

Questions Arise About Need for Algebra 2 for All

Transition to Standards Looms

By **Erik W. Robelen**

Should all students take Algebra 2?

Florida seemed to say "no" this spring with the passage of a law striking it from graduation requirements. Texas said much the same in legislation Republican Gov. Rick Perry signed this week that also backs away from Algebra 2 for all.

Those steps come as the **Common Core State Standards** for math set the expectation that all students should meet learning objectives at what's generally considered the Algebra 2 level.

The new standards would represent a big shift. About one-quarter of high school students never take the course (or its equivalent), based on **recent federal data**. Also, some math educators say their Algebra 2 courses are about to get tougher as they align with the common core.

Success in Algebra 2 is often touted as a critical gateway to college and career readiness, but some question that view.

During Florida's legislative debate, state Sen. Aaron Bean said some students, if they're not college bound, don't need the course for a good career. And he fears that mandating it is a recipe for a higher dropout rate.

Not all students should have to "climb Mount Algebra 2," the Republican declared.

But other states have moved in the opposite direction from Florida, by adopting and recently starting to implement an Algebra 2 requirement, including Arizona, Minnesota, New Mexico, North Carolina, Ohio, and Tennessee.

Even so, fewer than half of states have such a requirement. And some of those states have an "opt out" provision for families.

Not all Algebra 2 courses, of course, are created equal. Although experts say there are some basic topics typically included, the content and rigor may vary widely.

"There is not now and hasn't ever been a consistent definition of Algebra 2, not when you look closely at it," said Michael Cohen, the president of Achieve, a Washington-based group that helped develop the common core and has long advocated that all students complete Algebra 2 or its equivalent. "The label, in some sense, is the wrong thing to focus on."

Indeed, Mr. Cohen said he hopes the standards foster more creativity in reimagining Algebra 2 and other high school math courses to better engage students, including through career and technical education that brings the subject to life.

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"You really don't have to just do it in a traditional sequence," he said.

Building a Ramp

At the high school level, the common core does not call for any specific courses. Rather, it identifies the content and skills students should master by the time they graduate, including in such domains as algebra, geometry, and probability and statistics. (It also contains more advanced, or "plus," standards for students who plan to pursue a STEM major in college.)

However, a common-core appendix suggests [several model pathways](#), including the traditional Algebra 1, geometry, Algebra 2 sequence, as well as integrated courses it dubs Mathematics 1, 2, and 3. The appendix details key content students might tackle in those courses.

Across K-12, the common core —adopted by nearly all states, including Florida—also has standards for math practice, including reasoning, solving problems, and modeling.

William McCallum, a math professor at the University of Arizona who was a lead writer on the math standards, said the more advanced algebra in the common core will likely be difficult for some students to master. In fact, some students "just hit a wall at algebra, period," he said.

But the common core, Mr. McCallum said, is carefully designed and sequenced over time to prepare students to succeed with all the algebra in the standards, beginning in kindergarten.

"We've tried to build a ramp up to that wall," he said. "There is this whole domain called operations and algebraic thinking, which tries to think about arithmetic as a rehearsal for algebra."

Jennifer Barrett, a math curriculum consultant for the 14,500-student Kenton County schools in Kentucky, said her district and state already require students to complete Algebra 2, but said it will be a "heavy lift" to adjust to the new expectations for all students.

"Algebra 2 at the level of the common core ... is a different beast," she said. "It's almost like Algebra 2 is Algebra 2 plus a good portion of what precalculus has been in the past."

Cliff Bara, who teaches math and science at Troy Junior and Senior High School in Troy, Mont., echoed that point. "Some of the stuff they have to do with polynomials—the remainder and factor theorems, rational roots theorem, using polynomial identities—these are not things we have normally done in Algebra 2 class," he said.

While Algebra 2 can benefit all students, he would stop short of requiring it. "To actually say every kid in my state is going to complete Algebra 2, I think that's setting some folks up for disaster. There is a subset of students for whom that is either an unreasonable expectation or it's just not necessary."

'Out of the Running?'

Whether all students really need the subject is hotly contested.

"Mastery of Algebra 2 is widely thought to be a prerequisite for success in college and careers," says a [report issued last month](#) by the National Center on Education and the Economy, a

Coursetaking Paths

An [appendix](#) to the Common Core State Standards in mathematics outlines "model pathways" for high school coursetaking, including one that features Algebra 1, geometry, and Algebra 2, and another with integrated courses that combine math, geometry, and other topics. Among the content the appendix suggests for an Algebra 2 course:

PERFORM arithmetic operations with complex numbers.

USE complex numbers in polynomial identities and equations.

INTERPRET the structure of expressions (polynomial and rational).

UNDERSTAND the relationship between zeros and factors of polynomials.

CREATE equations that describe numbers or relationships.

UNDERSTAND solving equations as a process of reasoning and explain the reasoning.

ANALYZE functions using different representations.

Washington-based research and advocacy group. "Our research shows that that is not so."

Marc S. Tucker, the president of the NCEE, said the study is not suggesting schools water down their standards, but rather focus on math coursework that will be more relevant and useful. The study recommends a greater focus on statistics and probability, as well as mastery of complex applications of measurement and geometric visualization, for example. Algebra 2, it says, should be offered but not required.

But the report has come under fire, in part because of its methodology: It's based on a close look at what students need to succeed in the first year at seven community colleges. Mr. Tucker says that's because community colleges provide much of the nation's vocational training, and many students end up transferring to four-year colleges.

"Just because some community colleges' standards are low doesn't mean that we should lower high school standards," writes Linda Rosen, who leads the advocacy group Change the Equation, in a [Huffington Post piece](#) last month.

She makes the case that Algebra 2 should be universal.

"How many 13- or 14-year-olds know what they want to be when they grow up?" writes Ms. Rosen, whose organization represents business leaders promoting STEM education. "If they don't take Algebra 2 in high school, students will be out of the running for a host of careers, from engineering to health care."

Also, she said, if states don't require Algebra 2, low-income and minority students will be especially harmed, as they're more likely to be steered into less-rigorous courses.

Anthony P. Carnevale, who directs the Center on Education and the Workforce at Georgetown University, said "it's not a straightforward question" as to whether students need Algebra 2.

Additional Skills

Based on his research, he estimates that about 11 percent of U.S. jobs involve work that requires an understanding of concepts usually taught in Algebra 2, but only about 6 percent use advanced algebraic operations on a regular basis.

He does say Algebra 2 promotes valuable skills that are helpful in many other jobs.

"If you start throwing away Algebra 2 because you can't see [people] using it on the job or in going to college, then the question is: How do they get this other set of skills?" such as analyzing, problem-solving, and reasoning. "These are skills we tend to give people through math."

In Florida and Texas, the rewrite of diploma requirements was promoted as a way to give students more flexibility to focus on different career paths, and in particular, to be mindful of students not headed to a four-year college.

The new Texas law reduces from 15 to five the number of required end-of-course exams, deleting Algebra 2. It also replaces the state's "4x4" default curriculum, which requires four years of high school math, including Algebra 2, with a "foundation" diploma that requires three years but not Algebra 2. Students can pursue

BUILD a function that models a relationship between two quantities.

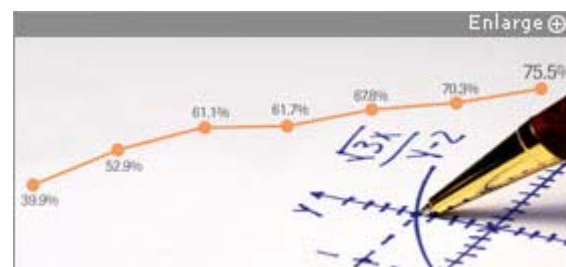
CONSTRUCT and compare linear, quadratic, and exponential models and solve problems.

PROVE and apply trigonometric identities.

Source: Common Core State Standards

Building Steam

Federal data show significant growth over time in the proportion of high school students who completed Algebra 2.*



*Figure includes students who took an integrated math course that also incorporated trigonometry or geometry.

SOURCE: National Center for Education Statistics

diploma "endorsements" in several areas. In addition, students may seek a "distinguished level of achievement" designation with additional course requirements, including Algebra 2.

"I just don't believe everybody needs Algebra 2," said state Rep. Jimmie Don Aycock during floor debate in March, according to the Associated Press. "I don't believe it should be the determining factor in a student's future."

The Texas measure won overwhelming support in the state House and Senate, though the business community was sharply divided, with opponents arguing that it watered down the state's standards.

The **new Florida law** GOP Gov. Rick Scott signed in April designates "multiple pathways" for demonstrating the skills and knowledge to graduate. It includes a "scholar designation" for students planning to attend a four-year college, as well as a "merit designation" that involves pursuing industry certifications for some credit. Only students on the "scholar" path must complete Algebra 2 and pass an end-of-course exam in the subject.

Observers say it remains to be seen whether the state-approved industry certification courses will include the Algebra 2-level math in the common core.

In explaining his support for the new law, Sen. Bean said he's troubled by big dropout rates. Requiring Algebra 2, he said, will exacerbate the problem.

"We want to give hope instead of [requiring] these advanced courses specifically designed for someone going to college," he said in an interview. "So, you're going to be ready, maybe not for college, but for the workforce, or a technical college. ... And you're going to graduate; we're going to keep you in school."

In North Carolina, new graduation requirements call for most students to follow a Future-Ready Core with four years of math, including Algebra 2 (or an integrated math course with that content). Also, completion rates for Algebra 2 or an integrated course at that level will factor in the state's accountability system next school year.

Jason Van Heukelum, an assistant superintendent with the 40,000-student Cabarrus County district, near Charlotte, said his district is taking steps to ensure most students take Algebra 2, but he has misgivings about the new accountability mandate, especially coming so soon in the common-core era. Today's high schoolers, he said, haven't had a curriculum aligned with the common core since their academic career began. "For these kids right now, you got on the ramp two-thirds of the way through," he said, "and schools are going to be judged for that."

California has no immediate plans to require Algebra 2, said Michael W. Kirst, the president of the state education board.

He notes that both of the state's four-year university systems require students to complete the course. State officials, he said, are exploring some career and technical education offerings for students who are not college bound that would likely meet some, but perhaps not all, of the more advanced algebra in the standards. The question, he said, is: "Do you need the whole boatload of Algebra 2?"

Whether or not states require it, the common-core exams two state consortia are creating will include at least some of the standards' content at the Algebra 2 level.

'Support Courses'

Eric P. Johnson, the math director for the 311,000-student Clark County district in Nevada, said his high schools offer three versions of Algebra 2: a "regular" course, an honors offering, and Applied Algebra 2, "which you could call Algebra 2 lite." But the district plans to phase out the applied course, he said, "because of the common core's higher expectations."

To ease the transition, it is creating elective "support courses" for students to take alongside Algebra 1 and 2. Also, the district may shift to integrated courses that blend algebra, geometry, and other topics.

"With common core, it seems like more and more the way it should be experienced is in an integrated way," he said.

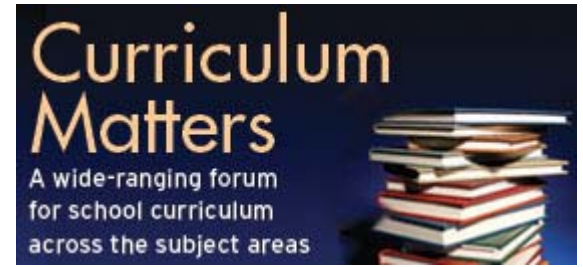
Greta Bornemann, the math director for Washington state's education agency, said she understands why some people have misgivings about Algebra 2, since their experience with it may have "seemed useless," but said the common core will help bring it more appeal, as it becomes more engaging and applied to "authentic" situations, especially with the standards' emphasis on mathematical modeling.

"We're talking about ... a kind of mathematics we've never delivered before," she said.

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