

Presentation to the Idaho Interim Committee

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Questions to Discuss

1. What states have good English, mathematics or science standards and why are they good?
 - I will focus on mathematics, although some of the advice may transfer.
2. What advice do you have for a state reviewing its academic standards?

My Background

I teach courses for future and practicing mathematics teachers and have been active in mathematics education for 40+ years. In particular, I have been a leader in setting standards for mathematics at the national and state levels:

- Writer, *Principles and Standards for School Mathematics* -- National Council of Teachers of Mathematics (NCTM), 2000
- Writer, *Alabama Course of Study: Mathematics* -- 2003
- Lead writer, *Focus on High School Mathematics* -- NCTM, 2009
- Reviewer, *Alabama Course of Study: Mathematics* -- 2009
- Reviewer, *Common Core State Standards: Mathematics*; writer, Appendix A
- Writer, *Principles to Actions: Ensuring Mathematical Success for All* -- NCTM, 2016
- Reviewer, *Catalyzing Change in High School Mathematics* -- NCTM, 2018
- Writer, *Alabama Course of Study: Mathematics* -- 2019

Back Drop -- 2019 *Alabama Course of Study: Mathematics*

First attempt:

- The committee met a total of 33 days from March 2018 to January 2019.
- A public draft was released for review in October 2018.
- A final draft was presented to the State Board of Education in January 2019.
- The final vote scheduled for March 2019 was deferred due to concerns about the relationship of the proposed document to the Common Core.

Second attempt:

- The committee reconvened for an additional 10 days from June 2019 to December 2019.
- A second public draft was released for review in November 2019.
- A final draft was presented to the State Board of Education in January 2020, which was approved 5-3.

Review of State Standards

We had previously done an extensive review of state standards in June 2018. Based on the “suggestion” of our state superintendent, we reviewed the standards of the top six high-performing states on the National Assessment of Educational Progress (NAEP).

- All but two of the top 6 were based on the Common Core or closely related

Review of state standards by the Thomas B. Fordham Foundation:

- The four Common Core states -- STRONG
- Virginia -- GOOD
- Minnesota -- WEAK

Desired Qualities for Standards

The standards must emphasize deep learning of mathematics.

- Being able to recite facts and procedures is not good enough.
- Students must have flexible approaches to solve problems and be able to represent problems in multiple ways.

The standards must include attention to mathematical processes and practices.

- Students must be able to reason and use their knowledge to solve problems; this is what science and industry are looking for.

The standards must focus on essential content that:

- Is important for students' future success, that is not just included because that's what we have always taught.
- Respects students' trajectory of learning.

The standards must be understandable by teachers and other stakeholders.

Our Approach in Alabama

NOT Our Approach -- using standards from another state.

- We did not feel any of the other states exactly met our needs, although we did borrow some ideas.

NOT Our Approach -- starting over; recreating the wheel.

- Our previous standards were based on the Common Core State Standards, which were grounded in research on learning mathematics and vetted nationally.
- They were well-received by the vast majority of teachers in the initial public review.
- We had done 8 years of professional development using our previous standards, and many schools had made substantial progress.
- Our teachers could access many resources, since they were based on the Common Core.

OUR APPROACH -- improve the wheel, avoiding change for change's sake.

- Revisit the standards to ensure they are all essential for Alabama's students and none are missing.
- Streamline the standards, moving nearly all examples to an appendix.
- Simplify the language where appropriate to be more accessible.

The High School Standards -- A Major Challenge

The core high school mathematics sequence (Algebra I-Geometry-Algebra II) in Alabama had been based on Appendix A of the Common Core, but adjusted twice to decrease the emphasis on statistics.

- However, the high school courses still had too many standards to teach at the necessary level of rigor.
- Moreover, statistics is in fact important for students' future success.

Alabama requires a fourth year of high school mathematics.

- However, the set of courses offered did not present students with a coherent set of options.
- Many courses did not have clear targets of who would benefit from them and how.

Our Approach to High School, Part 1

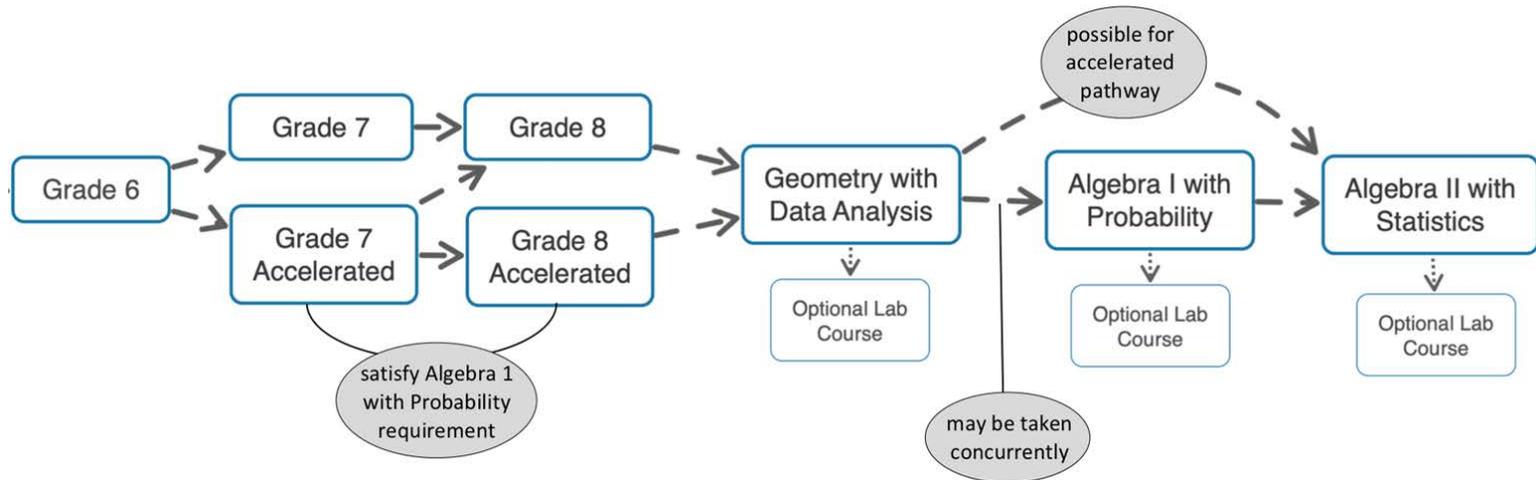
We redesigned our core sequence in alignment with the **essential concepts** -- key ideas that *all high school students* need to learn from NCTM's *Catalyzing Change for High School Mathematics*.

- Reducing the amount of content allows teachers time to develop greater depth.
- Eliminating obsolete topics allows space for more relevant content, such as data analysis and statistics.

Results:

- Geometry went from 43 standards to 38 standards.
- Algebra I went from 47 standards to 40 standards.
- Algebra II went from 50 standards to 38 standards.

NOTE: There are now also volumes of *Catalyzing Change* for elementary and middle grades.



Our Approach to High School, Part 2

- “Geometry First Pathway” (suggestion from *Catalyzing Change*)
 - Creates a more level playing field for entry into high school mathematics.
- Reimagined (and renamed) courses to be relevant and important for all students, emphasizing the importance of probability and statistics.
 - In particular, making Algebra II with Statistics a workable course.
- Ended the practice of offering Algebra I in eighth grade.
 - Instead of skipping a grade, the Algebra I standards are addressed in an accelerated Grade 7/8 pathway.

Our Approach, Part 3: Looking at Mathematics Pathways

- There needs to be a more seamless connection between what students are doing in K-12 and what they encounter post-secondary -- as they pursue additional education, complete certifications, and begin careers.
 - The Mathematics Pathway Initiative of the Conference Board of Mathematical Sciences is focused on this issue. (Both Idaho and Alabama are partners.)
- Consider the mathematics students will need in the future and work backwards.
 - Example: A student majoring in agriscience needs:
 - Core mathematics requirement: College Algebra
 - Statistical Methods
 - Question: What mathematics should they student have in high school?
 - College Algebra is equivalent to high school level coursework (???)
 - Thus, a course in statistics would likely be most useful.

Alabama's Fourth-year Courses

We began with an analysis of students' future mathematical needs and designed the fourth-year courses to prepare them accordingly.

- **Precalculus** -- designed for students going into mathematics-intensive majors or careers requiring calculus
 - The course was narrowly refocused on preparing them for calculus, reducing from 54 standards to 37 standards, to make it accessible to more students.
- **Mathematical Modeling** -- for students going into quantitative fields that do not necessarily require calculus, with a focus on real-world contexts
- **Applied Finite Mathematics** -- for students going into non-quantitative fields but who still need to develop mathematical reasoning and problem solving
- **AP Calculus** and **AP Statistics** can also count, although their content is not dictated by Alabama.

Notes on Completion of High School Courses

- *Catalyzing Change* recommends **four years of continuous engagement** in the study of mathematics at the high school level.
 - Studying mathematics each year of high school ensures steady and continuous growth toward future opportunity.
 - Compressing mathematics into fewer than four years, or allowing gaps of more than a year, interrupts the learning cycle and limits continued growth and opportunity. (NCTM, 2018)
- *My addendum*: Not taking a mathematics course during the senior year puts students headed for post-secondary study of mathematics at a serious disadvantage.

Final Advice

Start with the big picture:

- What is your vision for Idaho's students as they complete their mathematical preparation?

Be realistic about what standards can accomplish:

- Standards will not solve your problems; they are only one step in achieving your vision.
- What else needs to happen to ensure teachers are ready to prepare their students for future success in mathematics?