Testimony About Issues-With-Core Math Standards

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Controversy is swirling about the new Common Core national standards, which were created to transform K-12 education in English language arts and math. The standards themselves have areas that are very disturbing,

- For example, they are claimed to be research based, but the main reason I could not sign off on them was that there were too many areas where the writing team could not show me suitable research that justified their handling of key topics - particularly when they differed from standard approaches.
- In too many ways Common Core amounts to a massive experiment with our children – an experiment we think Arkansas would be wise to reconsider.

But perhaps even worse are the extremely expensive and highly non-standard tests that go along with the standards.

Supporters insist that Common Core it is the only way to address the problem of constantly declining U.S. Student outcomes and trying to match up with our international competitors. These failures cannot be taken lightly as they are likely to have severe economic consequences.

But the fact is that the Common Core math standards fall far short of what students need for more advanced work. Indeed, one of the main authors of the Core Math Standards, Jason Zimba, testified at a public meeting of the Massachusetts State Board of Education in 2010 that Common Core is only designed to prepare students for an entry level job or a non-selective community college, not a four year university.

Most educators would agree that mathematical education in the US is in crisis, and that the reason is the way math is currently taught here. But Common Core does nothing to address this problem. And in fact, in many areas the national standards are fully as poor as the standards of the weakest states.

The three most severe problem areas are

1. the beginning handling of whole numbers in particular adding, subtracting, multiplying, and dividing;
2. the handling of geometry in middle school and high school;
3. the very low level expectations for high school graduation that barely prepare students for attending a community college, let alone a 4-year university.

The classic method of, for example, adding two-digit numbers is to add the digits in the "ones" column, carry the tens in the sum to the "tens" column, then add the "tens" digits, and so on. This "standard algorithm" works first time, every time. But instead of preparing for and teaching this method, by first carefully studying and understanding the meaning of our place value notation and then using this to explain why the usual methods work, Common Core creates a three-step process.

The first is to let students create their own algorithms for doing one-digit additions, subtractions, and multiplications. The second is *probably* to extend these student constructions to more complex calculations. (We say “probably” because the standards are not at all clear on this point.) There is no point where the student-constructed algorithms are explicitly replaced by the very efficient standard methods for doing one-digit operations. Finally, but years later than is the case in the high achieving countries, it is simply required that students are able to use the standard algorithms without having been taught the key parts of the material that explains why and how they work.

1. In fourth grade: "Fluently add and subtract multi-digit whole numbers using the standard algorithm."
2. "In fifth grade: Fluently multiply multi-digit whole numbers using the standard algorithm."
3. Finally in sixth grade, when students in other countries are already beginning to study algebra, we have: "Fluently divide multi-digit numbers using the standard algorithm."

This approach is just the continuation of the approach pioneered in California in the early 1990's that had such bad outcomes that it spawned the Math Wars. Moreover, the use of student-constructed algorithms is at odds with the practices of high-achieving countries and the research that supports student constructed algorithms appears highly suspect.

Additionally, the way Common Core presents geometry is not research- based – and the only country that tried this approach on a large scale, the old USSR, rapidly abandoned it. The problem is that --though the outlined approach to geometry is rigorous -- it depends on too many highly specialized topics, that even math majors at a four year university would not see until their second or more likely their third years. Again, there is no research with actual students that supports the Core Standards approach.

Tied in with the problems in geometry, there are also severe problems with the way Common Core handles percents, ratios, rates, and proportions – the critical topics that are essential if students are to learn more advanced topics such as trigonometry, statistics, and even calculus.

In addition to these deficiencies, Common Core only includes most (but not all) of the standard algebra I expectations, together with only some parts of standard geometry and algebra II courses. There is no content beyond this, and this is exactly where the fact that it is designed to only prepare students for entry level jobs or entering a 2 year college after high school becomes apparent.

Let me say this again: the objective of the Common Core Math Standards is to present the minimal amount of material that high-school graduates need to be able 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 skip the entry-level courses. (Virtually no university student who has to take an entry-level 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.

The Common Core tests Currently being Prepared.

Core Standards admits the standards are only a “floor,” the minimal topics needed to enter the workforce in an entry level job or enroll in a community college with some expectation of being able to avoid taking a remedial math course.. But in practice standards and especially the aligned tests that come with them quickly control curriculum and the floor becomes the ceiling.

The aligned tests being developed by PARCC and SBAC are also extremely problematic.

Both groups are intent on using massive numbers of what are called “constructed response” questions, where students are required to write short essays or otherwise use multiple means of communication. Such exams are expensive to grade, usually require huge numbers of skilled graders – so many that the testing companies have to involve a majority of minimally qualified graders - and give inconsistent results. Additionally, at least in math, the questions tend to be so poorly designed that it is not at all clear what they are even testing.

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Grade 05 Mathematics Sample TE Item

Using estimation, classify each product below as less than $\frac{5}{8}$ or greater than $\frac{5}{8}$ by moving the product to the correct box.

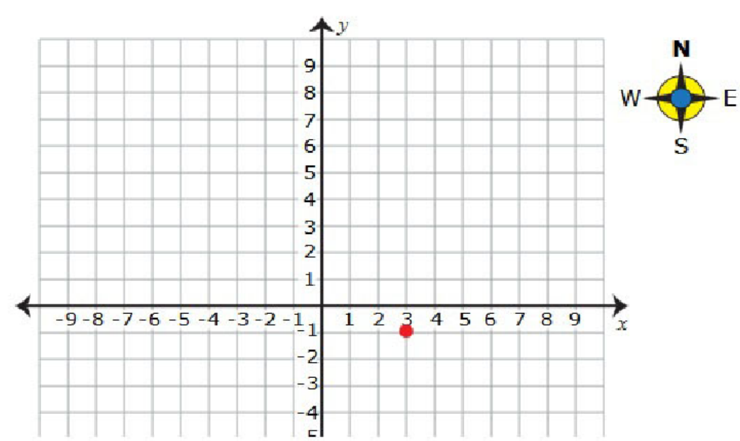
$\frac{5}{8} \times \frac{1}{4}$ $\quad \frac{5}{8} \times \frac{13}{6}$ $\quad \frac{5}{8} \times 1\frac{1}{16}$ $\quad \frac{5}{8} \times \frac{7}{8}$ $\quad \frac{5}{8} \times 3$

Less Than $\frac{5}{8}$	Greater Than $\frac{5}{8}$

Analysis: There are two things being tested here, students ability to "mouse" and one relatively routine fact about numbers -- when you multiply a positive number, a, by a number, b, that is greater than 1, then ba > a, and if b is less than 1, then ba < a. Mousing is something that is dependent on the resources available state-wide, and cannot be assumed. The second is relatively low level, typically third or at most fourth grade material in the high achieving countries.

Below is a sixth grade item. Once more, there are just two things going on. The first is students ability to "mouse," and the second is that the students are able to find coordinates in two of the four quadrants of the coordinate plane. However, the statement of the problem -- artificially embedding the tested math skill in a "story problem" -- fails dramatically. The biggest issue is that a grocery store is not really a point. It takes up space, and so we could, perhaps specify that coordinates (-2, -4) give the

> 22. The map of a town is placed on a coordinate grid with each whole number distance north (N), south (S), east (E), or west (W) representing 1 block.
> A grocery store has the coordinates (-2, -4). The owners of the grocery store plan to build an additional grocery store at a location that is 5 blocks to the east and 3 blocks to the north of the original store. Plot the location of the additional grocery store on the coordinate grid.



position of the upper left corner of the store, and we want to specify the coordinates of the upper left corner of the new store .... But as it is stated, students who have seen similar problems incorrectly developed in class know that the hidden assumption here is that we can represent a store by a single point, whereas a student who as been correctly taught to make minimal assumptions and to clearly be able to articulate the assumptions that are being made would have serious difficulties with this problem.

Here is an eighth grade item that , at first glance, seems little more than a test of vocabulary and skill with a computer mouse. But on second glance we see the hidden assumptions. If, as was the case with the problem above, the student knows the hidden assumptions underlying the statement of the problem, namely that the dots are exactly the points on an integer coordinate grid .

Grade 08 Mathematics Sample TE Item

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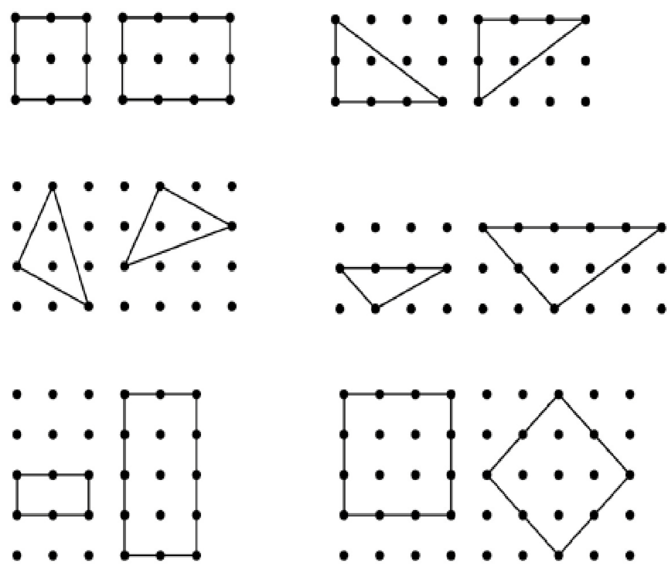
Classify each pair of shapes below as a pair of congruent shapes, a pair of similar shapes, or a pair of shapes that is neither congruent nor similar by moving each pair of shapes to the correct box.



Pairs of Congruent Shapes	Pairs of Similar Shapes	Pairs of Shapes That Are Neither Congruent Nor Similar

where the vertical distance is $|y_1 - y_2|$ and the horizontal distance is measured by $|x_1 - x_2|$. However, it turns out that in the actual pictures the vertical distance $|(y+1)-y|$ is about 1.18 times that of $|(x+1) - x|$. So, once more, a properly taught, careful student would be at a serious disadvantage. Moreover, this actually matters. If students are comfortable ignoring errors in the range of 20%, how would you like to have them designing things like a manned lunar probe?

Here is a second eighth grade sample item, which appears to be almost as trivial as the one above, but at least this one appears to be correct, even if the major skill being demonstrated is again "mousing."

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Mathematics Sample TE Item

Use the numbers in the box to make the equations below true. The numbers cannot be used more than once. Click on a number and then drag it to the appropriate box.

4	8	10	64	100	1,000

$\sqrt{\square} = \square$ $\qquad$ $\sqrt[3]{\square} = \square$