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EDUCATIONAL RESEARCHER 2011 40: 103

DOI: 10.3102/0013189X11405038

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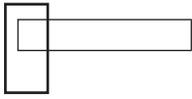
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Common Core Standards: The New U.S. Intended Curriculum

Andrew Porter, Jennifer McMaken, Jun Hwang, and Rui Yang

The Common Core standards released in 2010 for English language arts and mathematics have already been adopted by dozens of states. Just how much change do these new standards represent, and what is the nature of that change? In this article, the Common Core standards are compared with current state standards and assessments and with standards in top-performing countries, as well as with reports from a sample of teachers from across the country describing their own practices.

Keywords: comparative education; curriculum; educational reform; policy analysis

The Common Core standards released in 2010 represent an unprecedented shift away from disparate content guidelines across individual states in the areas of English language arts and mathematics. Led jointly by the National Governors Association Center for Best Practices and the Council of Chief State School Officers (CCSSO), the Common Core State Standards Initiative developed these standards as a state-led effort to establish consensus on expectations for student knowledge and skills that should be developed in Grades K–12. By late 2010, 36 states and the District of Columbia had adopted the standards (<http://www.corestandards.org/>). These standards are therefore poised to be widely adopted and to become entrenched in state education policy.

The Common Core State Standards both for mathematics and for English language arts and literacy are explicit in their focus on what students are to learn, what we call here “the content of the intended curriculum,” and not on how that content is to be taught, what often is referred to as “pedagogy and curriculum.” Both sets of standards claim to be, among other things, internationally benchmarked. The math standards are explicit in the intention to be more focused than current state standards: “To deliver on the promise of common standards, the standards must address the problem of a curriculum that is ‘a mile wide and an inch deep.’ These standards are a substantial answer to that challenge” (Common Core State Standards Initiative, 2010b, p. 3). Both sets of standards are grade specific, with the math standards stating that “grade placements for specific topics have been

made on the basis of state and international comparisons and the collective experience and collective professional judgment of educators, researchers, and mathematicians” (Common Core State Standards Initiative, 2010b, p. 5). Both standards intend to influence the assessed and enacted curricula. For example, the standards for English language arts state, “The standards aim to align instruction with this framework so that many more students than at present can meet requirements of college and career readiness” (Common Core State Standards Initiative, 2010a, p. 5). The math standards explicitly refer to the bulk of the document as content standards; for example, in the table of contents of the mathematics document, “Standards for Mathematical Content” is the largest section (Common Core State Standards Initiative, 2010b).

The federal government is putting considerable resources behind adoption and use of the standards. Although the U.S. Department of Education (USDE) was not directly involved in creating the standards, developing and adopting a common set of standards is included among the criteria in the scoring rubric used to grant awards in the Race to the Top competition. In addition, the USDE recently awarded \$330 million in Race to the Top funds to two consortia, representing the majority of states, to help develop assessments aligned with the common standards. The SMARTER Balanced Assessment Coalition, representing 31 states, received \$160 million, and the Partnership for Assessment of Readiness for College and Careers, representing 26 states, received \$170 million (12 states are members of both consortia).

Common Core standards represent an opportunity to create a national curriculum in mathematics and in English language arts and reading (ELAR). A national curriculum would offer several benefits:

1. *Shared expectations.* Some argue that math is math and reading is reading. Why, then, should we have different expectations for students who live in Ohio than for students who live in Mississippi? A national curriculum would offer consistency.
2. *Focus.* Standards-based reform was intended to bring more focus to the U.S. curriculum, as in the curricula in high-achieving countries around the world (Schmidt et al., 2001). The Common Core standards may represent greater focus than state standards typically do; that is the explicit intention of the math standards.

Topics	Categories of Cognitive Demand				
	Memorize	Perform procedures	Demonstrate understanding	Conjecture, generalize, prove	Solve nonroutine problems
Multistep equations					
Inequalities					
Linear, nonlinear relations					
Rate of change/slope/line					
Operations on polynomials					
Factoring					

FIGURE 1. *Design of the Surveys of Enacted Curriculum: Defining content at the intersection of topics and cognitive demand.*

3. *Efficiency.* Under a national curriculum, it would not be necessary for each state to develop its own content standards, assessments, and curriculum guides. Even if two multistate consortia are building assessments, two assessments are more efficient than 50. Moreover, the efficiency produced by a national curriculum could extend to other sectors of the education business, for example, development of curriculum materials, professional development for educators, and preservice teacher education.
4. *Quality of assessments.* With the set of Common Core standards and one or two aligned assessments, it might be possible to (a) deliver assessments electronically and (b) make them computer adaptive. Electronically delivered assessments could be more animated and engaging; computer-adaptive testing would produce fewer floor and ceiling effects.

Given the interest in common standards and the incentives to adopt them, one question we should be asking is just how much change the Common Core standards represent in comparison with current practice among U.S. states. In this study, we compare the content of the intended curriculum for the Common Core standards with the content of the intended curriculum for current state standards in mathematics and ELAR. We also compare the Common Core intended curriculum with the National Council of Teachers of Mathematics (NCTM) content standards (comparable national professional content standards do not exist in ELAR). Because under No Child Left Behind, a state's student achievement assessments must be aligned with the state's content standards for ELAR, mathematics, and science, we also ask how current state assessments and the National Assessment of Educational Progress (NAEP) compare to the Common Core standards. Of course, current state and national assessments were not built to be aligned to the Common Core standards. Still, some believe that the tested curriculum is closer to the enacted curriculum than is the intended curriculum portrayed in content standards (Klein, Hamilton, McCaffrey, & Stecher, 2000). We also benchmark the Common Core to standards and assessments from selected other countries, just as the developers of the Common Core did. Finally, we compare estimates of the enacted curriculum with the Common Core.

How We Measure Alignment

Our data on the standards and assessments were produced by a nationally recognized content analysis procedure, the Surveys of Enacted Curriculum (SEC). This approach does not rely on direct comparison of assessments or assessment items with objectives or standards. Instead, it employs a two-dimensional framework defining content at the intersections of topics and cognitive demands (Porter, 2002; see Figure 1). The topic dimension is divided into general areas: 16 for mathematics and 14 for ELAR. Each general area is further divided into 4 to 19 topics, for a total of 217 topics in mathematics and 163 topics in ELAR. The second dimension consists of five levels of cognitive demands, which differ by subject (Figure 1). Thus, for mathematics, there are 1,085 distinct types of content contained in the categories represented by the cells in Figure 1; for ELAR, there are 815. For coding, all documents are analyzed by three to five trained content analysts. Each analyst places each objective (or test item) into one or more of the cells defined by the intersection of topics and cognitive demand. These data are then converted into proportions and averaged across the content analysts. The resulting matrix of proportions is used to calculate alignment.

The alignment index assesses the extent to which two documents have the same content message (Porter, 2002), based on the extent to which the cell proportions (topics by cognitive demand) are equal cell by cell across two documents. The index is defined as follows:

$$\text{alignment index} = 1 - [\sum |x_i - y_i|]/2,$$

where x_i and y_i stand for the proportion in cell i for documents x and y , respectively. The index ranges from 0 to 1, with 1 indicating perfect alignment (i.e., having 100% of the content in common). The value of the index can be thought of as the proportion of content in common across the two documents.

The SEC approach to calculating alignment is recognized for its ability to compare any two documents of content standards, assessments, curriculum materials, and instructional practices (Martone & Sireci, 2009). Reliability of the content analyses has repeatedly been shown to be strong both for content standards and for assessments (Porter, 2002; Porter, Polikoff, Zeidner, & Smithson, 2008). The SEC approach allows the use of content

maps to visualize the nature of alignment or misalignment. The maps are generated to resemble topographical maps in which topics are displayed like lines of latitude and cognitive demands like lines of longitude.

Results of Alignment From Previous Studies

Previous studies indicate that the average level of alignment of state standards with state assessments is moderate (Polikoff, Porter, & Smithson, in press; Porter, 2002; Webb, 2005, 2006). Similarly, when state standards are compared one with another within a content area, the level of alignment is low to moderate (Porter, Polikoff, & Smithson, 2009). When assessments are compared across states, the extent to which different states test the same content is low to moderate as well. To some extent, the degree of alignment improves for both standards and assessments if one aggregates across grades so that similar content covered at different grade levels is not counted as lack of alignment (Polikoff, Porter, & Smithson, in press). Still, the general finding for both standards and assessments is great state-to-state variability.

The Data

In June 2010, CCSSO convened 35 specialists in math and ELAR from 18 states to conduct a content analysis of the Common Core standards using the content frameworks and SEC methodology.¹ All grade levels (K–12) of the Common Core standards were included in the analysis. Teams of four to five specialists reviewed the standards documents to code each standards statement to the SEC framework. The analysts independently coded each objective in the standards, although objectives could be flagged for group discussion.

CCSSO also convened content experts to analyze the content of state standards and assessments. The content analysis data for the Common Core standards, as well as for state standards and state assessments, are stored at the Wisconsin Center for Education Research at the University of Wisconsin, Madison. The database contains standards or assessments for 31 states. However, the database contains content analysis of mathematics standards for only 27 states and content analysis of ELAR standards for only 24 states. Of the 27 states with content analysis of math standards, 14 have data for each of Grades 3–8; of the 24 states with content analysis of ELAR standards, 13 have data for each of Grades 3–8. The database also contains math assessments for 16 states and ELAR assessments for 12 states.

Results

Comparing Common Core Standards With State Content Standards

Degree of alignment. We first consider the alignment between state standards and the Common Core. Our purpose in comparing Common Core and state standards is to describe how they are alike and how they are different and, in so doing, to characterize the amount of change that lies ahead for states adopting the Common Core. As noted previously, there is great variability among states in their standards (and their assessments); the Common Core standards must necessarily be different from at least some states. The Common Core standards are designed not just to create homogeneity of intended content across states but

also to improve the content message to teachers in most if not all states.

Table 1 shows the alignment of state math standards to the Common Core standards by grade level. This table also presents the alignment between the NCTM standards and the Common Core. We found low to moderate alignment between state standards and the Common Core. Across the 10 grade levels of Common Core standards, alignments ranged from .01 to .51, with an average alignment of .25. No significant patterns in degree of alignment were found across the grade levels of the Common Core. Moreover, the NCTM standards did not exhibit a higher degree of alignment with the Common Core standards than did the average for state standards.

A similar pattern emerged when we examined the alignment between Common Core and state standards in ELAR. Alignment indices ranged from .10 to .48, with an average alignment between state and Common Core ELAR standards of .30. Table 2 shows the alignments across grade level for all available state standards.

One possible explanation for the moderate alignments reported here may be the assignment of content at particular grade levels. Standards may in fact share more content, but because content is to be taught at a particular grade level, paired grade-level standards may not be as highly aligned as they would be if content from the surrounding grades were also considered in the calculation. One way to investigate this possibility is to aggregate the content of standards across a series of grades and calculate alignment indices for these aggregate standards. We considered two different aggregations of standards: Grades 3–6 and Grades 3–8. The general conclusions were the same, so we present results from only the Grades 3–6 aggregation, thereby focusing on what are commonly considered elementary school grades.

Aggregation strengthened alignment. Average math alignment rose from .25 to .35 (Grades 3–6; Table 1). ELAR standards followed the same pattern; mean alignment rose to .38 (Grades 3–6; Table 2). Aggregating across Grades 3–8 raised the state average alignment in math from .35 to .41 and in ELAR from .38 to .41. When data are aggregated across states as well, the alignments are .45 for math and .52 for ELAR. Although aggregation does raise the level of alignment, there is still a considerable difference in content between state and Common Core standards.

Content differences. What content differences account for the lack of alignment? One way to address this question is to look at the marginal distributions for cognitive demand and topics. After aggregating across Grades 3–6 and aggregating across states, Table 3 presents the results for cognitive demand and Table 4 presents the results for coarse-grain topics. As Table 3 shows for math, the Common Core standards emphasize the cognitive demand category “demonstrate understanding” more than state standards do; the Common Core standards place slightly less emphasis than state standards do on “memorize” and “perform procedures.” Both sets of standards place a similar emphasis on “conjecture.” Although there is relatively little emphasis on “solve nonroutine problems” in either set of standards, the Common Core standards have twice the emphasis that state standards do. (See Table 5 for definitions of each level of cognitive demand.)

Table 1
Alignment of State and Common Core Math Standards

State Standards	Common Core Standards by Grade										
	K	1	2	3	4	5	6	7	8	9–12	3–6
Alabama							.19	.31	.28	.22	
California	.27	.20	.27	.21	.16	.20		.19		.31	
Delaware		.30	.38	.32	.30	.26	.25	.22	.26	.32	.47
Florida										.23	
Idaho	.25	.19	.27	.25	.21	.25	.23	.25	.20	.27	.34
Illinois		.27	.32	.25	.23	.15	.25	.34	.22	.31	.35
Indiana	.25	.26	.34	.27	.29	.27	.26	.26	.26	.25	.43
Iowa					.20				.07		
Kansas	.35	.29	.40	.31	.19	.21	.20	.30	.29	.33	.36
Maine				.18		.22	.19	.30	.30	.32	.32
Massachusetts								.19		.24	
Michigan			.46	.41	.43	.30					
Minnesota	.51	.28	.44	.41	.27	.24	.21	.33	.29	.26	.41
Mississippi					.25				.16		
Montana				.10	.12	.10	.01	.07	.07	.05	.15
New Hampshire	.23	.27	.23	.24	.19	.17	.20	.21	.23		.32
New Jersey					.15				.23		
North Carolina				.30	.21	.16	.16	.15	.22		.39
Ohio	.42	.29	.33	.22	.21	.21	.27	.17	.30	.37	.38
Oklahoma		.23	.32	.28	.28	.24	.06	.09	.16	.30	.36
Oregon	.34	.27	.41	.30	.18	.19	.24	.28	.33	.15	.38
Pennsylvania									.20		
Rhode Island										.12	
Texas							.17		.15		
Vermont	.15	.19	.21	.24	.17	.21	.21	.22	.21	.19	.30
West Virginia									.22		
Wisconsin					.17				.14	.11	
National Council of Teachers of Mathematics	.23	.27	.30	.27	.24	.27	.22	.22	.22	.38	
Minimum	.15	.19	.21	.10	.12	.10	.01	.07	.07	.05	.15
Maximum	.51	.30	.46	.41	.43	.30	.27	.34	.33	.37	.47
Average	.31	.25	.34	.27	.22	.21	.19	.23	.22	.24	.35

For mathematics, then, the Common Core standards represent a modest shift toward higher levels of cognitive demand than are currently represented in state standards. Of course, state standards vary considerably, so these differences would vary across states.

Table 3 shows the cognitive demand results for ELAR. The Common Core standards put much greater emphasis on “analyze,” at roughly a third of the content, than do states, at less than 20% of the content. The states put greater emphasis on “perform procedures” and “generate” than do the Common Core standards. Thus, for ELAR, the Common Core standards would shift the content even more strongly than they would for mathematics toward higher levels of cognitive demand (but, in both cases, not to the highest level of cognitive demand).

Table 4 shows results for mathematics topics defined at the coarse-grain level. There are many notable differences between Common Core and state standards. For example, whereas Common Core standards place a much greater emphasis on basic algebra, state standards place a much greater emphasis on advanced algebra. Similarly, Common Core standards place

greater emphasis than do states on geometric concepts, but less emphasis on advanced geometry. There is a huge difference in emphasis on instructional technology (e.g., calculator use); in the state standards, nearly 26% of content is on instructional technology, compared with none in the Common Core standards. Table 4 also shows coarse-grain topic results for ELAR. Although the differences are far fewer than for mathematics, the Common Core standards put less emphasis on reading comprehension and more on language study than do the state standards.

We looked at differences between the Common Core standards and the state aggregated standards at the cell level (recall that there are 1,085 distinct cells for mathematics and 815 for ELAR). Perhaps not surprisingly, at this fine-grain size none of the differences reached the level of 3% of total content. For mathematics, however, 19 cells had differences exceeding 1%; for ELAR, there were only 8 such cells. This pattern reflects the differences noted earlier for marginal distributions of cognitive demand and topics. For mathematics, most of the cells have a greater emphasis for Common Core than for states on

Table 2
Alignment of State and Common Core ELAR Standards

State Standards	Common Core Standards by Grade											
	K	1	2	3	4	5	6	7	8	9/10	11/12	3–6
Arizona				.22		.22			.21	.18		
California	.26	.37	.35	.33	.28	.35	.40	.39	.42			.43
Delaware			.14	.14	.15	.15	.38	.38	.35	.23	.38	.28
Florida			.38			.26			.37			
Idaho	.31	.33	.40	.34	.19	.30	.38	.34	.32	.39	.39	.41
Illinois		.37	.34	.32	.39	.24	.24	.41	.35	.23	.31	.44
Indiana	.36	.29	.26	.33	.35	.21	.36	.30	.33	.35	.35	.45
Kansas			.26	.28	.16	.23	.20	.24	.36	.37	.36	.37
Maine				.11	.10	.15	.14	.15	.11	.18	.18	.19
Massachusetts							.29	.13	.33			
Michigan	.31	.35	.34	.30	.30		.20					
Minnesota	.28	.35	.37	.33	.39	.39	.37	.37	.43	.40	.37	.45
Mississippi			.27	.21								
Montana					.23				.19		.17	
New Hampshire			.19	.16	.14	.17	.22	.23	.25			.25
New York		.34	.32	.31	.36	.37	.35	.35	.33	.39	.37	.42
North Carolina						.28			.35	.34		
Ohio	.29	.34	.35	.37	.37	.34	.38	.39	.40	.38	.34	.47
Oklahoma				.20	.29	.30			.16	.39		
Oregon	.32	.34	.40	.24	.29	.31	.44	.43	.48	.39		.44
Utah				.22	.26	.22	.22	.22	.23	.31	.31	
Vermont	.31	.31	.32	.31	.32	.32	.40	.40	.41	.39	.36	.40
Virginia							.37		.33		.33	
Wisconsin					.25				.32		.38	
Minimum	.26	.29	.14	.11	.10	.15	.14	.13	.11	.18	.17	.19
Maximum	.36	.37	.40	.37	.39	.39	.44	.43	.48	.40	.39	.47
Mean	.30	.34	.31	.26	.26	.27	.31	.32	.32	.33	.33	.38

Table 3
Contrasting Common Core (CC) and State Standards on Cognitive Demand (Percentages)

Cognitive Demand	Math		English Language Arts and Reading		
	State	CC	Cognitive Demand	State	CC
Memorize	12.11	9.50	Memorize	9.06	8.07
Perform procedures	48.82	43.74	Perform procedures	29.00	23.07
Demonstrate understanding	28.66	35.65	Generate	37.92	29.88
Conjecture	7.78	5.96	Analyze	16.47	33.35
Solve nonroutine problems	2.63	5.16	Evaluate	7.53	5.64

“demonstrate understanding” for topics on number sense, operations, and measurement. For ELAR, the 8 cells involved “analyze” and “perform procedures” for writing and speaking.

These differences between Common Core and state aggregated standards for Grades 3–6 can be seen graphically (see Figures 2–5, pp. XXX–XXX). When reading these graphs, the representation of content emphasis is accurate at each column-by-row intersection, but the smoothing between rows and between columns is not meaningful because the data are nominal. Still, we believe these graphic displays powerfully represent similarities and differences between Common Core standards and state aggregated standards for Grades 3–6.

In Figure 2, one quickly sees that the Common Core standards do not contain any probability, analysis, special topics, or instructional technology, whereas the state standards include at least some of each of those topics. Both Common Core and state standards put heavy emphasis on number sense and operations, but the state standards put more emphasis on measurement than do the Common Core standards, and the Common Core standards put more emphasis on “demonstrate understanding” and “conjecture” than do the state standards. At the fine-grain level for basic algebra (Figure 3), the greater emphasis in Common Core can easily be seen, with much of it at the cognitive-demand level of “perform procedures.”

Table 4
Contrasting Common Core (CC) and State Standards on Topics (Percentages)

Math			English Language Arts and Reading		
Topic Area	State	CC	Topic Area	State	CC
Number sense	13.84	32.75	Phonemic awareness	0.82	0.05
Operations	15.08	22.72	Phonics	0.83	0.29
Measurement	0.00	17.79	Vocabulary	8.72	9.85
Consumer applications	11.58	0.05	Text and print features	3.82	1.75
Basic algebra	0.03	13.40	Reading fluency	2.98	2.64
Advanced algebra	14.47	0.00	Reading comprehension	21.38	14.57
Geometric concepts	0.24	5.73	Reading critical reasoning	9.75	11.24
Advanced geometry	9.27	1.64	Reading author's craft	9.87	7.85
Data displays	2.83	2.76	Writing processes	8.34	5.16
Statistics	4.72	3.16	Elements of presentation (verbal and written)	10.78	12.72
Probability	0.15	0.00	Writing applications	6.28	9.48
Analysis	0.03	0.00	Language study	6.87	12.12
Trigonometry	0.64	0.00	Oral communication: Listening and viewing	3.72	3.67
Special topics	0.32	0.00	Oral communication: Speaking and presenting	5.85	8.60
Functions	1.09	0.00			
Instructional technology	25.71	0.00			

For ELAR, Figure 4 presents the topographical maps at the coarse-grain topic level. A greater emphasis on analysis for the Common Core is quickly seen, as is a decrease in emphasis on comprehension and an increase in emphasis on language study. Focusing on reading comprehension at the fine-grain level (Figure 5), a greater emphasis for states is evident on “perform procedures/explain” than on higher levels of cognitive demand (i.e., levels of cognitive demand to the right in the figure). Neither the Common Core nor the aggregate state standards are focused in their call for work on comprehension. Both cover most topics and most levels of cognitive demand.

Focus. Now we turn our attention to degree of focus. Some have suggested, based on international benchmarking, that U.S. content standards need to be more focused (Schmidt et al., 2001). Does the Common Core represent greater focus than is currently represented in state content standards? At least for math, that was the explicit intention (Common Core State Standards Initiative, 2010b, p. 3). We investigated focus in two ways. First, we asked how many cells were needed in the content matrix of topics by cognitive demand to capture 80% of the total content; the fewer the cells, the greater the focus.²

Next, we asked how many cells contained 1% or more of total content; the more such cells, the greater the focus. We asked these questions first for data aggregated across states and second for the average across states. Because state content standards differ from one another, the aggregate across states is almost sure to have less focus than the average across states.

In math, the state aggregate takes 161 cells to capture 80% of the content; the Common Core takes 94 cells. In ELAR, the state aggregate takes 206 cells to capture 80% of the content, compared with 149 cells for the Common Core.

For individual states, we once again find huge state-to-state variation. In math, the number of cells required to capture 80% of the content for Grades 3–6 ranges from 27 for Montana to 157 for Illinois; the average is 88 cells, with a standard deviation of

31. In ELAR, the number of cells required to capture 80% of the content for Grades 3–6 ranges from 32 for Maine to 200 for New York; the average is 111 cells, with a standard deviation of 44.

Collectively, then, across states, the state content standards are substantially less focused using this criterion than is the Common Core. However, when taking the average across states, the difference is less dramatic, and the states are slightly more focused than is the Common Core. That is, to capture 80% of the content in math, the average required across states is 88 topics versus 94 for the Common Core. In ELAR, the average across states is 111 topics versus 149 for the Common Core. Once again, the huge variability across states must be taken into consideration. Some state content standards for Grades 3–6 are much more focused than is the Common Core, and some are much less focused.

Turning to the criterion of number of cells with 1% or more of content, for mathematics, the aggregated state standards have 14 such cells, representing 21% of the total content; the Common Core has 31 such cells, representing 58% of total content. In ELAR, the aggregated state standards have 7 such cells, representing 10% of total content, and the Common Core has 13 such cells, representing 18% of total content. Again, we find that the aggregated state standards are less focused than is the Common Core. However, state-by-state results once more tell a somewhat different story. The average across states for mathematics is 24.5 cells with 1% or more of content (vs. 31 for Common Core), covering 45% of total content, with a minimum of 13 such cells and a maximum of 34 such cells. In ELAR, the state average is nearly 22 such cells, covering 39% of total content, with a minimum of 10 and a maximum of 38 cells. The average for state content standards represents greater focus than is seen in the Common Core for ELAR, but the Common Core for mathematics is still more focused. The Common Core has more focus than some states' standards and less focus than other states' standards, both for mathematics and for ELAR.

Table 5
Cognitive Demand Definitions

Mathematics	English Language Arts and Reading
<p><i>Memorize</i></p> <ul style="list-style-type: none"> • Recite basic mathematics facts • Recall mathematics terms and definitions • Recall formulas and computational processes <p><i>Perform procedures</i></p> <ul style="list-style-type: none"> • Use numbers to count, order, or denote • Do computational procedures or algorithms • Follow procedures/instructions • Make measurements, do computations • Solve equations/formulas, routine word problems • Organize or display data • Read or produce graphs and tables • Execute geometric constructions <p><i>Demonstrate understanding</i></p> <ul style="list-style-type: none"> • Communicate new mathematical ideas • Use representations to model mathematical ideas • Explain findings and results from data analysis • Develop/explain relationships between concepts • Explain relationship between models, diagrams, and other representations <p><i>Conjecture, generalize, prove</i></p> <ul style="list-style-type: none"> • Determine the truth of a mathematical pattern or proposition • Write formal or informal proofs • Analyze data • Find a mathematical rule to generate a pattern or number sequence • Reason inductively or deductively • Use spatial reasoning <p><i>Solve nonroutine problems, make connections</i></p> <ul style="list-style-type: none"> • Apply and adapt a variety of appropriate strategies to solve problems • Apply mathematics in contexts outside mathematics • Recognize, generate, or create patterns • Synthesize content and ideas from several sources 	<p><i>Memorize, recall</i></p> <ul style="list-style-type: none"> • Reproduce sounds or words • Provide facts, terms, definitions, conventions • Locate literal answers in text • Identify relevant information • Describe <p><i>Perform procedures, explain</i></p> <ul style="list-style-type: none"> • Follow instructions • Give examples • Check consistency • Summarize • Identify purpose, main ideas, organizational patterns • Gather information <p><i>Generate, create, demonstrate</i></p> <ul style="list-style-type: none"> • Create/develop connections among text, self, world • Recognize relationships • Dramatize • Order, group, outline, organize ideas • Express new ideas (or express ideas in new ways) • Develop reasonable alternatives • Integrate with other topics and subjects <p><i>Analyze, investigate</i></p> <ul style="list-style-type: none"> • Categorize/schematize information • Distinguish fact and opinion • Compare and contrast • Identify with another's point of view • Make inferences, draw conclusions • Predict probable consequences <p><i>Evaluate</i></p> <ul style="list-style-type: none"> • Determine relevance, coherence, internal consistency, logic • Assess adequacy, appropriateness, credibility • Test conclusions, hypotheses • Synthesize content and ideas from several sources • Generalize • Critique

Comparing Common Core Standards With State Assessments

We also examined the alignment of state assessments to the Common Core standards. As assessments are a sample of the domain, we would expect alignment to the Common Core standards to be lower than for state standards, which in theory map the full intended domain. Average alignment of Common Core standards and state assessments is slightly lower than the alignment of state standards to the Common Core. Across Grades 3–12 in math, the average alignment of state assessments to Common Core standards is .19, compared with .25 for state standards to the Common Core (Table 6). In ELAR, the average alignment of assessments to the Common Core standards is .17, compared with .30 for state standards (see Table 7).

Less variability in alignment indices exists between assessments and the Common Core than between state standards and

the Common Core. For math, the alignment index ranges from .10 to .31 across states and grades for assessments. For ELAR, the alignment index ranges from .07 to .32.

Another question we sought to answer is the degree to which NAEP assessments align with the Common Core standards (NAEP was an explicit guide for ELAR Common Core standards; Common Core State Standards Initiative, 2010a, p. 5). Alignment indices were calculated for NAEP assessments for Grades 4 and 8. In math, NAEP's alignment with the Common Core standards was .28 for fourth grade and .21 for eighth grade; the average alignment of state math assessments to the Common Core standards was .20 in both grades. Thus the NAEP's alignment with the Common Core math standards is significantly higher than the average of state assessments only in fourth grade. In ELAR, however, NAEP has a higher alignment than the average of state assessments in both fourth and eighth grades. NAEP's

All Content Areas

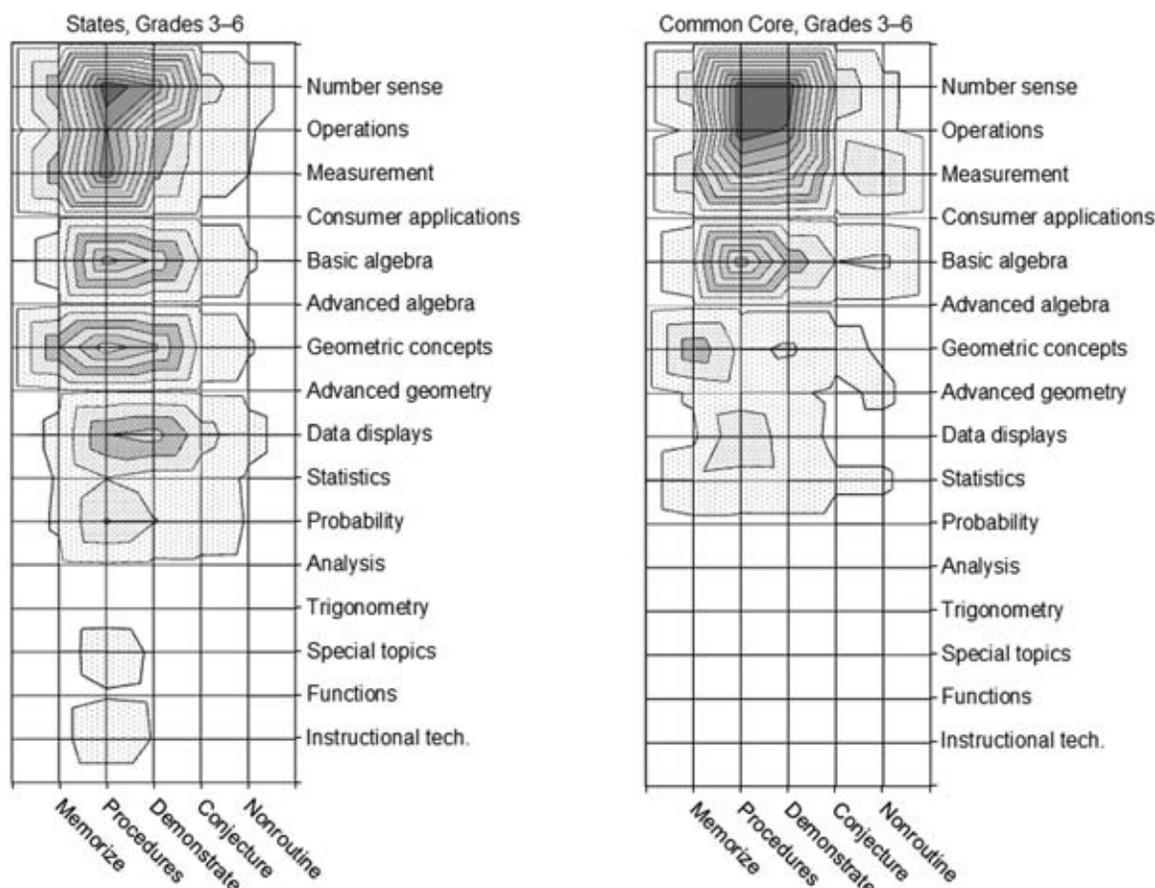


FIGURE 2. Topographical maps comparing Common Core and state standards at coarse-grain topic level for math. Alignment = .45, contour interval bands represent 1% differences in content emphasized.

alignment to the Common Core standards is .25 in fourth grade and .24 in eighth grade, compared with an average alignment of .17 for state assessments in both grades. To some extent, NAEP can be considered a grade band test assessing content at and below the stated grade level, so alignment should be slightly higher than if NAEP were grade-level specific.

We also calculated alignments between the Common Core standards and state assessments aggregated across Grades 3–6. Results from these analyses are presented in Tables 6 and 7. For math, the average aggregate alignment for Grades 3–6 is .34 (it was .35 for standards); for ELAR, it is .24 (.38 for standards). Thus, when aggregating across grades, average alignments increase both for math and for ELAR, but increase for ELAR. For both subjects, a considerable lack of alignment remains.

In examining the content that is unique to state assessments relative to the Common Core, the general pattern described earlier holds: Common Core standards include a variety of content across many coarse-grained topic areas that is not included in state assessments. In many ways, this is not surprising. Assessments are a sample of a domain; we would thus expect lower levels of alignment when looking at the relationship between standards and assessments and, therefore, more content in the Common Core that is unique in relation to state assessments than for state standards.

As for standards, we looked at differences between the Common Core standards and the state assessments at the cell level. For mathematics, 31 cells had differences exceeding 1%, and for ELAR, there were 30. In math, the cell differences were split evenly between content more emphasized in the assessments and content more emphasized in the Common Core (15 differences favoring state assessments and 16 favoring Common Core). Most of these cells were in number sense and instructional technology for the demands of “perform procedures” and “demonstrate understanding.” Of the 30 cells for ELAR that had at least a 1% difference between the Common Core and state assessments, 21 were emphasized more in state assessments and 9 more in Common Core standards. Of the 21 cells more emphasized in state assessments, half were on “memorize/recall”; the others were split between “analyze/investigate” (7) and “perform procedures/explain” (4). For topics, the cells favoring state assessments fell under comprehension and critical reasoning. The cells favoring Common Core fell under elements of presentation (verbal and written) and writing applications for “perform procedures/explain” (3), “generate/create/demonstrate” (1), and “analyze/investigate” (5).

Thus far in our analyses, a comparison of Common Core standards with aggregated state standards for Grades 3–6 has revealed a shift toward greater emphasis on higher order cognitive demand. Some would interpret this as a move toward greater

Basic Algebra

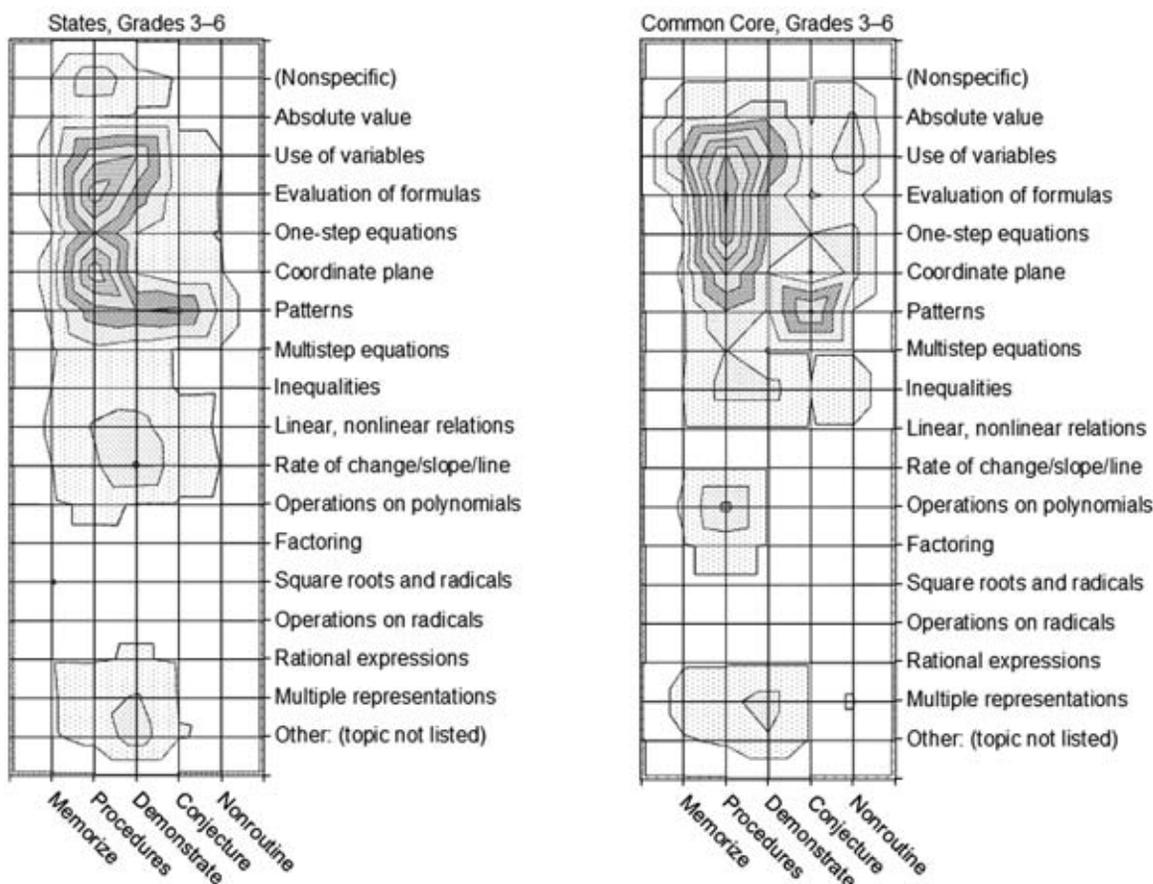


FIGURE 3. Topographical maps comparing Common Core and state standards at fine-grain topic level for basic algebra. Contour interval bands represent .2% differences in content emphasized.

rigor, although when people call for more rigorous curricula, the meaning of *rigor* is not always clear. Our analyses also have revealed some shifts in emphasis across topics, although none of these shifts is definitive in terms of rigor. In math, we saw a decrease in emphasis on advanced algebra and advanced geometry in the Common Core in comparison with states' content standards. In ELAR, we saw a decrease in emphasis on comprehension and an increase in emphasis on language study in the Common Core. These shifts may represent important increases in quality, but we are not prepared to make that judgment.

Benchmarking the Common Core Against Massachusetts

Massachusetts is the top-performing state on NAEP assessments. For that reason, we asked how the Common Core differs from Massachusetts' content standards. In our data set, the only grade level for which we have Massachusetts data that is common across mathematics and ELAR is Grade 7, so we focused on that grade. As we have seen already, the alignment between Massachusetts and the Common Core for mathematics at Grade 7 is .19—less than the state average of .23 and considerably less than the figure for the most aligned state, .34. In ELAR, Massachusetts' alignment is .13, again less than the state average of .32 and substantially less than the state maximum of .43.

What content differences are behind these low levels of alignment at Grade 7? In mathematics, for cognitive demand, there are no large differences. Common Core puts slightly less emphasis than does Massachusetts on “perform procedures” (45% vs. 51%) and slightly more emphasis on “demonstrate understanding” and “conjecture.” Thus the Common Core represents only the slightest of shifts toward higher levels of cognitive demand. For topics, the Common Core puts considerably more emphasis on operations, less on basic algebra and geometric concepts, and more on probability. In ELAR, the differences in cognitive demand are more striking. The Common Core puts substantially less emphasis on “memorize” and somewhat less emphasis on “perform procedures,” and substantially more emphasis on “generate,” than does Massachusetts at Grade 7. At the coarse-grain level for topics, the Common Core puts greater emphasis on writing processes, writing applications, and oral communication, whereas Massachusetts puts more emphasis on reading (critical reasoning and author's craft) and language study. Whether these differences between Common Core and Massachusetts mean that Common Core represents a better curriculum is difficult to judge, although at least at Grade 7 in ELAR, there is a shift in the Common Core standards toward greater emphasis on higher cognitive demand.

All Content Areas

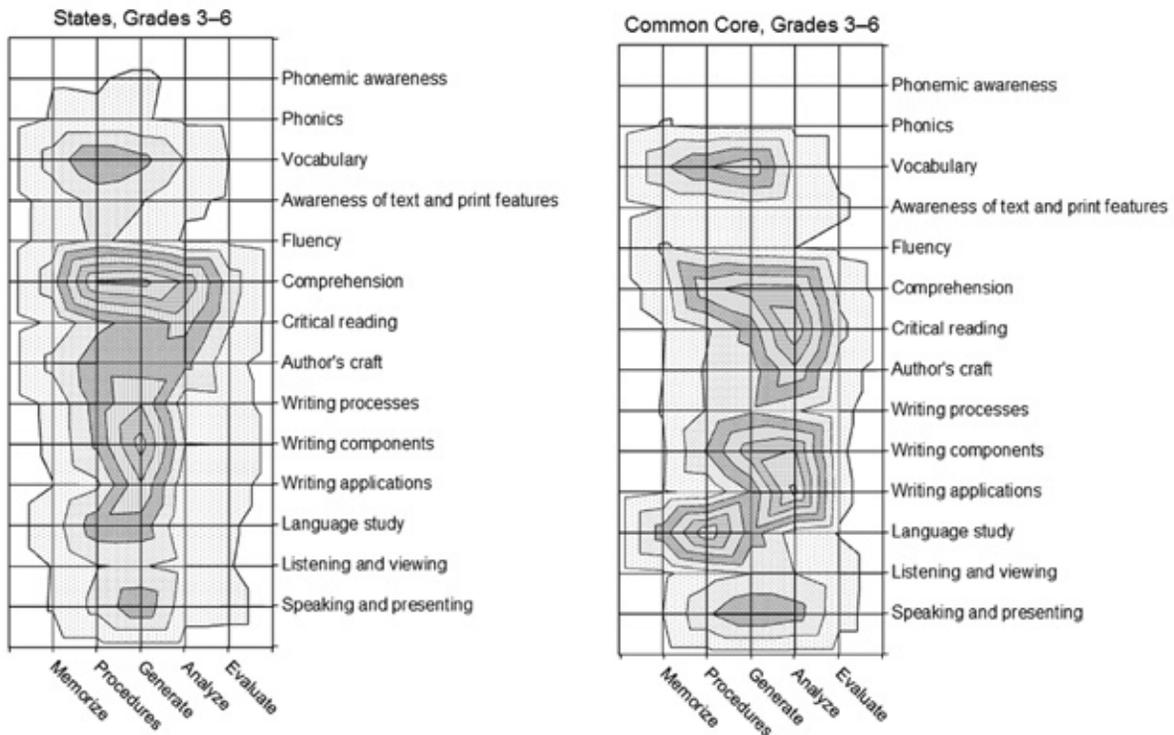


FIGURE 4. Topographical maps comparing Common Core and state standards at the coarse-grain topic level for English language arts and reading. Alignment = .52, contour interval bands represent 1% differences in content emphasized.

Reading Comprehension

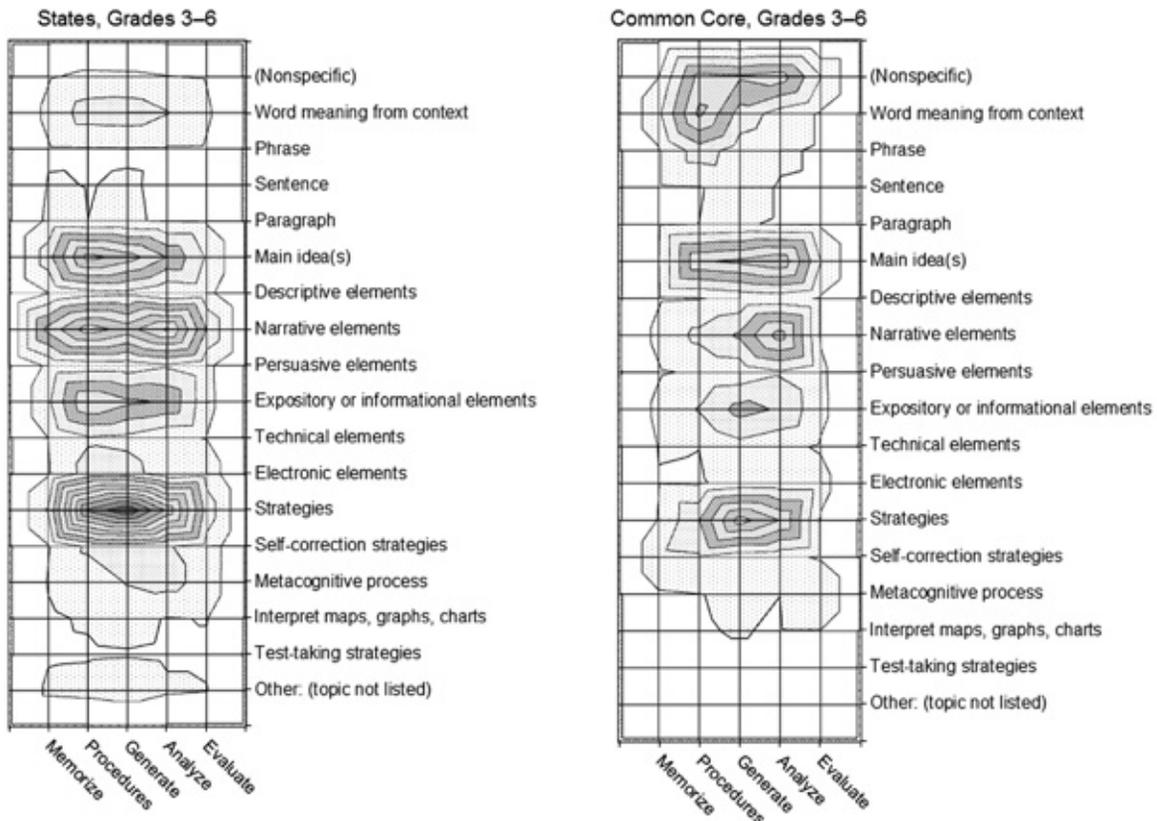


FIGURE 5. Topographical maps comparing Common Core and state standards at the fine-grain topic level for reading comprehension. Contour interval bands represent .2% differences in content emphasized.

Table 6
Alignment of State Assessments and Common Core: Math Standards

State Assessments	Common Core Standards by Grade							
	3	4	5	6	7	8	9–12	3–6
State A		.11						
State G	.17	.21	.21	.21	.17	.29	.17	.33
State H	.17			.15			.16	
State I	.27	.22	.14	.21	.24	.31	.20	.33
State K	.29	.17	.18	.17	.17	.18	.20	.35
State L			.23			.14	.24	
State M		.20				.15	.18	
State N	.14	.28	.19	.19	.30	.21	.15	.35
State O	.16	.20			.15	.13	.20	
State P		.22				.16		
State S	.15	.18	.16	.14	.17	.22	.10	.33
State U		.14				.17	.14	
State V		.22				.19		
State W	.18	.21	.23	.21	.29	.27	.17	.37
State X				.18		.18		
State Y						.15		
National Assessment of Educational Progress		.28				.21		
Minimum	.14	.11	.14	.14	.15	.13	.10	.33
Maximum	.29	.28	.23	.21	.30	.31	.24	.37
Average	.19	.20	.19	.18	.21	.20	.17	.34

Table 7
Alignment of State Assessments and Common Core: English Language Arts and Reading Standards

State Assessments	Common Core Assessments by Grade								
	3	4	5	6	7	8	9–10	11–12	3–6
State C	.17	.17	.19	.22	.19	.18	.21		.23
State I	.19	.13	.22	.14	.15	.24	.18		.28
State K	.21	.20	.18	.08	.08	.14	.23		.23
State M	.14	.10	.13	.14	.17	.20		.19	.17
State N	.21	.23	.32	.26	.26	.21	.28	.27	.36
State Q				.16				.12	.16
State S	.18	.15	.11	.07	.16	.07	.14	.13	
State U		.16				.11	.10		
State W		.24				.12	.18		
State Y	.16	.20	.18	.20	.20	.24	.14	.14	.23
State AB						.21			
State AC		.14	.17	.16					
National Assessment of Educational Progress		.25				.24			
Minimum	.14	.10	.11	.07	.08	.07	.10	.12	.16
Maximum	.21	.24	.32	.26	.26	.24	.28	.27	.36
Average	.18	.17	.19	.16	.17	.17	.18	.17	.24

International Benchmarking

Wisconsin's SEC database contains some information on content standards for other countries. In mathematics, there are data for Finland, Japan, and Singapore on eighth-grade standards; alignments to the U.S. Common Core are .21, .17, and .13, respectively. All three of these countries have higher eighth-grade

mathematics achievement levels than does the United States. The content differences that lead to these low levels of alignment for cognitive demand are, for all three countries, a much greater emphasis on “perform procedures” than found in the U.S. Common Core standards. For each country, approximately 75% of the content involves “perform procedures,” whereas in the

Common Core standards, the percentage for procedures is 38%. Differences for the other five levels of cognitive demand are not as uniform across countries. However, none of the three countries puts as much as 1% of its content emphasis on “solve nonroutine problems,” whereas Common Core puts 4.5% of its content emphasis there. Clearly, these three benchmarking countries with high student achievement do not have standards that emphasize higher levels of cognitive demand than does the Common Core. Marginal distributions for coarse-grain topics are quite similar between each of the three benchmarking countries and the U.S. Common Core.

For ELAR, SEC data are available for Grades 1, 3, and 5 for Ontario; Grade Bands 1–2 and 3–5 for Finland; Grade Bands 1–2 and 3–5 for Sweden; and Grade Band 6–8 for New Zealand. We aggregated across grades to make the alignment comparisons with international benchmarking countries’ grade bands. Alignment was highest for New Zealand Grade Band 6–8 at .37, and next highest for each of the three grade levels for Ontario (.26, .27, and .29, respectively). The lowest alignments were for Finland Grade Band 1–2 at .09, Sweden Grade Band 1–2 at .17, and Sweden Grade Band 3–5 at .14. For Finland Grade Band 3–5, the alignment was .25. None of these alignments is large, not even when aggregating across grade levels. According to a McKinsey & Company (2007) report on the world’s best performing school systems, Finland might be the focus country. The differences in cognitive demand emphasis are substantial at Grades 1 and 2. Finland emphasizes “perform procedures” in almost two thirds of content, compared with none at all for Common Core. On the other hand, Common Core emphasizes “memorize/recall,” in almost two thirds of content, and Finland in only 25%. The difference for “generate/create” is also large: 39% for Common Core and 12% for Finland. At Grade Band 3–5, Finland continues a greater emphasis on “perform procedures,” although Finland has almost twice as much emphasis as Common Core on “memorize/recall.” At the coarse-grain topic level, the differences are not dramatic, although Common Core stresses phonics more at Grades 1 and 2 than does Finland, and Finland puts a greater emphasis on writing than does Common Core. Common Core also puts a greater emphasis on language study, whereas Finland puts a greater emphasis on listening and viewing. The greater emphasis on “perform procedures” for Finland versus the Common Core holds up across the other benchmarking countries as well.

Comparing Common Core Curriculum With the Current Enacted Curriculum

The Wisconsin SEC data set contains considerable data on what teachers say they teach using the SEC metric. The quality of these and similar types of data has been investigated repeatedly and found to be quite good (Mayer, 1999; Porter, Kirst, Osthoff, Smithson, & Schneider, 1993; Ross, McDougall, Hogaboam-Gray, & LeSage, 2003). The data set is so extensive that we limit our comparison to fourth grade. The data are not based on a probability sample for the nation. For mathematics, 27 states are represented by 1,536 teachers. For ELAR, 22 states are represented by 919 teachers. Teachers report their instructional content practices in an end-of-year survey, indicating what fine-grain topics are taught and to what extent, and for each topic taught,

what levels of cognitive demand are emphasized and to what extent. Thus it is possible to build a matrix of content proportions for each teacher. For mathematics, the average alignment across teachers to the Common Core standards was .22, with a standard deviation of .042, a minimum alignment of .00 and a maximum alignment of .33. For ELAR, the mean alignment was .27, with a standard deviation of .071, a minimum alignment of .001, and a maximum alignment of .398. Again, we find generally low levels of alignment.

What types of content differences create the low alignment? For cognitive demand in mathematics, teachers place a greater emphasis on “memorize”—nearly 25% of the content, compared with 10% in the Common Core standards. Teachers also report greater emphasis on “conjecture” and “solve nonroutine problems,” at 14% each, versus 7% and 3%, respectively, in Common Core. In contrast, teachers place considerably less emphasis than does Common Core on “perform procedures” and “demonstrate understanding.”

For ELAR, a somewhat different pattern emerges. Although teachers again report a greater emphasis on “memorize” at 22%, compared with 9% for Common Core, the teachers’ emphasis on “perform procedures” and “generate” parallels that in the Common Core standards. Also, the Common Core standards put a much greater emphasis on “analyze,” at almost 40%, than do teachers, at 17%, whereas the teachers put greater emphasis on “evaluate,” at 15%, than does the Common Core, at 5%.

When looking at the distribution of emphasis across coarse-grain topics for mathematics, there are few sharp differences, with the exception that teachers put a greater emphasis on geometric concepts, at 16%, than does Common Core, at 10%, and teachers put less emphasis on number sense, at 27%, than does Common Core, at 36%. For ELAR, there are even fewer sharp differences in emphasis on coarse-grain topics than for mathematics. At Grade 4, teachers report putting greater emphasis on phonemic awareness, at 4%, and phonics, at 5%, than does Common Core, at 1% and less than 1%, respectively. Teachers also report putting greater emphasis on text and print features and reading fluency, at 5% each, than do the Common Core standards, at approximately 2% each. A shift to Common Core standards will require teachers to place less emphasis on memorization both for mathematics and for ELAR, at least in fourth grade, and a much greater emphasis on analysis for ELAR.

Conclusion

The Common Core standards represent considerable change from what states currently call for in their standards and in what they assess. The Common Core standards are somewhat more focused in mathematics but not in ELAR. The Common Core standards are also different from the standards of countries with higher student achievement, and they are different from what U.S. teachers report they are currently teaching.

Adoption of the Common Core standards will represent considerable change, especially at specific grade levels but even across ranges of grade levels, ignoring grade-to-grade differences. Clearly, the new multistate consortia charged with building aligned assessments will strive to do exactly that, but what are the implications for textbook publishers and other sources of curriculum materials? To what extent are existing materials aligned

to existing standards? The answer must be that they are far from perfectly aligned, because standards vary so much from one state to the next. If there is a single set of content standards across states, will there be more opportunity and more motivation to build curriculum materials that are carefully aligned? Similar questions can be raised for preservice and in-service teacher education.

Our conclusions are based on the assumption that the content distinctions made by our SEC procedures are important. But a key question remains: Do we describe content at too crude or too precise a level of detail? If too crude, we have undoubtedly overlooked important additional uniqueness in the Common Core. If too precise, some of the uniqueness we find may not be important. Any definition of content is surely subject to criticism in either direction. We take as some assurance of the validity of our distinctions that when SEC procedures are used by teachers to describe the content of their instruction and SEC procedures are used to measure the degree of alignment of that content to assessed content, the degree of alignment is a powerful predictor of gains in student achievement, with correlations of nearly .5 (explaining 25% of the variance). Further, the strength of prediction drops to near zero when topics are collapsed to just consider cognitive demand and, similarly, when cognitive demand is collapsed to just consider topics (Gamoran, Porter, Smithson, & White, 1997).

Do the Common Core standards represent a change for the better from existing state standards? If one takes state adoption (or at least states' intentions to adopt) as evidence of quality, then the answer must surely be yes. From our results, the answer is yes if the hope is to move toward greater emphasis on higher order cognitive demand. In terms of topics, the answer is less clear, although at least for Grades 3–6 in mathematics, the Common Core represents less emphasis on advanced algebra and geometry than current state standards do. Perhaps that is an improvement, or perhaps not.

Those who hope that the Common Core standards represent greater focus for U.S. education will be disappointed by our answers. Only one of our criteria for measuring focus found that the Common Core standards are more focused than current state standards and only for mathematics, not for ELAR. Further, some state standards are much more focused and some much less focused than is the Common Core, and this is true for both subjects. How much focus is desirable is unknown, but clearly the Common Core standards could have been more focused than they are.

We also used international benchmarking to judge the quality of the Common Core standards, and the results are surprising both for mathematics and for ELAR. Top-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.

Our conclusions must be tempered by the data set available for analysis. First, for each subject, only roughly half of the 50 states are represented. It could be that there are some nonrepresented states for which standards and assessments are much more aligned with the Common Core than what we have found for the states for which data were available. Our efforts at international

benchmarking are similarly limited by the available data. Further, in benchmarking against Massachusetts and a handful of other countries, we are not arguing that their higher achievement is due to their having better standards. We are simply arguing that benchmarking against higher achieving countries and states is common and may be useful, adding yet another lens for viewing the content messages represented in the Common Core standards.

Judging the quality of the Common Core standards is of great importance, but it is only partially and tentatively addressed here. We are not questioning the quality of the content messages represented in the Common Core standards. Again, the analyses here address how much change the Common Core standards represent for content standards and assessments.

NOTES

¹We are especially thankful to Rolf Blank at the Council of Chief State School Officers and John Smithson at the Wisconsin Center for Education Research, University of Wisconsin, Madison. Under their leadership, the Council of Chief State School Officers initiated and paid for the generation of the data on which the following analyses and results are based.

²If content is spread across many cells with just a small amount of the total content allocated to each cell, that pattern, we argue, represents a lack of focus. In contrast, if the proportion of content is large for a relatively small number of cells, that pattern represents focus.

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- PA 19104; andy@se.upenn.edu. His research focuses on curriculum policies and their effects.
- JENNIFER McMAKEN is a doctoral student at the University of Pennsylvania, Graduate School of Education, 3700 Walnut Street, Philadelphia, PA 19104; jmcmaken@dolphin.upenn.edu. Her research focuses on quantitative methods and psychometrics.
- JUN HWANG is a doctoral student at the University of Pennsylvania, Graduate School of Education, 3700 Walnut Street, Philadelphia, PA 19104; thisisjunhwang@gmail.com. His research focuses on quantitative methods and psychometrics.
- RUI YANG is a doctoral student at the University of Pennsylvania, Graduate School of Education, 3700 Walnut Street, Philadelphia, PA 19104; rayeryoung@gmail.com. His research focuses on quantitative methods and psychometrics.

AUTHORS

ANDREW PORTER is dean at the University of Pennsylvania, Graduate School of Education, Dean's Office, 3700 Walnut Street, Philadelphia,

Manuscript received January 4, 2011

Revision received March 2, 2011

Accepted March 3, 2011



Errata

Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011). Common Core Standards: The New U.S. Intended Curriculum. *Educational Researcher*, 40(3), 103–116. (Original DOI: 10.3102/0013189X11405038)

In the April 2011 issue of *Educational Researcher*, on page 108, Table 4, the numbers for “Math” under the “State” column should have been located one row lower, with the bottom percentage of 25.71 moving to the top to describe number sense. The percentage 13.84 describes operations, 15.08 describes measurement, and so forth.

The discussion of the table also needs correction. After the first sentence of the second full paragraph on page 106 (“Table 4 shows results for mathematics topics defined at the coarse-grain level”), the next four sentences should be replaced by the following: “There are some differences between Common Core and state standards. For example, Common Core puts a heavier emphasis on number sense and operations than do state standards. In contrast, Common Core puts much less emphasis on geometric concepts, data displays, and probability than do states.” The rest of the paragraph, beginning with “Table 4 also shows coarse-grain topic results for ELAR,” is correct.

On page 115, the fourth sentence of the second full paragraph, beginning with “In terms of topics,” should read as follows: “In terms of topics, the answer is less clear, although at least for Grades 3–6 in mathematics, the Common Core represents less emphasis on geometric concepts, data displays, and probability than current state standards do.”

Porter, A., McMaken, J., Hwang, J., & Yang, R. (2011). Assessing the Common Core Standards: Opportunities for Improving Measures of Instruction. *Educational Researcher*, 40(4), 186–188. (Original DOI: 10.3102/0013189X11410232)

In the May 2011 issue of *Educational Researcher*, on page 186, third paragraph, the sentence beginning with “In mathematics” should read: “In mathematics, the Common Core standards would increase the emphasis on number sense and operations while decreasing the emphasis on geometric concepts, data displays, and probability in Grades 3–6. For ELAR, the Common Core standards would decrease the emphasis on reading comprehension in Grades 3–6.” This correction reflects the table correction described in the erratum above.