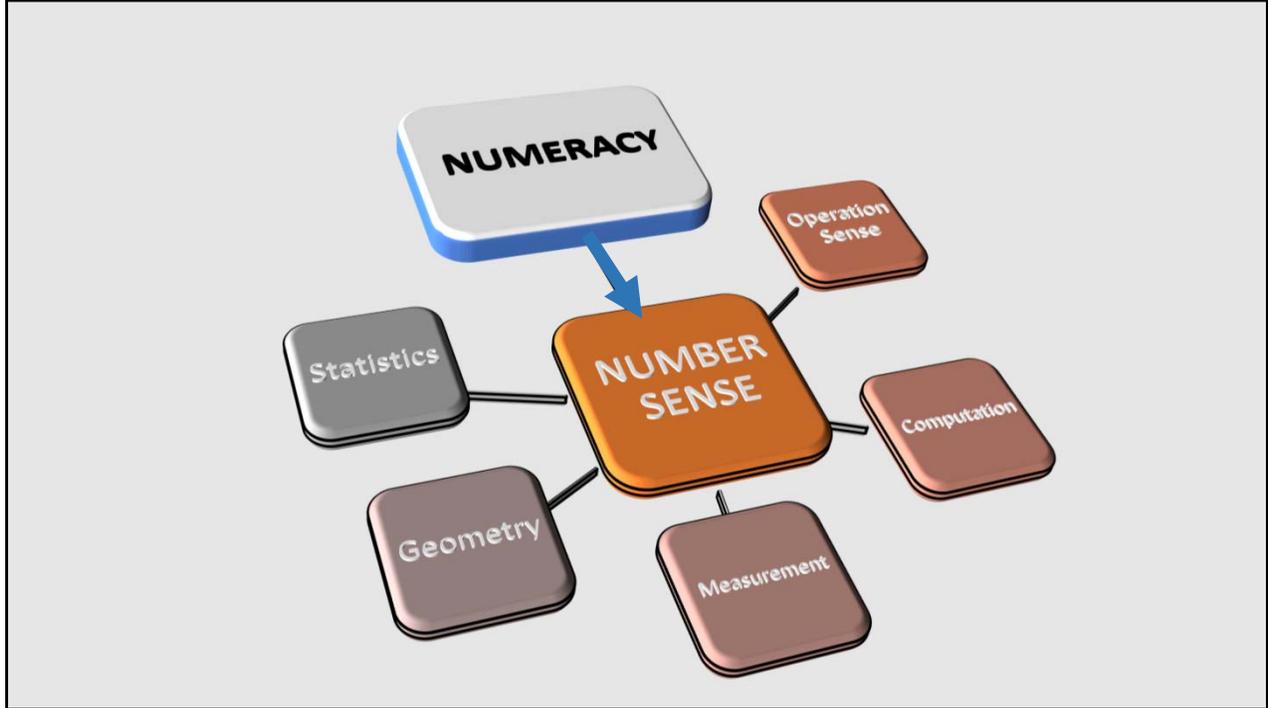
So let's get started by answering the question – what exactly is numeracy. Google's search engine records a dramatic increase in the number of times the word numeracy is found in sources over the years. But, what exactly do we mean?



So what exactly is numeracy?

1. Department for Education and Employment, England, 1999: ... a proficiency, which involves **confidence and competence** with numbers and measures.
2. Merriam-Webster: the capacity for **quantitative thought** and expression
3. Google Dictionary: the **ability to understand** and work with numbers
4. Wikipedia.org: the **ability to reason and to apply** simple numerical concepts...A numerically literate person can manage and respond to the mathematical demands of life
5. GeorgiaStandards.org Glossary: the ability to use mathematical ideas efficiently to make sense of the world

Authorities have addressed the definition using words like confidence and competence with numbers and the ability to understand, reason and apply numerical concepts, but my favorite definition is the one in our georgiastandards.org glossary - *the ability to use mathematical ideas efficiently to make sense of the world.*



Central to understanding numeracy is the identification of the fundamental facets of this competency and a recognition that all facets of Numeracy flow from Number Sense. So let's take a closer look at number sense and let's do so with an example.

Number Sense ...



Subtract $1\frac{3}{4}$ from $2\frac{1}{2}$.

[This Photo](#) [CC BY-NC-ND](#)

Take a minute to think about the process you would use to solve this numeracy problem.

Number Sense ...

Subtract $1\frac{3}{4}$ from $2\frac{1}{2}$.

$$\begin{array}{r} 2\frac{1}{2} = 2\frac{2}{4} = 1\frac{6}{4} \\ - 1\frac{3}{4} = 1\frac{3}{4} = 1\frac{3}{4} \\ \hline \frac{3}{4} \end{array}$$



[This Photo](#)

[CC BY-NC-ND](#)

Some students will apply the traditional algorithm represented here ...nothing wrong with that as long as they understand why they changed $2\frac{1}{2}$ to $2\frac{2}{4}$ and why when they needed to rename $2\frac{2}{4}$ before subtracting, they correctly chose to rename it $1\frac{6}{4}$ and not $1\frac{12}{4}$. However if they relied on rote memorization and their memory fails them, they might experience math anxiety. Math anxiety when explored is often the result of not being good at memorizing or at completing timed tests. Memorization is a very small component in math and speed does not contribute to success in mathematics ... yet sadly these are factors that often cause students to turn away from math.

Number Sense ...

Subtract $1\frac{3}{4}$ from $2\frac{1}{2}$.



$$\$2.50 - \$1.75 = \$0.75 \text{ or } \frac{3}{4}$$

This Photo

CC BY-NC-ND

Some students will choose to find the answer through money equivalents, and this works fine in this situation. However, this is not an effective strategy for every situation – like when the numeracy problem includes $3\frac{1}{16}$ - for instance.

Number Sense ...

Subtract $1\frac{3}{4}$ from $2\frac{1}{2}$.



[This Photo](#)

[CC BY-NC-ND](#)

Students who have developed a deep understanding of number sense might find the solution without ever picking up a pencil. These same students will often use mental computation and situational flexibility like the money solution when choosing a strategy.

Number Sense ...

Subtract $1\frac{3}{4}$ from $2\frac{1}{2}$.



$1\frac{3}{4}$ is $\frac{1}{4}$ from 2,

$\frac{1}{2}$ is the same as $\frac{1}{4} + \frac{1}{4}$ or $\frac{2}{4}$,

and... $\frac{1}{4} + \frac{2}{4} = \frac{3}{4}$

This Photo

CC BY-NC-ND

That student might choose to use a mental number line here. She would begin with $1\frac{3}{4}$ and recognize that another $\frac{1}{4}$ will move her to 2 on her mental number line. Next she looks at the distance – mentally of course - between 2 and $2\frac{1}{2}$. Recognizing the relationship between halves and fourths will lead her to $\frac{1}{2} = \frac{2}{4}$. She will arrive at the solution adding the $\frac{1}{4}$ (which moved her to 2) and the additional $\frac{2}{4}$.

Thoughts about Number Sense

David Sousa: **We are born with number sense ... so why do so many students and adults say they can't do math.**

Jo Boaler: **When students fail algebra it is often because they don't have number sense.**

There is a widespread misconception that only some students are cognitively capable of excelling in math – not so says Sousa.

Number sense is a prerequisite for succeeding in math says Boaler.

Why Focus on Numeracy?



- ❑ Millennial Performance
- ❑ Technological Advances
- ❑ Essential Workplace Skills
- ❑ Underrepresented Groups in STEM

[This Photo](#)

[CC BY-NC-SA](#)

So why do we need to on focus on numeracy.

1. First because more than one half of US millennials lack proficiency in workplace numeracy skills.
2. Secondly, because while technology advances have decreased the need for math procedural skills, the need for mathematical **understanding** has increased because of technology.
3. With greater numbers of workers engaging in more sophisticated tasks requiring critical thinking and problem solving, numeracy is recognized as an essential workplace skill. Because companies are relying more and more on data to guide their decisions, employees who can analyze and interpret data have become extremely valuable.
4. And finally, what about underrepresented groups in STEM careers. A Georgia pilot of *YouScience* found that nine times more young women have the aptitude for architecture and engineering careers than identified using traditional means. Other studies indicate that girls decide as early as K-2 that boys are better at STEM-related subjects. The 2015 STEM Index showed a slight uptick in STEM-related education and employment, but indicated that gaps between men and women and between whites and minorities remain deeply entrenched -- and, in some cases, have even widened.



Let's take a look at the steps we have already taken to meet the challenge of numeracy. First, we adopted a set of K-12 standards which de-emphasized rote memorization and fast recall and emphasized the learning of math facts along with a deep understanding of numbers; our over-arching standards for mathematical practice (SMPs) encourage mathematical habits of perseverance, collaboration, flexibility and reflection.

Then, we added engaging instructional strategies like group task work, formative assessment lessons, and 3-Act Tasks, to our toolkit. Please allow me to give a shout out to our RESA Mathematics Mentors who have offered statewide training in numeracy which has resulted in Number Talks in many of our K-8 classrooms.

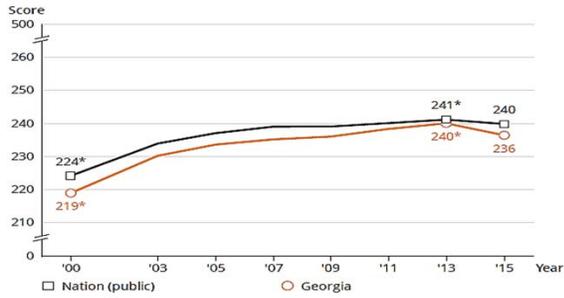
Next, our SBOE approved additional high school fourth course options to blend student interest with the demands of numeracy – Foundations of Algebra, Statistical Reasoning, College Readiness Mathematics, and Technical College Readiness Mathematics.

Early on, we enlisted Georgia master teachers to provide teachers with comprehensive resource packages – our most recent addition to the package - a video series of 53 videos.

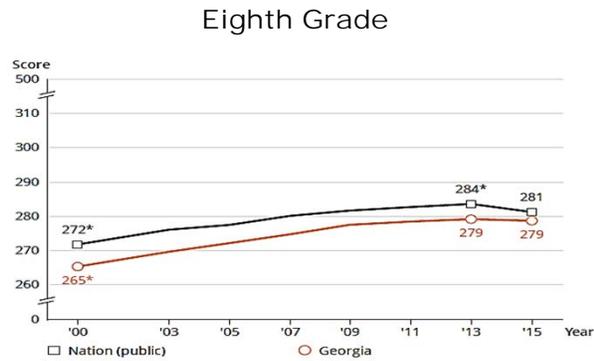
And because K-5 Math teachers have been asked to take a heavy lift in this process, RESAs continue to offer endorsement course series.

NOTE: Some of you have incorporated STEM/STEAM programs. Georgia currently boasts 34 STEM/STEAM certified elementary schools.
What have these steps yielded in terms of student achievement?

Georgia's NAEP Fourth and Eighth Grade Math Scores from 2000 - 2015



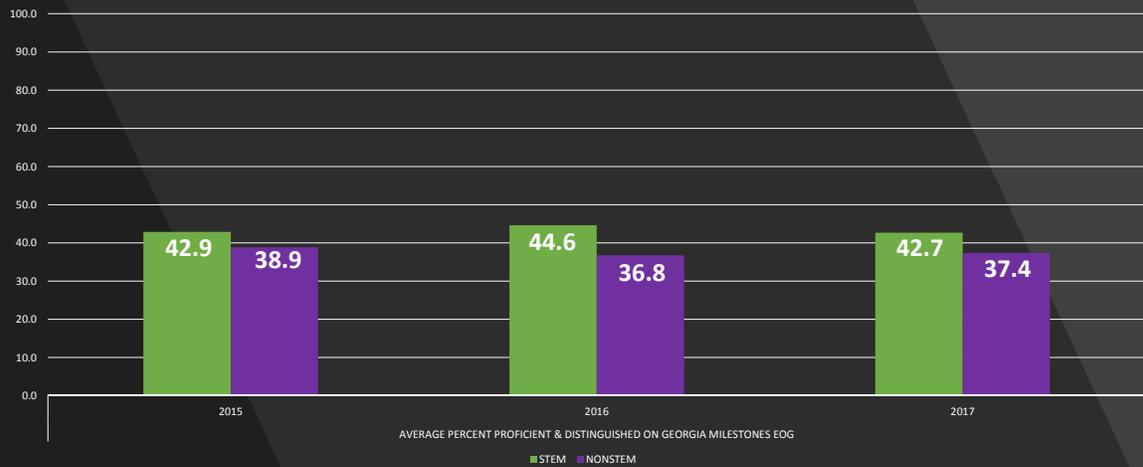
Fourth Grade



Eighth Grade

Our K-8 teachers are to be commended for a steady increase in NAEP scores as the challenge of numeracy is most significant in those grade levels.

GRADE 5 MATHEMATICS ACHIEVEMENT COMPARISON Georgia STEM Schools and Comparable Non-STEM Schools



And what about STEM/STEAM certification. This graph compares each of our 34 Elementary STEM-certified schools to 34 Non-STEM elementary schools with similar demographics in terms of Grade 5 EOG scores for the past three years. Please note that 23 of our 34 STEM Certified Schools are Title I. Clearly STEM programs are influencing student proficiency in mathematics by grade 5 – a priority of Superintendent Woods’ Strategic Plan.

Where do we go from here?

- Whole-School Structures
- Resource Enhancements
- Mathematics PLCs across Grade Levels
- Personalization of Teacher and Student Learning

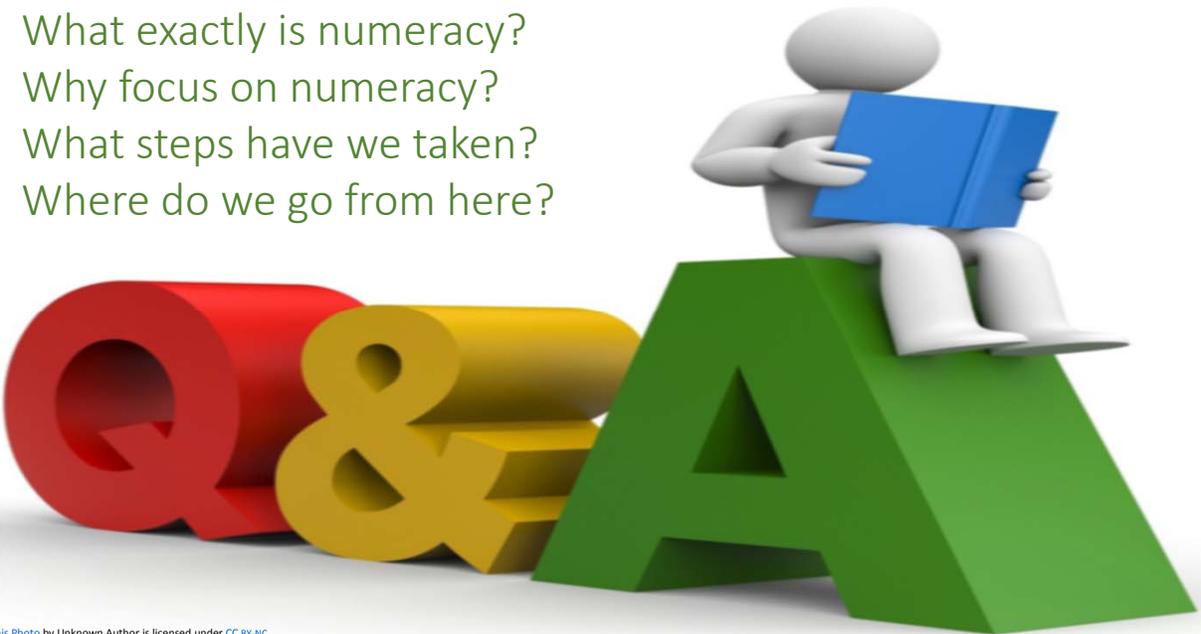


Where can we find promising next steps?

In addition to STEM/STEAM Programs, we might examine numeracy opportunities across the curriculum. Just like literacy, numeracy does not have to be limited to math class. We could consider whole-school structures which encourage common planning periods and routine peer observations to showcase exceptional math teachers. Our current K-5 structures could be analyzed to fully utilize teachers who teach mathematics effectively. We might take a closer look at no-cost quality open resources including the continually upgraded GaDOE resource packages.

Because our experts are in our classrooms, PLCs across Grade Levels can encourage vertical alignment, along with deep discussions surrounding number sense, content and pedagogy. Finally, we might begin to consider opportunities for personalization in both teacher and student learning. An effective personalization strategy for students might include routine administrations of numeracy diagnostic assessments to identify gaps early and to facilitate timely interventions.

What exactly is numeracy?
Why focus on numeracy?
What steps have we taken?
Where do we go from here?



This Photo by Unknown Author is licensed under [CC BY-NC](#)

Thank you for taking the time to think about these numeracy questions today as we seek to support the whole child through numeracy.



[This Photo](#) by Unknown Author is licensed under [CC BY-NC-ND](#)

from the Math Team – Brooke Kline, Lya Snell, and Sandi Woodall

Allow me to introduce my colleagues – Brooke Kline and Lya Snell. It is our pleasure to serve and support you as you seek to enhance mathematics instruction across the state.