Common Core's Validation

A Weak Foundation for a Crooked House

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Ze'ev Wurman

Contents

"There Was a Crooked Man" by Mother Goose
There was a crooked man, and he walked a crooked mile,
He found a crooked sixpence against a crooked stile;
He bought a crooked cat which caught a crooked mouse,
And they all lived together in a little crooked house.
Source: *The Dorling Kindersley Book of Nursery Rhymes* (2000)

Overview

The final version of the Common Core standards was released in June 2010. Also released at the same time was a report containing the signatures of 24 members of the Common Core Validation Committee, a committee appointed in the summer of 2009 to review the various drafts of the standards and to assure the public that the standards in mathematics and English language arts were research-based, rigorous, and internationally competitive.

The report, however, did not make it clear that the Validation Committee consisted of 29 members and that five of its original members did not sign a form attesting that Common Core's standards were comparable in rigor to the standards of the highest-performing countries in the world. Two Validation Committee members who did sign off later attempted to provide evidence to support their sign-offs. But their research was poorly executed and failed to provide evidence to sustain their claim that Common Core's standards were internationally competitive and could prepare American high school students for college-level work. Moreover, other studies of the standards since their release have raised concerns about their rigor.

As the situation now stands, Common Core's standards remain unvalidated despite the fact that over 46 states adopted them on the basis of a promise on their Race to the Top (RttT) applications in 2010 that they would be internationally benchmarked and, hence, rigorous. As outlined in the RttT applications, these standards were supposed to be "supported by evidence that they are internationally benchmarked." But they were not. This paper explains the problems in the *post facto* studies that sought to validate Common Core's standards and the concerns raised by the other studies.

Background

In December 2008, the National Governors Association (NGA) in partnership with the Council of Chief State School Officers (CCSSO) and Achieve Inc. published *Benchmarking for Success*, a report whose main recommendation called for "*adopting a common core of internationally benchmarked standards in math and language arts for grades K-12 to ensure that students are equipped with the necessary knowledge and skills to be globally competitive*." Elaborating on the need for national standards, the report promised "*to provide to states a roadmap for benchmarking their K-12 education systems to those of top-performing nations*." It went on at some length to describe what students in high-achieving countries are doing:

> *By the eighth grade, students in top-performing nations are studying algebra and geometry, while in the U.S., most eighth-grade math courses focus on arithmetic. In science, American eighth-graders are memorizing the parts of the eye, while students in top-performing nations are learning about how the eye actually works by capturing photons that are translated into images by the brain. In fact, the curriculum studied by the typical American eighth-grader is two full years behind the curriculum*

being studied by eighth-graders in high-performing countries.

In September 2009, the Common Core State Standards Initiative (CCSSI)[1] issued the first draft of its Career- and College-Readiness Standards (CCRS) in mathematics and English language arts (ELA).[2] The standards documents were criticized for their definition of career and college readiness; their exemplars; the assumption that both career and college readiness can be satisfied by the same set of standards; and the non-transparent process in which they were developed. For example,

(1) College readiness was set at the level of Algebra 1 in mathematics.

(2) The exemplars for the mathematics standards, provided in only four of 11 domains, were unsuitable for teaching purposes.[3]

(3) Doubts were expressed by two major experts on career readiness, Michael Kirst of Stanford University and Paul Barton of Educational Testing Service, that the same standards can serve to prepare students for both college and career.[4]

(4) No records are available to show why members of the various CCSSI committees were chosen or what their relevant credentials were. The Standards Development Work Group was composed chiefly of staff members of or consultants to Achieve, Inc., National Center on Education and the Economy (NCEE), and the two major college testing companies (College Board and American College Testing, or ACT).[5]

Although CCSSI later included educators on its review committee, control of the standards stayed in the hands of the actual standards-writers: William McCallum, Jason Zimba, and Phil Daro[6] in mathematics, and David Coleman and Sue Pimentel in English language arts/reading.[7]

In July 2009, CCSSI announced the members of a Validation Committee (VC) whose purpose was to:

- Review the standard-writing process;
- Ensure that the standards were internationally benchmarked;
- Ensure that the standards were research-based; and
- Add missing standards if they were needed and could be justified.[8]

Membership and Purpose of the Validation Committee

Most of the 29 members of the VC had doctorates in education. Several had no doctorates. Two had doctorates in psychology. Only one had a doctorate in mathematics. None had a doctorate in English literature or language. Only a few committee members had had more than a casual experience in writing educational standards: R. James Milgram (mathematics), Sandra Stotsky (ELA), and Dorothy Strickland (early childhood). In addition, both Milgram and Stotsky had worked on or reviewed standards in many states. Given that all 50 states have had standards for a decade or more and that there is a pool of experienced people who have written standards in mathematics or ELA, it is not clear why so few were on the VC.

In May 2010, CCSSI asked the VC to approve formally the Common Core standards attesting that they were:

1) Reflective of the core knowledge and skills in ELA and mathematics that

students need to be college-and career-ready

2) Appropriate in terms of their level of clarity and specificity
3) Comparable to the expectations of other leading nations
4) Informed by available research or evidence
5) The result of processes that reflect best practices for standards development
6) A solid starting point for adoption of cross-state common core standards
7) A sound basis for eventual development of standards-based assessments

Surprisingly, 24 out of the 29 VC members agreed that both sets of standards met the Committee's charge. The official report on the VC does not indicate that some members did not agree. Nor did the report refer to their grounds for disagreement.[9] Three dissenting views are available, and I quote from them below.

From R. James Milgram:

With respect to the standards' appropriateness in terms of their level of clarity and specificity:

> *"I conclude that they are, but "appropriate" needs to be clarified. The standards are not at the level of those of the high-achieving countries or the top state mathematics standards – including California, Minnesota, Indiana, and Massachusetts. Moreover this difference in level is significant, being approximately 1 - 2 years at the end of eighth grade."*

With respect to the standards' comparability to the expectations of other leading nations:

> *"This is where the problem with these standards is most marked. While the difference between these standards and those of the top states at the end of eighth grade is perhaps somewhat more than one year, the difference is more like two years when compared to the expectations of the high-achieving countries – particularly most of the nations of East Asia."*

With respect to the standards' being informed by available research or evidence:

> *"This is also a problem area. First, as indicated in the first paragraph of my report, there are a very large number of important standards that are unique to this document, not reflective of any expectations I am aware of that appear in the standards of the high- achieving countries, or that have been supported by any reliable research I am aware of. The individual standards listed on the first page of my report are analyzed in considerable detail in the body of that report. For most of them, I have indicated reasons for serious doubts as to the likelihood that serious research would validate them."*[10]

From Dylan William:[11]

> *"I can agree with statements 1, 6 and 7. I can persuade myself that statements 4 and 5 are just about OK (although it's a stretch). However, I cannot in all conscience endorse statements 2 and 3. The standards are, in my view, much more detailed, and, as Jim Milgram has pointed out, are in important respects less demanding than the standards of the leading nations. For this reason, while I can see there are strong political reasons for securing consensus, and while I can see that they are the best that we can get at this stage, I am unable to agree to "sign off" on the standards if doing so is taken to be assent to all 7 propositions."*[12]

From Sandra Stotsky:

With respect to the standards' being reflective of the core knowledge and skills in ELA and mathematics that students need to be college- and career-ready:

> *"In my judgment, Common Core's standards for grades 6-12 do not reflect the core knowledge needed for authentic college-level work and do not frame the literary and cultural knowledge one would expect of graduates from an American high school. ... These minimal requirements, laudatory in themselves, would not be considered adequate to frame a literature and language curriculum in any country. In addition, the distribution of literature and informational standards indicate about a 50% division between imaginative literature and informational texts in the English language arts/reading class at all grade levels, a division that is inappropriate at the secondary level given English teachers' academic background and what they are prepared to teach based on their undergraduate or graduate coursework. ..."*

With respect to the standards' appropriateness in terms of their level of clarity and specificity:

> *"Many standards are paraphrases of the "anchor" "college and career readiness standards." Many others are unclear in meaning, not easily interpretable, or unteachable. The "college and career readiness standards" that govern all grade-level standards have no discernable academic level; for the most part, they are simply a set of poorly written, confusing, content-empty, and culture-free generic skills with no internally valid organization of their own. ..."*

With respect to the standards' comparability to the expectations of other leading nations:

> *"The two English-speaking areas for which I could find assessment material (British Columbia and Ireland) have far more demanding requirements for college readiness. The British Commonwealth examinations I have seen in the past were far more demanding in reading and literature in terms of the knowledge base students needed for taking and passing them. No material was ever provided to the Validation Committee or to the public on the specific college readiness expectations of other leading nations in mathematics or language and literature."*

With respect to the standards' being informed by available research or evidence:

> *"No evidence was ever provided to the Validation Committee supporting the specific 'college and career readiness standards' as a group and their use as an organizing scheme for generating grade-level standards. In fact, the evidence that can be located is either counter-evidence or misinterpreted evidence ... Nor is there clear evidence that career readiness is similar to college readiness."*[13]

In sum, committee members with the most relevant content knowledge and experience writing or evaluating standards refused to sign off on the Common Core standards citing their low level and incomparability with those of high-achieving nations. Requests for evidence supporting the standards or the names of countries with which they were supposedly benchmarked had gone unanswered. In the final version of the standards, released in June 2010, the level of college readiness in mathematics was a weak Algebra 2 that included some Geometry standards.[14] The level of college readiness in English language arts/reading was not clear. Several high school standards require reading

of this country's seminal political documents, suggesting that students are to be able to read adult material by the end of high school. It remains to be seen whether significant sections of these late 18th-century documents are assessed on college-readiness tests.

Post Facto Attempts to Validate Common Core's Standards

Two VC members who attested to the rigor and international competitiveness of the standards in May 2010 later attempted to validate their decision.

David Conley's 2011 study claims to show that Common Core's college-readiness standards lead to college readiness. It carefully avoids asking the key question: "Do the college readiness standards reflect a sufficient level of preparation for college coursework?"

William Schmidt's 2012 study claims to show that Common Core's mathematic standards are "similar to" or "aligned with" those of high-achieving countries, and that the greater the alignment of a state's standards to Common Core's, the higher-achieving its students are. This study suffers from a sloppy methodology and a creative use of statistics in its attempt to show what it claims to show.

In both studies, researchers engage in a *post facto* effort to justify what they had already attested to in 2010.

A. David Conley's 2011 Study

In a 2003 study, David Conley had determined what knowledge and skills are necessary to succeed in college based on a survey of higher education faculty.[15] Instead of showing whether Common Core's standards reflected this knowledge and these skills, his 2011 study asked teachers of a wide range of college freshman courses about the relevance of the Common Core standards to their courses and then claimed that Common Core's standards are aligned with college requirements.[16] His study suffers from at least three major methodological deficiencies.

A.1 Biased, unrepresentative survey sample

The study used a two-stage selection process. In stage 1 it identified a stratified random sample of two- and four-year private and public colleges. In stage 2 the study requested each college to provide a liaison person, who in turn was asked to provide a "representative teacher" who taught entry-level courses at the college. In other words, the second stage selection was not random. The liaison person might have been more involved in education than in disciplinary content compared with average faculty. The recommended instructors might have been better than average teachers or they might have expressed interest in Common Core and in being surveyed. We don't know. To avoid selection bias, the liaison could have been asked to provide a list of three to five instructors, one or two of whom would be randomly drawn. The weakness of the sample selection was pointed out to the study project officer early on, yet the methodology was not modified.[17]

A.2 Limited survey instrument

The survey instrument asked the respondents to rate how relevant each standard was to teaching their course. It did not also ask the more important question: "What content knowledge is necessary to succeed in your course?" (a question asked in Conley's first study). Evaluative questions relating to the overall sufficiency of the standards were also never asked, such as: "Do the standards reflect a sufficient level of preparation for your course?" or "Do the standards reflect a better, or a worse, level of preparation as

compared to your current requirements?" While missing content could be identified on a single optional item, it would have miniscule weight compared to the hundreds of responses on the standards themselves. The chosen methodology thus elicited many positive responses because most of the content of Common Core's mathematics standards is relevant to some extent in any freshman mathematics course.

A.3 Results not appropriately broken down

The report did not disaggregate the results by two-year and four-year colleges. This is of key importance because much of the criticism of the Common Core has focused on the inadequacy of its definition of college readiness for selective four-year colleges. By lumping the results together, the study doesn't shed any light on this cardinal educational question.

B. The 2012 Schmidt and Houang Study

William Schmidt, an educational statistician at Michigan State University, together with a colleague, carried out a study to explore whether the Common Core State Standards in Mathematics (CCSSM) are comparable to the expectations of leading nations and what reasonable outcomes might be expected after adoption of the Common Core.[18] For an answer to the first question, Schmidt and Houang used the methodology they developed to map mathematics curriculum content in grades 1-8 in the six highest-achieving countries in the 1995 Third International Mathematics and Science Study (TIMSS), as reported in 2005.

B.1 Visualization

Figure 1, from the 2005 study, shows what topics at least four of the six highest-achieving countries (also known as the A+ countries) taught at each of these grade levels. The profile has a distinct triangular shape. The shape of the topic-by-grade profile conveys information on coherence and focus.

A few things should be noted:

- The descending order of the rows reflects a **logical and coherent progression** of topics in terms of complexity. So, for example, 3D geometry is introduced after 2D geometry.
- Only very few topics span more than half the grades. Most topics are taught to mastery and then are no longer taught. This reflects the **focused** nature of the progression.
- The number of topics per grade (the number of topics in a vertical column) is limited. This allows for **depth** in instruction.

The Common Core State Standards in Mathematics (CCSSM) profile in Figure 2 in Schmidt and Houang's 2012 paper does resemble the overall shape of the curriculum profile of the A+ countries in Figure 1. It is somewhat "thicker" than Figure 1 because Figure 1 reflects only the topics in at least four of the six highest- achieving countries on the 1995 TIMSS test, while Figure 2 reflects all the standards in a complete set of standards and hence is somewhat fuller.

Based on the seeming similarity in overall shape, Schmidt and Houang declare that because:

> *"... CCSSM bears a strong resemblance to Figure 1 (A+ model), at least in terms of its general shape. .... From that point of view, it can be suggested that the CCSSM are coherent and focused."*

Schmidt and Houang then conclude this part of their paper with:

"There being no major differences between the two sets of standards, this provides further evidence that the CCSSM are coherent and very consistent with the international benchmark."

However, the order of the rows in Figure 2 differs from the order of rows in Figure 1. Figure 3 shows these differences in vivid color.

Apparently, Schmidt and Houang rearranged the original cohesive and hierarchical order of topics so that now, for example, in Figure 2, "3D Geometry" comes before "2D Geometry Basics," and "Relations of Common and Decimal Fractions" comes before students even study "Decimal Fractions." In other words, their Figure 2 is an artificially-produced shape that leads to their desired visual conclusion of "coherence" and "consistency" with the 2005 A+ curriculum profile.

B.2 Congruence

Figures 1 and 2 have less than 60% congruence: 86 overlapping topic-grade combinations versus 58 non-overlapping ones.[19] This weak congruence further undermines Schmidt and Houang's claim of consistency between CCSSM and high-achieving countries in K-8. Because some of the inconsistency may result from the fact that Figure 1 reflects the curricular choices of two-thirds or more of

Figure 1: Mathematics topics taught at each grade level by at least four of the six A+ countries in the 1995 TIMSS as reported in Schmidt and Houang, 2012

	Grade							
Topic	1	2	3	4	5	6	7	8
Whole Number Meaning	●	●	●	●	●			
Whole Number Operations	●	●	●	●	●			
Measurement Units	●	●	●	●	●	●	●	
Fractions			●	●	●	●		
Equations & Formulas			●	●	●	●	●	●
Data Representation & Analysis			●	●	●	●		●
2-D Geometry Basics			●	●	●	●	●	●
Polygons & Circles				●	●	●	●	●
Perimeter, Area & Volume				●	●	●	●	●
Rounding & Significant Figures				●	●			
Estimating Computations				●	●	●		
Properties of Whole Numbers Operations				●	●			
Estimating Quantity & Size				●	●			
Decimals				●	●	●		
Relation of Decimals & Fractions				●	●	●		
Properties of Decimals & Fractions					●	●		
Percentages					●	●		
Proportionality Concepts					●	●	●	●
Proportionality Problems					●	●	●	●
2-D Coordinate Geometry					●	●	●	●
Geometric Transformations						●	●	●
Negative Numbers, Integers & Their Properties						●	●	
Number Theory							●	●
Exponents, Roots & Radicals							●	●
Orders of Magnitude							●	●
Measurement Estimation & Errors							●	
Constructions Using Straightedge & Compass							●	●
3-D Geometry							●	●
Congruence & Similarity								●
Rational Numbers & Their Properties								●
Functions								●
Slope								●

Intended by two-thirds or more of the top-achieving countries ●

Figure 2: Mathematics topics in the Common Core State Standards as reported in Schmidt and Houang, 2012

	Grade							
Topic	1	2	3	4	5	6	7	8
Whole Number Meaning	●	●	●	●	●			
Whole Number Operations	●	●	●	●	●			
Properties of Whole Numbers Operations	●	●	●	●	●	●		
Fractions	●	●	●	●	●	●		
Measurement Units	●	●	●	●	●	●	●	●
Polygons & Circles	●	●	●	●	●	●	●	●
Data Representation & Analysis	●	●	●	●	●	●	●	●
3-D Geometry	●	●			●	●	●	●
Measurement Estimation & Errors		●	●					
Number Theory		●		●	●	●		
2-D Geometry Basics		●		●	●	●	●	●
Rounding & Significant Figures			●	●	●			
Relation of Decimals & Fractions			●	●	●	●		
Estimating Computations			●	●	●		●	●
Perimeter, Area & Volume			●	●	●	●	●	●
Equations & Formulas			●	●	●	●	●	●
Decimals				●	●	●		
Patterns, Relations & Functions				●	●	●	●	●
Geometric Transformations				●		●	●	●
Properties of Decimals & Fractions					●	●		
Orders of Magnitude					●			●
2-D Coordinate Geometry					●	●	●	●
Exponents, Roots & Radicals					●	●		●
Percentages						●	●	
Negative Numbers, Integers & Their Properties						●	●	
Proportionality Concepts						●	●	●
Proportionality Problems						●	●	●
Rational Numbers & Their Properties						●	●	●
Constructions Using Straightedge & Compass							●	
Systematic Counting							●	
Uncertainty & Probability							●	
Real Numbers & Their Properties								●
Congruence & Similarity								●
Slope								●
Validation & Justification								●

Topic Intended in Common Core Standards ●

the A+ countries – not complete sets of topics taught in all six countries – Schmidt and Houang, after noting this fact, proceed to fill in another 29 topic-by-grade combinations out of 45 possible ones[20] in order to create a "complete" A+ curriculum profile.

A fair way to do it would be to choose these 29 topics *randomly* from the possible 45.[21] Instead, they first chose all "those topics that were consistent with those in the CCSSM and then randomly chose from the rest." This process guarantees maximal congruence between the two figures, but even after putting their thumb on the scale, the congruence between the Common Core and the simulated A+ curriculum profile barely reaches an unimpressive 73%:110 overlapping topic-grade combinations and 39 non-overlapping ones.

To address this new problem, Schmidt and Houang define a new *ad hoc* measure of congruence for their study and, *mirable dictu*, their newly invented measure of congruence reaches the impressive "*value of 889 implying an almost 90% degree of consistency between the two sets of standards*."

Figure 3: Figures 1 and 2 side by side, with rows colored to show differences between the original topic order and the revised order in Schmidt and Houang, 2012

	TIMSS								COMMON CORE									
	Topic	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	Topic
1	Whole Number: Meaning	●	●	●	●	●				●	●	●	●	●				Whole Number: Meaning
2	Whole Number: Operations	●	●	●	●	●				●	●	●	●	●				Whole Number: Operations
3	Measurement Units	●	●	●	●	●	●	●		●	●	●	●	●	●			Whole Numbers: Properties of Operations
4	Common Fractions			●	●	●	●			●	●	●	●	●	●			Common Fractions
5	Equations & Formulas			●	●	●	●	●	●	●	●	●	●	●	●	●	●	Measurement Units
6	Data Representation & Analysis			●	●	●	●		●	●	●	●	●	●	●	●	●	2-D Geometry: Polygons & Circles
7	2-D Geometry: Basics			●	●	●	●	●	●	●	●	●	●	●	●	●	●	Data Representation & Analysis
8	2-D Geometry: Polygons & Circles				●	●	●	●	●	●	●			●	●	●	●	3-D Geometry
9	Measurement: Perimeter, Area & Volume				●	●	●	●	●		●	●						Measurement: Estimation & Errors
10	Rounding & Significant Figures				●	●					●		●	●	●			Number Theory
11	Estimating Computations				●	●	●				●		●	●	●	●	●	2-D Geometry: Basics
12	Whole Numbers: Properties of Operations				●	●						●	●	●				Rounding & Significant Figures
13	Estimating Quantity & Size				●	●						●	●	●	●			Relation of Common & Decimal Fractions
14	Decimal Fractions				●	●	●					●	●	●		●	●	Estimating Computations
15	Relation of Common & Decimal Fractions				●	●	●					●	●	●	●	●	●	Measurement: Perimeter, Area & Volume
16	Properties of Common & Decimal Fractions					●	●					●	●	●	●	●	●	Equations & Formulas
17	Percentages					●	●						●	●				Decimal Fractions
18	Proportionality Concepts					●	●	●	●				●	●		●	●	Patterns, Relations & Functions
19	Proportionality Problems					●	●	●	●				●		●	●	●	Geometry: Transformations
20	2-D Geometry: Coordinate Geometry					●	●	●	●					●	●			Properties of Common & Decimal Fractions
21	Geometry: Transformations						●	●	●					●			●	Exponents & Orders of Magnitude
22	Negative Numbers, Integers, & Their Properties						●	●						●	●	●	●	2-D Geometry: Coordinate Geometry
23	Number Theory							●	●					●	●		●	Exponents, Roots & Radicals
24	Exponents, Roots & Radicals							●	●						●	●		Percentages
25	Exponents & Orders of Magnitude							●	●						●	●		Negative Numbers, Integers, & Their Properties
26	Measurement: Estimation & Errors							●							●	●	●	Proportionality Concepts
27	Constructions Using Straightedge & Compass							●	●						●	●	●	Proportionality Problems
28	3-D Geometry							●	●						●	●	●	Rational Numbers & Their Properties
29	Geometry: Congruence & Similarity								●							●		Constructions Using Straightedge & Compass
30	Rational Numbers & Their Properties								●							●		Systematic Counting
31	Patterns, Relations & Functions								●							●		Uncertainty & Probability
32	Proportionality: Slope & Trigonometry								●								●	Real Numbers & Their Properties
33	Systematic Counting																●	Geometry: Congruence & Similarity
34	Uncertainty & Probability																●	Proportionality: Slope & Trigonometry
35	Real Numbers & Their Properties																●	Validation & Justification
36	Validation & Justification																	Estimating Quantity & Size

B.3 Common Core-like standards and achievement

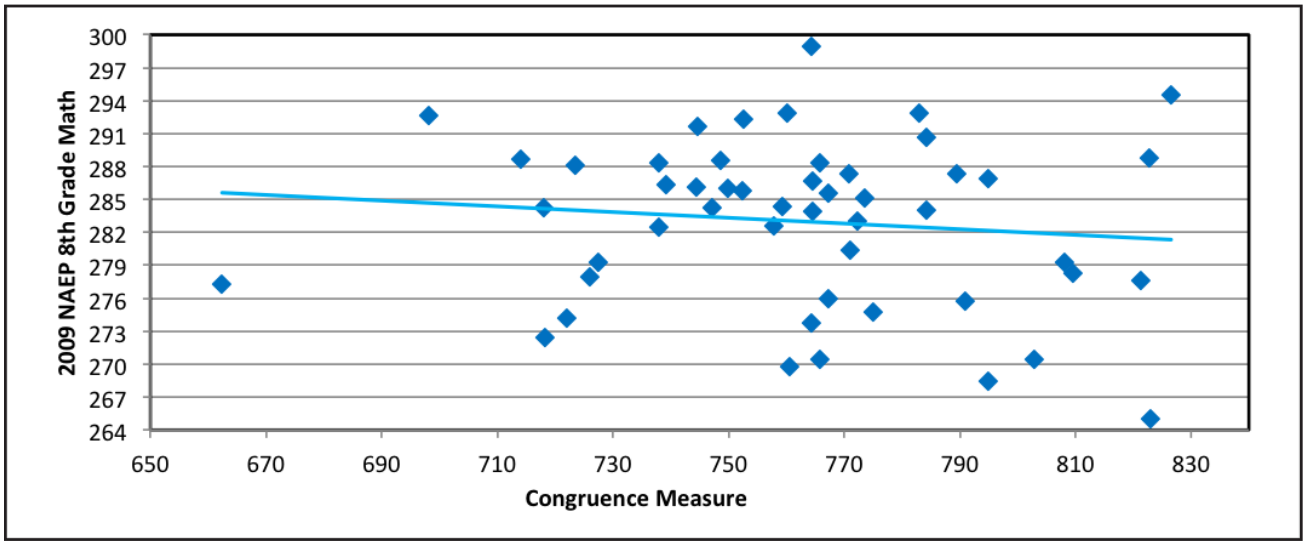
Schmidt and Houang then move on to demonstrate how alignment of state standards with CCSSM positively relates to state achievement on the grade 8 mathematics test given in 2009 by the National Assessment of Educational Progress (NAEP). Table 1, based on Table 2 in their 2012 paper, shows how similar the standards in various states are to those in CCSSM.[22]

However, this measure of congruence with the Common Core does not show a positive relationship with achievement. In fact, of the ten states with standards most like the CCSSM, only two (Washington and Minnesota) are in the top ten on NAEP achievement, while four of them (Alabama, California, Mississippi, and Oklahoma) are in the bottom ten on the NAEP grade 8 mathematics test, and the overall relationship is negative as shown in Figure 4.

Table 1: Degree of congruence between state and Common Core's mathematics standards as reported in Schmidt and Houang, 2012

Most like CCSSM	Alabama Michigan	California Minnesota	Florida Mississippi	Georgia Oklahoma	Indiana Washington
	Idaho Utah	North Dakota	Oregon	South Dakota	Tennessee
	Alaska Massachusetts Pennsylvania	Arkansas New Mexico South Carolina	Colorado New York Texas	Delaware North Carolina Vermont	Hawaii Ohio West Virginia
	Connecticut Montana	Illinois Nebraska	Maine New Hampshire	Maryland Virginia	Missouri Wyoming
Least like CCSSM	Arizona Nevada	Iowa New Jersey	Kansas Rhode Island	Kentucky Wisconsin	Louisiana

Figure 4: Relationship of state achievement on the 2009 grade 8 NAEP mathematics test to the congruence between Common Core's standards and the standards for all 50 states as determined by Schmidt and Houang, 2012.



Nevertheless, Schmidt and Houang don't give up their quest to show a positive relationship. The easiest way to do so is to remove the states in the second (lower right) quadrant because they "pull" the right side of the graph down. They "declare" that the states in this quadrant are somehow "different" from the others and put them in a separate group, as shown in Figure 5.

They now get a positive relationship between CCSSM and student achievement for the "blue" states (Group A), but the separated "red" states (Group B) still show a negative relationship. Then they proceed to arbitrarily remove the one lower-right state that pulls this relationship down (Mississippi) implying it is an obvious outlier, and … finally … they get their sought-after positive relationship for

Figure 5: Figure 4 data with states arbitrarily split into two groups.

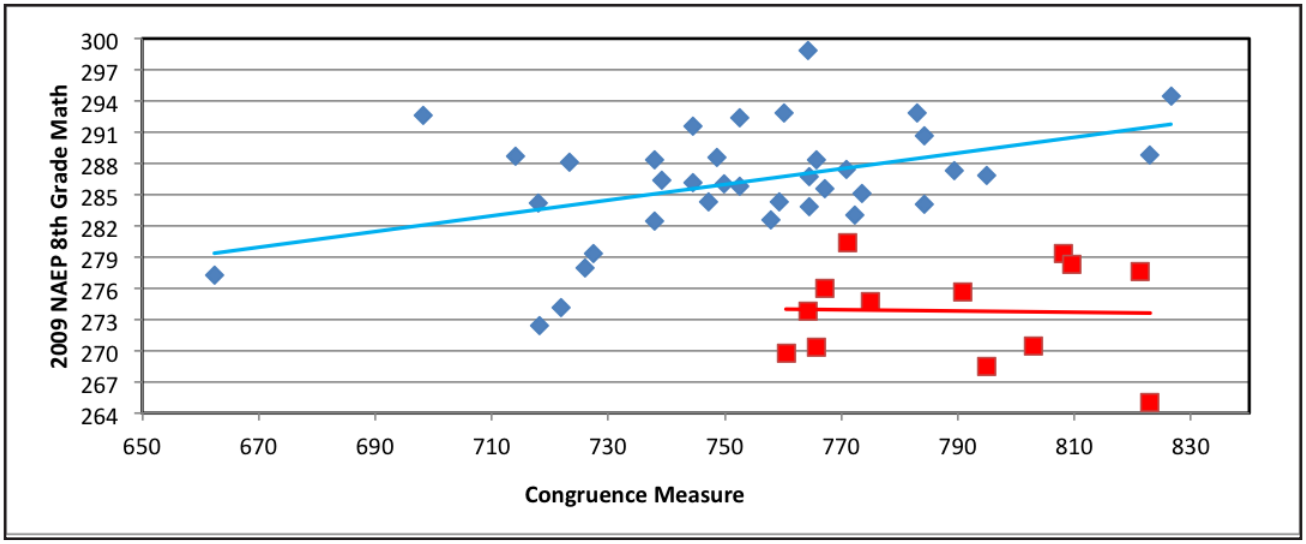
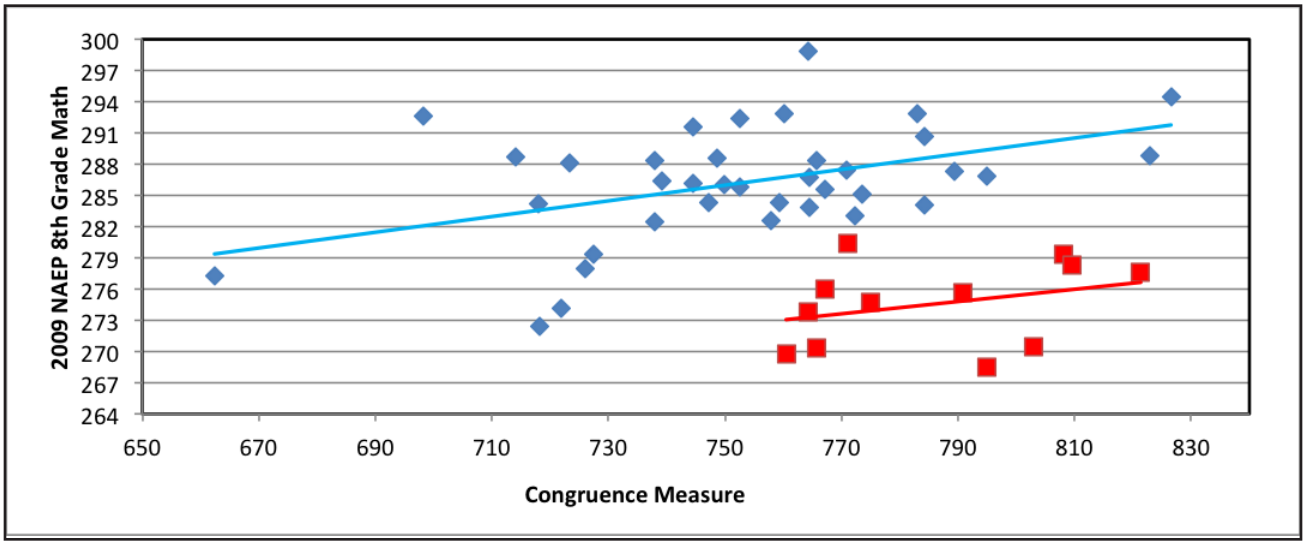


Figure 6: Figure 5 data with Mississippi eliminated, as presented in Schmidt and Houang, 2012.



these states too.[23] They present Figure 6 in their 2012 paper, arguing not only that both Group A (blue) and Group B (red) show a positive relationship, but that the

> *"estimated value of the regression coefficient (.06) was essentially the same (at least within the bounds of error) as the corresponding coefficient for Group A, suggesting a parallel relationship between the two groups even though it was not significant for Group B."*

Yes, it does … after they have eliminated an offending state and carefully split them into groups to find positive relationships where previously there were none.[24]

Once Schmidt and Houang have figured out how to get a positive relationship, they then make it seem even stronger. It is well-known that high-achieving states can afford to have higher cut scores. But those aligned-but-low-achieving southern states get more federal funds because they contain more disadvantaged students. So they "correct" for cut-score rigor and for intensity of federal funding and – presto – now they get a strong relationship.[25]

While admitting that they "*do [congruence] in a novel way ... coupled with several assumptions*," they also admit that these analyses "*should be viewed as only exploratory in nature, merely suggesting the possibility of a relationship*." But when the time comes for a conclusion, Schmidt and Houang are quite categorical when they write:

> *The totality of the multiple analyses we have done suggests a statistically significant positive relationship between the degree of congruence between a state's standards and the CCSSM and achievement as defined by the 2009 NAEP assessment, but is only an indication of correlation not of causality. On the other hand, combining these analyses with the strong degree of consistency that the CCSSM have with those of the countries whose eighth-grade students achieve at the highest levels, makes the likelihood of such a relationship even greater.*

B.4 Quality of coding of the standards

Schmidt and Houang's research also suffers from an even more fundamental flaw.

In the beginning of their paper they say that "*[a]pplying the same methodology [as their 1997 TMISS analysis], we coded the Common Core State Standards in Mathematics*." Yet either this statement is incorrect, or the coding was done in a sloppy manner. For example, Systematic Counting is described in their 1997 analysis as "*general permutations, combinations, etc. ... introduced for grade 10*."[26] In their current CCSSM coding, systematic counting shows up in grade 7, despite the fact that CCSSM clearly places permutations and combinations in high school.[27] Similarly, Schmidt & Houang find Constructions Using Straightedge and Compass in CCSSM grade 7, while anyone can easily verify for himself that such constructions are placed by CCSSM in high school.[28] That the coders could not distinguish between formal geometric constructions and informal ones, or understand what systematic counting is, casts a doubt on the validity of the whole paper, because its superstructures assume reliable coding of the standards.

In sum, even if it were true that the profile of the topics in the Common Core Mathematics Standards is similar to the curriculum profile of the A+ countries, and that states whose standards seem – in Schmidt and Houang's coding – more like the CCSSM show higher achievement on the NAEP 2009 test, their

conclusion wouldn't be based on a sound foundation. All their statistical manipulations are fundamentally based on how the CCSSM were coded. Because this coding is unreliable, the findings based on them are equally unreliable.

C. Other studies on international benchmarking

The conclusion of the 2012 Schmidt and Houang study—that the CCSSM are "*consistent with the internationally benchmarked standards and as a result are coherent, focused, and rigorous*"—is not supported by other research. The question of whether Common Core's standards are "comparable to the expectations of other leading nations" has been studied by others.

Mathematician Jonathan Goodman of the Courant Institute at New York University found them having "*significantly lower expectations with respect to algebra and geometry than the published standards of other [high-achieving] countries*."[29]

Andrew Porter, dean of the Graduate School of Education at the University of Pennsylvania found them "*different from the standards of countries with higher student achievement, and they are different from what U.S. teachers report they are currently teaching*." Porter also found to his surprise that "*[t]op-achieving countries for which we had content standards put a greater emphasis on 'perform procedures' than do the U.S. Common Core standards. High-performing countries' emphasis on 'perform procedures' runs counter to the widespread call in the United States for a greater emphasis on higher order cognitive demand*."[30]

Performing procedures refers to developing students' facility in performing arithmetic operations, manipulating expressions, and solving equations, while emphasis on higher order cognitive demand means direct focus on reasoning such as understanding why a particular operation is executed the way it is, or why a step in an operation is logically justified. Porter et al. are saying that Common Core focuses on such direct teaching of understanding, in contrast with top-achieving countries that focus of students' fluency with actually doing the mathematics and expect understanding to develop naturally out of such work.

As mentioned earlier, Stanford mathematician R. James Milgram found their expectations below that of high-achieving countries. As he commented: "*the difference is more like two years when compared to the expectations of the high achieving countries – particularly most of the nations of East Asia*." Milgram also found that the standards fail to prepare students for STEM careers, their proclaimed *raison d'être*.[31]

Conclusions

Advocates of Common Core's mathematics standards claim they are rigorous, reflect college-readiness, and are comparable with those of high achieving countries. The two members of the Common Core Validation Committee with college-level mathematics content knowledge refused to sign off on them, finding them significantly lower than those of high-achieving countries.

With respect to Common Core's English language arts standards, Common Core's VC member, David Conley, certified them as internationally benchmarked and research-based in 2010, and then went on to try and prove his case more than a year later. His 2011 study was poorly done and its results shed little light on whether Common Core's ELA standards can actually prepare students for more than a community college.

William Schmidt, another VC member, also attested in 2010 that Common Core's standards were comparable to those in high-achieving countries. But Schmidt and Houang's 2012 study—the only study that claimed the standards met international expectations—lacks reliable coding of the standards, and uses a variety of visual and statistical strategies to create the illusion that the profile of topics in Common Core's mathematics standards is, indeed, comparable to the curriculum profile of six high-achieving countries. In fact, their own data suggest that Common Core's mathematics standards are not at all like those of international high achievers, and that—at least from a statistical point of view—they do not carry any promise of improving American educational achievement.

Not only do Common Core's standards remain unvalidated, but there are now many doubts that they could be validated as research-based, rigorous, and internationally competitive. Indeed, there is growing concern that they are far below the level of standards in high-achieving countries. Yet, these standards were officially adopted by over 46 states, national tests are being piloted based on them, textbooks and other curriculum materials have been aligned down to them, and all our seemingly independent indices of academic achievement or potential for college-level work have been or are in the process of being aligned down to them. What should be done?

Postscript

After my analysis of Schmidt and Houang's 2012 study was completed for this report, Tom Loveless at the Brookings Institution published his own analysis of this study. He makes two points:

(1) The degree of overlap between state mathematics standards and Common Core's mathematics standards that Schmidt and Houang claimed they found "proved to be a poor predictor" of changes in state achievement at grade 8 on NAEP tests since 2009, whether or not states were placed in smaller groups.

(2) Even if one accepts Schmidt and Houang's measure of overlap and their findings for its predictive value (i.e., that the more a state's mathematics standards looked like Common Core's mathematics standards, the greater the impact on state achievement), the impact is educationally insignificant for individual students even if statistically significant for the state as a whole.[32]

About the Author:

Ze'ev Wurman is a visiting scholar at the Hoover Institution. Between 2007 and 2009, he served as a senior policy adviser with the Office of Planning, Evaluation, and Policy Development at the U.S. Department of Education. Wurman served as a commissioner on the California Academic Content Standards Commission that in 2010 evaluated the Common Core's suitability for California adoption.

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Endnotes

1. CCSSI is the organization created by the three authors of *Benchmarking for Success* to develop the Common Core standards.

2. https://web.archive.org/web/20091019070946/http://www.corestandards.org/

3. Z. Wurman, "Common Core standards undermine California's gains," *San Francisco Chronicle*, Dec. 22, 2009

4. See http://collegepuzzle.stanford.edu/?p=466 and http://www.edweek.org/media/comments_regarding_draft_common_standards_edit2.pdf. Interestingly, in 2013 NAGB decided that they could not support equating college-readiness with career-readiness because it found that between two thirds and three quarters of its math framework objectives were "not evident as prerequisite" in any of the training required for the careers studied, a finding Cornelia Orr, the board's executive director, called "quite shocking." http://www.edweek.org/ew/articles/2013/08/15/01nagb.h33.html

5. Members of the standards-writing teams are listed here: https://web.archive.org/web/20090708081452/http:/www.nga.org/portal/site/nga/menuitem.6c9a8a9ebc6ae07eee28aca9501010a0/?vgnextoid=60e20e4d3d132210VgnVCM1000005e00100aRCRD&vgnextchannel=759b8f2005361010VgnVCM1000001a01010aRCRD

6. Phil Daro was a staff member of America's Choice, a for-profit intervention program for "turn-around" (failing) schools. So was Sally Hampton, compiler of Appendix B in Common Core's English language arts document. America's Choice was a program offered by the NCEE, directed by Marc Tucker, a member of the review committee.

7. Members of the review committee are listed here: http://www.nga.org/files/live/sites/NGA/files/pdf/2010COMMONCOREK12TEAM.PDF

8. The original 25 Validation Committee members are listed here: https://web.archive.org/web/20091019070946/http:/www.nga.org/portal/site/nga/menuitem.6c9a8a9ebc6ae07eee28aca9501010a0/?vgnextoid=f541ea15a18e3210VgnVCM1000005e00100aRCRD&vgnextchannel=759b8f2005361010VgnVCM1000001a01010aRCRD. Later CCSSI added four teachers/principals as members.

9. Reaching Higher: The Common Core Validation Committee, June 2010. http://www.corestandards.org/assets/CommonCoreReport_6.10.pdf

10. Michigan House Testimony, p.9 at: http://house.michigan.gov/sessiondocs/2013-2014/testimony/Committee223-3-20-2013-9.pdf

11. William was Deputy Director of the Institute of Education, University of London, with a strong knowledge of international expectations.

12. Email to Keith Gayler at CCSSO, May 2010.

13. S. Stotsky, Common Core Standards Miss the Mark, National Association of Scholars, June 2010. http://www.nas.org/articles/Common_Core_Standards_Miss_the_Mark

14. The Common Core never backed off from their ridiculously low definition of college-readiness in September 2009: Algebra 1. While some standards might suggest that college-readiness is higher than that, no other definition was provided by CCSSI. In May 2013, NCEE published results of

a study by Phil Daro, one of the Common Core mathematics standards writers, asserting that completion of Algebra I is all that is necessary to be ready for college (as in Common Core's first draft of its mathematics standards in September 2009). http://www.ncee.org/college-and-work-ready/

15. Understanding University Success, Center for Educational Policy Research (Eugene, OR) 2003. https://www.epiconline.org/publications/documents/UUS_Complete.pdf

16. David T. Conley, et al., Reaching the Goal, Educational Policy Improvement Center, (Eugene, OR) 2011. http://www.epiconline.org/publications/documents/ReachingtheGoal-FullReport.pdf

17. Email from the author to Ash Vasudeva, Bill & Melinda Gates Foundation project officer for Conley's study, April 23, 2010.

18. W.H. Schmidt, R.T. Houang, Curricular Coherence and the Common Core State Standards for Mathematics, Educational Researcher v41 p. 294 (2012)

19. Cohen's kappa.

20. W. H. Schmidt, H. C. Wang, C. C. McKnight, "Curriculum coherence: an examination of US mathematics and science content standards from an international perspective," J. of Curriculum Studies, v37 p525 (2005). Approximately 45 additional topics are taught in less than a majority of the A+ countries in grades 1-8.

21. Schmidt himself wrote in 2005 that "*[c]hoosing additional topics to round out a composite curriculum would be arbitrary*." Ibid, p. 537.

22. Schmidt & Houang (2012), Table 2, p. 301.

23. Figs. 4-6 are recreated from their paper. Mississippi's congruence measure lies between 821 and 826 based on their paper. Here it is estimated to be .823.

24. A description of a statistical technique that is used to prove anything one wants is described here: http://slatestarcodex.com/2014/01/02/two-dark-side-statistics-papers/

25. Cut-score rigor is positively correlated with achievement but it is unclear whether it causes higher achievement or is caused by higher achievement. Schmidt and Houang's use of it as an explanatory variable presumes, without substantiation, that causality flows from cut-scores to achievement. How federal funding may affect the dependency between standards alignment with the Common Core and student achievement is an even bigger mystery. After all, one could easily argue that if Common Core standards are so effective, their effectiveness might actually increase in poorer populations.

26. Schmidt, McKnight, Valverde, et al. (1997), Many visions, many aims, Volume I: A cross-national investigation of curricular intentions in school mathematics. Dordrecht: Kluwer. p. 63

27. High school CCSSM standard S-CP 9, "Use permutations and combinations to compute probabilities of compound events and solve problems." Presumably they got confused by a grade 7 standard (7.SP.8) "Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation."

28. High school CCSSM standard G-CO 12, "Make formal geometric constructions with a variety of tools and methods (compass and straightedge …" In grade 7 the standard (7.G.2) says "Draw

(freehand, with ruler and protractor, and with technology) …"

29. J. Goodman, A comparison of proposed US Common Core math standard to standards of selected Asian countries, July 2010. http://www.educationnews.org/ed_reports/94979.html

30. A. Porter, et al., Common Core Standards: The New U.S. Intended Curriculum, Educational Researcher v40 p. 103 (2011).

31. R.J. Milgram and S. Stotsky, *Lowering the Bar: How Common Core Math Fails to Prepare High School Students for STEM*. Pioneer Institute, September 2013. http://pioneerinstitute.org/?wpdmdl=381&

32. Tom Loveless, *A Progress Report on the Common Core*, March 2014. http://www.brookings.edu/research/reports/2014/03/18-common-core-loveless

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