

Indiana is special to me since I was born and spent my first 7 years in South Bend, But I'm here today because I was a member of the Validation Committee that supervised the writing of the Common Core Math Standards (CCMS). My view is that they have such serious problems that no state should adopt them at this time. They dramatically lower the bar for students and the handling of many of the key math topics is not research based.

Indeed, the writing team's inability to show me such supporting research was the main reason I could not sign off on CCMS.

To be fair, CCMS are significantly better than most of the state standards it replaces. Moreover a number of parts are very good indeed. However, the old Indiana math standards that it could replace are significantly **better**.

Math outcomes in America are poor and getting worse, and this failure could be catastrophic.

- Indeed, the recent mortgage crises that almost brought us to our knees can be directly tied to the fact that we no longer teach compound interest in K-12. It was only a precursor of what could be coming.
- We included compound interest as a seventh grade standard in California's 1997 standards, but it turned out that middle school teachers could not generally handle it.
- It is crucial to understand that math is entirely hierarchical. What you learn later always depends on your understanding of the material that came earlier.
- This is the major problem. Our past failures create today's failures. But it is not easy to address.

International expectations in a number of the high achieving countries are that a calculus course is required to graduate from high school, and over 90% of their citizens have high school degrees.

A major problem with CCMS is that it only covers material from Algebra I, Geometry and Algebra II. It does not cover more advanced material in trigonometry or linear algebra, let alone pre-calculus, or calculus.

Past experience shows that even when standards are presented as setting a floor for student expectations, in practice they become a ceiling since they determine assessments. So the lack of higher level material in CCMS means that students in this country will tend to have even poorer outcomes than they do now.

All but two of the State Universities in the U.S. require 4 years of high school mathematics for admission. In spite of the fact that many CCMS supporters argue that CCMS is designed to give students the math they need to enter the workforce or higher education, the reality is that it only prepares students for an entry level job or anon-selective community college, not a four year university. Indeed, one of the main writers of CCMS, Jason Zimba, testified to the Massachusetts State Board of Education that in CCMS, the concept of college readiness is minimal and focuses on non-selective colleges. (Minutes of the March 2010 meeting.)

There are two types of CCMS math standards, advanced and ordinary.

CCMS describes the advanced standards as follows:

“Additional mathematics that students should learn in order to take advanced courses such as calculus, advanced statistics, or discrete mathematics.”

They then go on to say:

“All ordinary standards should be in the common mathematics curriculum for all college and career ready students. ”

The problem is that the CCSSI advanced standards are comprised almost entirely of topics that are normally in regular high school Algebra I, Algebra II, or Geometry courses. And the above makes it clear that the expectation is that (all) students are not expected to even be exposed to this material.

It is implicitly being recommended that the high schools should (a) dumb down the regular algebra and geometry courses and track students: taking the “more able ones” and putting them in more advanced or highly enriched courses.

However, even including the advanced topics there is virtually no material that would be in a regular pre-calculus course or more than the beginning weeks of linear algebra or trigonometry. Nor is there any material that would be in a course on solid and spherical geometry, old topics that are recently becoming more important.

Besides the low level of the standards, there are other issues including mistakes like CCMS’ confusion of vectors and vector fields, or errors in the discussion of ratios and proportions.

CCMS is also prescriptive about teaching methods, but most of the required pedagogy does not conform to the practices in the high achieving countries.

Indeed, there is research by professional mathematicians as well as math educators in the old USSR that indicate it is precisely these CCMS recommended teaching methods that are responsible for our horrible outcomes in teaching place value and fractions.

The only experiences supporting the highly non-standard way Geometry is presented in CCMS are in a single area in Belgium. However, when the old USSR tried this approach on a large scale, they rapidly had to abandon it.

Looking at the material in the lower grades we find that Core Standards’ approach to whole numbers is the continuation of the approach pioneered in California in the early 1990’s. It had such bad outcomes in California that it spawned the Math Wars.

Instead of preparing for and teaching the standard methods of adding, subtracting, multiplying and dividing numbers, by first carefully studying and understanding the meaning of our place value notation which is what they do in the high achieving countries,

1. Common Core has a relatively superficial discussion of place value and place value notation that is almost entirely consistent with the usual U.S. practice of treating numbers written in place value notation as reading words.
2. In the U.S., students learn that the important thing is to be able to read 311 as “three hundred eleven” rather than emphasizing that it means “the sum of 3 copies of 100, one copy of 10 and a 1” (the key word being sum) as is carefully focused on in the high-achieving countries. In other words students in the high achieving countries are taught to see the number, while our students are taught read a word.

All of the standard methods for operating with whole numbers and then fractions start with the above understanding of the meaning of the shorthand base 10 place value notation - as illustrated with the example of “311” in (2) above. Students like those in the U.S. who have not internalized it (seeing the *symbol* as shorthand for sum of multiples of powers of ten that it represents) simply do not succeed.

In summary: the objective of the Common Core Math Standards is to present the minimal amount of material that a high-school graduate needs to enter the work force in an entry-level job, or to enroll in a community college with a reasonable expectation of avoiding a remedial math course. There is no preparation for anything more, such as entering a university (not a community college) with a reasonable expectation of being able to avoid remedial courses. (Virtually no university student who must take an entry-level or remedial math course ever gets a degree in a technical area such as the hard sciences, engineering, economics, statistics, or mathematics.)

I cannot emphasize enough that Common Core is using our children for a huge and risky experiment, one that consistently failed when tried by individual states such as California in the early 1990’s and even countries such as the old USSR in the 1970’s.