

V. DARLEEN OFFER, JULIA H. KAUFMAN, JOSEPH D. PANE, LINDSEY E. THOMPSON

Aligned Curricula and Implementation of Common Core State Mathematics Standards

Findings from the American Teacher Panel

This report presents findings from a survey of the American Teacher Panel (ATP) teachers conducted in the spring of 2016 and follows up on a previous survey of teachers conducted in the spring of 2015. It specifically examines responses from mathematics teachers across the United States in regard to their understanding of their standards and standards-aligned practices. We also consider how teachers' instructional materials might support their understanding of their standards and practice. This report is primarily intended to provide data to support decisionmaking regarding policies and related to state standards and teachers' instructional practice.

As with our previous research, we specifically focus on three key “instructional shifts” that teachers must undertake to align their instruction with the Common Core:

KEY FINDINGS

- Most of the materials that teachers reported using regularly for their instruction during the 2015–2016 school year were not highly aligned with the Common Core State Standards.
- A majority of teachers were able to identify Common Core–aligned topics at their grade level.
- Over one-third of teachers reported that their students engaged in various standards-aligned practices to a great extent.
- Teachers using at least one highly aligned material reported their students engaging in standard-aligned practices more than teachers not using highly aligned materials.

- **Teachers are expected to focus on fewer mathematical topics within grade levels.** The standards expect teachers to narrow and deepen instruction by focusing on covering fewer topics at each grade level but with greater depth. The standards also divide the content across grade levels in ways that create a progression of mathematical concepts and skills development.

- **Teachers are expected to focus on coherence in mathematics instruction by linking topics and thinking across grades.** Because mathematics is a coherent body of knowledge consisting of interconnected topics, the standards consist of a progression of topics from grade to grade that builds new knowledge onto existing knowledge. Standards in higher grades are written as extensions of content learned in previous grades.
- **Teachers are expected to address the three aspects of rigor equally in instruction.** Rigor in the standards refers to a deep command of mathematics achieved through three areas of emphases in instruction: development of conceptual understanding, development of procedural skills and fluency, and application of knowledge to real-world situations.

We consider how well teachers understand these shifts, as well as the extent to which they have incorporated “Standards for Mathematical Practice” emphasized by the Common Core.

To conduct this research, we administered a web-based survey to the RAND ATP in the spring of 2016. The ATP includes a nationally representative sample of American K–12 public school teachers. For this administration, teachers were asked about their understanding of their states’ mathematics standards, practices aligned with their standards, and the curriculum materials they use to implement them.

In the spring 2016 administration of the survey, there were 3,524 teachers in the ATP, and 1,718 responded to the survey, for a response rate of 48.5 percent. Of the responding teachers, 625 were mathematics teachers. Teacher and school characteristics were used in our analyses as variables that might be related to teachers’ understanding of standards and related practices such as the vulnerability of the students and whether a teacher came from a state that has adopted the Common Core State Standards. Teachers’ responses on the survey were weighted considering characteristics such as subject and school level, region, size, and school rates of free or reduced-price lunch (FRL) eligibility. These characteristics were used in a model of nonresponse that

gave more weight to the teachers in subgroups that were less likely to have completed the survey. This report presents descriptive differences between subgroups related to teachers’ understanding of state standards, their related practices, and their use of instructional materials. In addition, this report presents results from logistic and poisson regressions that were conducted to examine relationships between teachers’ use of standards-aligned instructional materials and their understanding of the content and approaches aligned with their mathematics standards, as well as relationships between teachers’ use of standards-aligned instructional materials and their standards-aligned instructional practices. These analyses are not intended to establish or support causal inferences regarding the relationship among teachers’ use of materials, their understanding of their standards, and their practices.

These analyses resulted in the following key findings for each research question:

What instructional materials do teachers report using in mathematics classrooms? Most of the materials that teachers reported using regularly for their instruction during the 2015–2016 school year were not highly aligned with Common Core State Standards, using a measure of alignment derived from reviews of EdReports, an independent organization that has conducted many reviews of published textbooks for their alignment with the Common Core. Specifically, about 16 percent of elementary mathematics teachers and 5 percent of secondary mathematics teachers reported regularly using materials with a high degree of alignment. That said, EdReports has not conducted reviews of all mathematics textbooks, including more recent versions of published textbooks that may be more aligned with the Common Core than older versions. Teachers in states that have not formally adopted the Common Core are not using highly aligned materials, by our definition.

What do teachers know about the content and approaches aligned with their state standards for mathematics? We identified the following trends based on questions we asked teachers about the content and approaches aligned with their state standards:

- A majority of teachers were able to identify Common Core–aligned topics at their grade level. At the same time, many teachers—particularly at higher grade levels—also indicated that many topics not aligned with the Common Core should be addressed at their grade level. Less than one-third of teachers were able to order two sets of standards from the lowest to the highest grade level, although most teachers could order at least one set of standards correctly.
- Teachers had varying degrees of success in identifying the intended aspect of rigor targeted by various standards. Specifically, teachers appeared somewhat less successful at identifying the intended aspect of rigor for standards that targeted students’ conceptual understanding, compared with standards targeting students’ procedural skill or fluency. Teachers at the K–2 grade level using highly aligned materials were significantly better at identifying aspects of rigor targeted by particular standards compared with teachers not using highly aligned materials.

To what extent do teachers report engaging students in standards-aligned mathematical practices? Over one-third of teachers reported that their students engaged in various standards-aligned practices to a great extent, including appropriate use of mathematical language and symbols, making sense of problems and persevering in solving them, explaining and justifying their work, choosing and using appropriate tools, and applying mathematics to solve problems in a real-world context. On the other hand, roughly 20 percent or fewer teachers reported

asking students to look for and make use of structure or construct viable arguments, which are two Standards for Mathematical Practice emphasized by the Common Core.

Teachers using at least one aligned main material more frequently reported their students engaging “to a great extent” in standards-aligned practices than teachers not using at least one aligned main material. We also found that teachers with more vulnerable students (i.e., more English language learner [ELL] students, more students receiving FRL, and more students with individualized education programs [IEPs]) were less likely to report engaging their students in standards-aligned practices than teachers serving less vulnerable students.

The report concludes by suggesting that teachers need a better understanding of their state standards if they are to engage their students in practices aligned with those standards. States and districts can help teachers gain this understanding by

- providing teachers with aligned curriculum
- providing teachers with access to aligned supplementary materials so that they can meet the needs of all students
- clarifying, via professional development and other means, the topics and sequencing of those topics they should be teaching at their grade level.

Introduction

During the past decade, 45 U.S. states and the District of Columbia adopted the Common Core State Standards for mathematics and English language arts (ELA), which have been judged as both more coherent and more rigorous than previous standards (Porter et al., 2011; Schmidt and Houang, 2012). While 24 of those states have since made changes to their standards, analyses suggest that most of these states have retained standards closely aligned with key tenets of the Common Core State Standards (Korn, Gamboa, and Polikoff, 2016; Achieve, 2017; Norton, Ash, and Ballinger, 2017). Furthermore, most states that never adopted the Common Core State Standards also emphasize important content and ideas that are part of the Common Core related to mathematics practice.¹

Abbreviations

ATP	American Teacher Panel
CCSSI	Common Core State Standards Initiative
ELA	English language arts
ELL	English language learner
FRL	free or reduced-price lunch
IEP	individualized education program

Research thus far is mixed on how much teachers have responded to the newer state standards. For example, Kane et al. (2015) indicates that teachers in some states have fully embraced standards and made considerable changes to their practice, and Kaufman and colleagues' research (2017) also suggests that teachers across the United States support their state standards. On the other hand, some of our RAND reports (Opfer, Kaufman, and Thompson, 2016; Kaufman et al., 2018) have documented that majorities of teachers do not know which instructional approaches are aligned with their state standards, which calls into question the extent to which teachers can be taking up those approaches in the classroom.

This report presents findings from a survey of American Teacher Panel (ATP) teachers conducted in the spring of 2016 and follows up on a previous survey of teachers conducted in the spring of 2015. It specifically examines responses from mathematics teachers across the United States in regard to their understanding of their standards and their standards-aligned practices. We also consider how teachers' instructional materials might support their knowledge and practices. This report is primarily intended to provide data to support decisionmaking regarding policies and related to state standards and teachers' instructional practice.

As with our previous research, we specifically focus on three key "instructional shifts" (CCSSI, 2018a) that teachers must undertake to align their instruction with the Common Core:

- **Teachers are expected to focus on fewer mathematical topics within grade levels.** The standards expect teachers to narrow and deepen instruction by focusing on covering fewer topics at each grade level but with greater depth. The standards also divide the content across grade levels in ways that create a progression of mathematical concepts and skills development.
- **Teachers are expected to focus on coherence in mathematics instruction by linking topics and thinking across grades.** Because mathematics is a coherent body of knowledge consisting of interconnected topics, the standards consist of a progression of topics from

grade to grade that builds new knowledge onto existing knowledge. Standards in higher grades are written as extensions of content learned in previous grades.

- **Teachers are expected to address the three aspects of rigor equally in instruction.** Rigor in the standards refers to a deep command of mathematics and requires three instructional practices. These practices require students to develop conceptual understanding, to develop procedural skills and fluency, and to apply their knowledge to real-world situations.

We consider how well teachers understand the three instructional shifts, as well as the extent to which they have incorporated the Standards for Mathematical Practice² emphasized by the Common Core. Nearly all states have standards for mathematics that incorporate these emphases. For example, several reviews of state standards have noted that most state standards include the major mathematics content included in the Common Core, although states might have additional standards and might have tweaked the language of the Common Core (Korn, Gamboa, and Polikoff, 2016; Achieve, 2017; Norton, Ash, and Ballinger, 2017). In addition, as noted by Achieve (2017), even states that have formally revised their standards from the Common Core attend to the idea that teachers should address different aspects of rigor as they relate to key mathematics topics, including conceptual understanding, procedural skills and fluency, and application to the real world, although a handful of states are somewhat weaker on some aspects of rigor compared with others. Finally, according to Achieve (2017) and our brief scan of state standards, all but a handful of states note that teachers should address Standards for Mathematical Practice or "process standards."

For teachers to be able to implement these instructional shifts required by newer state standards, they need sufficient understanding of the standards. This understanding can be gained in many ways and can come from many sources, including messages from their state department of education, their district, professional organizations, and colleagues. In this report, we focus on exploring the impact of one source of understanding: the instructional

materials teachers use. We examine whether teachers who use materials that are aligned with their state standards have a better understanding of content and approaches aligned with their standards and engage students in more standards-aligned instructional practices in their classrooms.

Some research studies support the idea that curriculum materials can have a positive impact on teachers' understanding and practices. For example, Koedel and Polikoff (2017) looked at the relationship between the mathematics curriculum that teachers were using in California schools and the achievement of their students. Using a quasi-experimental approach, these researchers found that district-level adoption of a specific textbook—California Math—resulted in significant student achievement gains compared with use of other textbooks. Similarly, Whitehurst (2009) showed that effect size gains from adoption or use of a particular textbook were larger than most other educational interventions, including the use of higher subject teaching standards. Several of our RAND reports have considered the role of instructional materials in supporting teachers' implementation of their state standards, drawing on survey data collected in the spring of 2015. Opfer, Kaufman, and Thompson (2016) noted that state standards appear to play a major role in which instructional materials teachers select for their instruction. In Louisiana, the state's focus on recommending and supporting the use of high-quality instructional materials may be associated with the higher percentages of Louisiana teachers who were able to identify standards-aligned content and approaches, compared with teachers in the rest of the United States (Kaufman, Thompson, and Opfer, 2016).

These promising findings guide our own analyses on whether teachers' use of mathematics instructional materials aligned with Common Core State Standards is associated with better understanding of the mathematics standards and more use of standards-aligned teaching practices. Using results from a spring 2016 survey of the RAND ATP, together with school-level demographic data, we provide findings addressing the following research questions:

- What instructional materials do teachers report using in mathematics classrooms?

- What do teachers know about the content and approaches aligned with their state standards for mathematics?
- To what extent do teachers report engaging students in standards-aligned mathematical practices?

Methods

In this section, we describe the data sources we relied on for this report, the sample of teachers who participated in the study, and the analytic methods applied to the data collected.

Data Sources

ATP Survey

The primary source of data for this study was a web-based survey to the RAND ATP that was administered in the spring of 2016. For this administration, teachers were asked about their instructional materials, their understanding of the content and approaches aligned with their state mathematics standards, the practices aligned with their standards, and the curriculum materials they use to implement them. Questions for the survey included several that were adapted from surveys developed by Student Achievement Partners, and some of those questions were also included in a survey to the ATP in the spring of 2015. In addition to classroom-level demographic characteristics (grade level and percentages of students who were English language learners [ELLs] and had an individualized education program [IEP]), the outcome measures used in answering the following research questions were derived from the ATP survey. Additional details on the survey items are included below, organized according to each research question we asked. For items meant to help us understand teachers' knowledge of content and approaches aligned with their standards, we also describe what constituted a standards-aligned approach.

What instructional materials do teachers report using in mathematics classrooms? We asked teachers to report on the frequency with which they used a range of published materials for their classroom instruction. The published materials included

most commonly used materials, based on teachers' reports to similar questions in the spring 2015 survey, as well as market-share information. We also assessed the extent to which teachers' materials were aligned with standards, using data from EdReports, and we describe EdReports in more detail below as another data source. We assessed only the alignment of materials that teachers reported using regularly (i.e., either "often" or "daily or almost daily"), and we considered them as teachers' "main" materials throughout this report.

What do teachers know about the content and approaches aligned with their state standards?

We asked teachers three questions to understand what they knew about the content and approaches aligned with their standards. First, we asked teachers at each grade level to identify which of four mathematics topics at their grade level were aligned with their state standards. Two of these standards were taken from the Common Core State Standards, which are reflected in nearly all state standards (Korn, Gamboa, and Polikoff, 2016; Achieve, 2017; Norton, Ash, and Ballinger, 2017), although some states may have added additional standards on top of those emphasized by the Common Core. Two "distractor" standards were typically selected from two grade levels above or below the targeted grade. Teachers who successfully selected the two correct standards for their grade level and none of the distractor standards or the "I don't know" response were designated as "correct." Otherwise, they were classified as "not correct."

Second, we asked teachers to put a set of standards in the order in which they should be taught. This item was meant to shed light on whether teachers had a clear understanding of how state standards build on one another from earlier to later grade levels. Teachers at each grade span (K–2, 3–5, 6–8, and 9–12) were provided with two sets of three standards each to place in order from lowest to highest grade level, and teachers were provided with standard topics addressed within the Common Core for their grade span.

Third, we asked teachers to identify the "aspect of rigor" targeted by specific standards. The Common

Core emphasizes "balance" among three aspects of rigor that teachers should emphasize in mathematics lessons: conceptual understanding, procedural skill and fluency, and application. According to the Common Core, teachers are expected to address these aspects of rigor in their mathematics instruction with equal intensity, not emphasizing one aspect at the expense of the others (see CCSSI, 2018a). Organizations that support teachers in understanding and implementing aspects of rigor in their instruction focus on the language used in the standards to help identify the particular aspect of rigor being targeted by a specific standard. For example, in Table 1, the Achievement Network identifies words in the standards that can be used to determine the aspect of rigor that should be the focus of instruction for that standard. To determine whether mathematics teachers understood the aspects of rigor and could correctly identify elements associated with specific standards, we provided teachers in each of four grade bands (K–2, 3–5, 6–8, and 9–12) with a list of standards typically taught at that grade band and asked them to identify the aspect of rigor associated with the standard. Each of the standards we provided was intended to address a specific aspect of rigor. To confirm the intended aspect of rigor targeted by each standard, we consulted with mathematics education experts, including those from Student Achievement Partners and the Louisiana Department of Education.³

To what extent do teachers report engaging students in standards-aligned mathematical practices?

We were also interested in understanding the extent to which teachers believed they were engaging their students in practices aligned with the Standards for Mathematical Practice within the Common Core. As we pointed out in the introduction to this report, nearly all states highlight the Standards for Mathematical Practice or similar "process standards" that are also recommended by the National Council of Teachers of Mathematics (see National Council of Teachers of Mathematics, 2018). We provided teachers with a list of such practices and asked them about the extent to which their students engaged in the practices, on a four-point scale from "not at all" to "to a great extent."

TABLE 1
Words in Standards Associated with Aspects of Rigor

Conceptual Understanding	Procedural Skill/Fluency	Application
Understand	Fluency	Word problems
Reason	Count	Real-world scenarios
Explain	Read/Write	Multi-step problems
Interpret	Evaluate	

NOTE: Adapted from Achievement Network, 2017.

National Center for Education Statistics

We used the National Center for Education Statistics' Common Core of Data (CCD) for 2015–2016 for school-level demographics. CCD provided information about teachers' school state, urbanicity, and the percentage of students in teachers' schools who were eligible to receive free or reduced-price lunch (FRL), which we merged with our survey data.

EdReports

To assess the alignment of teachers' main mathematics instructional materials with state standards, we drew on data from EdReports' reviews. EdReports is an independent nonprofit that conducts reviews of instructional materials. Expert panels of teachers work with EdReports to assess the extent to which curricula meet expectations in three major categories: Focus and Coherence, Rigor and Mathematical Practices, and Instructional Supports and Usability. These major categories reflect the major shifts emphasized in Common Core documents (see CCSS, 2018a and 2018b). Materials that meet or partially meet the requirements for Focus and Coherence (Gateway 1) are then reviewed for Rigor and Mathematical Practices (Gateway 2) (see EdReports, undated-a, undated-b). As a final step, the curriculum is reviewed for the extent to which the materials support student learning and engagement and support teacher learning and understanding of the standards (Gateway 3: Instructional Supports and Usability).

EdReports provides reviews of each material at each grade level for which there is a published edition. In its reviews, EdReports judged materials as "meeting expectations" for Focus and Coherence if they received at least 12 out of 14 possible points

(or 86 percent), and judged materials as "meeting expectations" for Rigor and Mathematical Practices if they received at least 16 out of 18 possible points (or 89 percent). Table A.1 lists all the materials we asked about in our survey, as well as indicators for meeting (+) or not meeting (–) expectations for each gateway.

For the purposes of our analysis, we identified a material as aligned if EdReports designated it as meeting expectations for Focus and Coherence, or—if both gateways were reviewed—both Focus and Coherence and Rigor and Mathematical Practices. EdReports has reviewed 53 mathematics materials/series thus far. Of those asked about in the ATP spring 2016 survey, three were rated by EdReports as "meeting expectations" in one or both gateways: Agile Mind, Bridges in Math, and Eureka Math. We thus considered these as aligned curricula in our analysis.⁴ We also considered EngageNY materials as "meeting expectations," since Eureka Math is the mathematics materials within EngageNY.

We took into account only alignment of materials teachers reported using regularly for their instruction (i.e., their main materials). We thus measured alignment for teachers who reported using a given material "often" (one or two times per week) or "daily or almost daily." A teacher was designated as using "highly aligned materials" when at least one main material he or she reported using in his or her instruction was judged as "meeting expectations" by EdReports. Admittedly, our high alignment measure sets a high bar for which curricula are considered as standards-aligned for our analyses. After conducting these analyses, we also conducted supplementary analyses to explore whether our findings were sensitive to a less rigorous measure of alignment, although we do not go into detail on these analyses in this report.⁵

Sample

The ATP includes a nationally representative sample of teachers randomly selected from American K–12 public schools. In the spring 2016 administration of the survey, there were 3,524 teachers in the ATP, and 1,718 responded to the survey, for a response rate of 48.5 percent. This response rate is consistent with those typically achieved in surveys of this kind and is higher than most longitudinal panels.⁶ Of responding teachers, 625 were mathematics teachers. The number of teachers surveyed increased between our 2015 and 2016 administrations of the survey because of efforts to expand the ATP sample that were made in the 2015–2016 school year.

Table 2 provides background information on the mathematics teachers who responded to the survey in the spring of 2016. Included in this information are demographic characteristics of the teachers and their students, including their grade range.⁷ We designated a teacher as serving a “high vulnerability” student population if the teacher’s students were in the top quartile for at least two of the following: school percentage FRL, classroom percentage ELL, and classroom percentage IEP. Similarly, a teacher serving students in the top quartile for only one of the FRL, ELL, and IEP percentages was designated “medium vulnerability,” and if a teacher fell in zero of the top quartiles he or she was considered as teaching “low vulnerability” students. In addition, we designated teachers as Common Core or not depending on whether their state was formally on record as having adopted the Common Core State Standards in the 2015–2016 school year. The states that are not Common Core states include Alaska, Indiana, Minnesota (mathematics only), Nebraska, Oklahoma, South Carolina, Texas, and Virginia.⁸

Teachers’ responses on the survey were weighted considering characteristics such as subject and school level, region, size, and school rates of FRL eligibility. These characteristics were used in a model of nonresponse that gave more weight to the teachers in subgroups that were less likely to have completed the survey. R version 3.4.1 was used for analyses.⁹ The R “survey” package (Lumley, 2004) was used to establish standard errors, which were adjusted for weighting.

Analytic Approach

Descriptive differences between subgroups related to teachers’ understanding of state standards, their related practices, and their use of instructional materials are presented in this report. Either logistic regression (for binary outcomes) or poisson regression (for count outcomes) was conducted to examine relationships between teachers’ use of standards-aligned instructional materials and their understanding of the content and approaches aligned with their mathematics standards, as well as relationships between teachers’ use of standards-aligned instructional materials and their standards-aligned instructional practices. We summarize our regression approach for each of our research questions below.

What instructional materials do teachers report using in mathematics classrooms? We used logistic regression to examine factors that could be associated with teachers’ use of at least one highly aligned material, based on teachers’ reports about what they used regularly (i.e., their “main” instructional materials) and whether EdReports judged it as meeting expectations in the first and second gateways of its review, as described above in the data sources section of our methods. One important note that we also emphasize in our findings is that there were no teachers from non–Common Core states who reported using at least one highly aligned material regularly. Therefore, in our logistic regression, we excluded the variable regarding whether teachers were from a Common Core state.

What do teachers know about the content and approaches aligned with their state standards? We used logistic regression to examine the factors related to whether a teacher was able to identify standards-aligned topics for at least one grade level they responded about in the survey. We also used logistic regression to examine the factors related to whether a teacher correctly ordered both sets of standards we asked about in our survey from lowest to highest grade level. We used poisson regression to analyze the outcome: “number of standards identifying the correct aspect of rigor.” For each of these outcomes, models were run separately for each grade

TABLE 2

Characteristics of Mathematics Teachers Who Completed the Spring 2016 ATP Survey

		Percentage of Math Teachers (n = 625)	Standard Errors %
State context	Teachers in states that adopted the Common Core	75.7	3.1
	Teachers in states that did not adopt the Common Core	24.3	3.1
Student demographics	High vulnerability (i.e., teachers in top quartile for more than one of the following: school % FRL, % ELLs, or % students with IEPs)	13.6	2.0
	Medium vulnerability (i.e., teachers in top quartile for one of the following: school % FRL, % ELLs, or % students with IEPs)	37.5	3.2
	Low vulnerability (i.e., teachers not in top quartile for school % FRL, % ELLs, or % students with IEPs)	49.0	3.3
Locale	Teachers in rural areas	20.7	2.7
	Teachers in cities, suburbs, or towns	79.3	2.7
Teacher grade level	Grades K–2	27.8	2.8
	Grades 3–5	30.4	3.0
	Grades 6–8	18.6	2.4
	Grades 9–12	23.1	2.8

span (K–2, 3–5, 6–8, and 9–12) because teachers received different questions depending on their grade span. For example, kindergarten through second-grade teachers were presented with standards-aligned content and approaches only at the kindergarten through second-grade level; similarly, high school teachers were presented with standards-aligned content and approaches for ninth- through twelfth-grade students. We chose to run these models separately rather than include a fixed effect for grade span because we did not want readers to draw inaccurate conclusions about comparisons between grade spans that might be present because of differing levels of difficulty for sets of items at some grade levels compared with others.

To what extent do teachers report engaging students in standards-aligned mathematical practices? We used poisson regression to analyze factors related to the number of practices for which teachers reported student engagement “to a great extent.” This measure of standards-aligned practices we asked about in the ATP survey was derived as a composite measure (Cronbach alpha = 0.77). Our outcome included all practices asked about in our survey other

than “use repeated practice to improve their computational skills,” a practice that we do not regard as clearly aligned with state standards.¹⁰

In addition to including a covariate measuring teachers’ use of standards-aligned mathematics instructional materials, we accounted for the following additional factors in each model: vulnerability of teachers’ students, grade band for the majority of grades a teacher reported teaching (K–2, 3–5, 6–8, or 9–12), school-level urbanicity, and teaching in a Common Core state. However, for items that attempted to capture teachers’ knowledge of standards-aligned content and approaches, teachers were asked about different standards or topics, depending on their grade span. For these items, as mentioned above, we did not include grade span as a fixed effect and instead ran separate models for each grade span.

The corresponding findings are presented in the next section, followed by a summary and discussion of the implications for supporting teachers’ implementation of state mathematics standards. First, we highlight findings regarding mathematics teachers’ use of instructional materials. Then, we consider teachers’ understanding of the content and

approaches aligned with their standards, followed by an exploration of the mathematics practices in which teachers report engaging their students. Throughout, we consider how use of aligned materials is related to teachers' reports of their knowledge and practice.

Findings

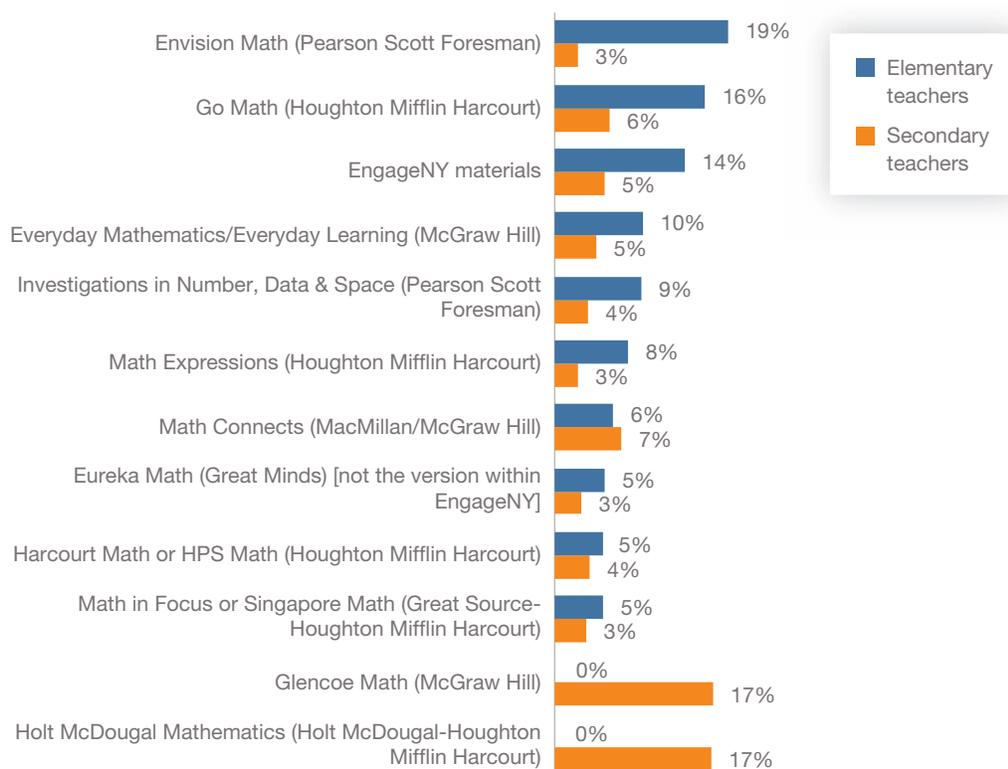
What Instructional Materials Do Teachers Report Using in Mathematics Classrooms?

Mathematics teachers reported using a wide variety of instructional materials regularly in their teaching. Figure 1 illustrates the percentage of teachers

who reported using each material we asked about in our survey “often (at least once a week)” or “daily or almost daily.” More than 10 percent of elementary teachers reported regularly using EngageNY, Envision Math, Go Math, and Everyday Mathematics. More than 15 percent of secondary mathematics teachers reported regularly using Glencoe Math and Holt McDougal Mathematics. On average, teachers reported using a little more than three of the published materials we asked about in our survey, but typically reported using just one material “often” or “daily or almost daily.”

The majority of materials used regularly by teachers during the 2015–2016 school year were not aligned with Common Core State Standards. Figure 2 illustrates the percentage of teachers using

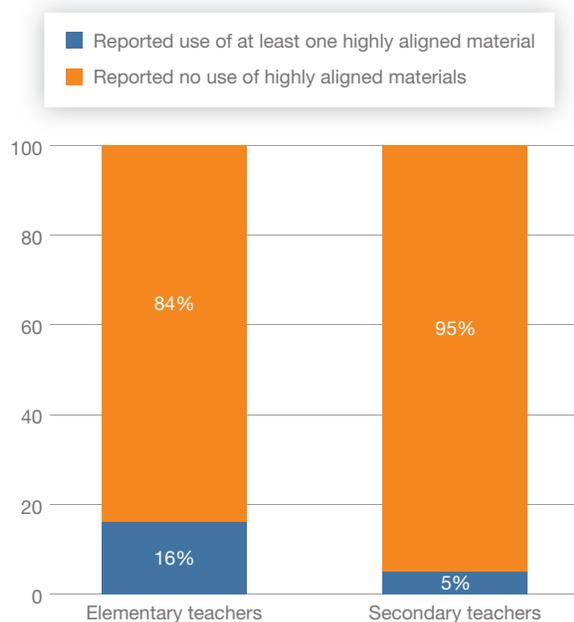
FIGURE 1
Percentage of Teachers Who Reported Using Each Material at Least Once a Week for Their Mathematics Instruction



NOTE: Data are based on the following survey item: “Please indicate the frequency with which you draw upon the following instructional materials for your mathematics classroom lessons this year (2015–16), including those you or your district developed or selected.” Percentages represent proportion of teachers who indicated using a material either “daily or almost daily” or “often (i.e., once a week or more)” and are ordered from high to low in terms of the overall percentage of teachers at the elementary level who reported using a material at least once a week. Materials used by less than 4 percent of mathematics teachers were excluded.

FIGURE 2

Percentage of Mathematics Teachers with High Alignment (i.e., Using at Least One Highly Aligned Material Regularly)



NOTE: A “highly aligned main material” is a material judged by EdReports as meeting expectations for all grade levels and categories of its review.

at least one highly aligned material regularly (i.e., as their main instructional materials). As noted in Figure 2, only 16 percent of elementary mathematics teachers and 5 percent of secondary mathematics teachers met our definition of “high alignment.” Unsurprisingly, the state standards context matters for high alignment: there were no teachers in our sample from states that had not adopted the Common Core who used at least one highly aligned material as one of their main instructional materials.

In a logistic regression model accounting for multiple factors that predict use of at least one highly aligned main material, teachers in grades 9–12 were significantly less likely to use at least one highly aligned material compared with K–2 and 3–5 teachers ($p = .003$ and $p = 0.001$, respectively). EdReports has reviewed fewer mathematics textbooks at the secondary level compared with the elementary level, and this may explain why 9–12 mathematics teachers reported less use of highly aligned materials. For

more information on that model, see Table B.1 in the appendix of this report.

What Do Teachers Know About the Content and Approaches Aligned with Their State Standards?

Teachers’ knowledge of standards-aligned grade-level content. If teachers are to teach the standards at the depth that is intended, they need to understand which standards are to be taught at their grade level and which are not. If teachers across different grade levels understand which standards should be taught, students may have a better chance of moving through the expected progression of mathematics content over time. Mathematics teachers appeared to have a fairly clear understanding of Common Core-aligned topics they should be teaching at their grade level. Between 63 percent and 98 percent of teachers were able to identify the major mathematics topics emphasized in the Common Core for the grade levels they taught. However, many teachers also identified distractor standards as aligned with their state standards at their grade level. As shown in Table 3, this was particularly true for seventh- and eighth-grade teachers, as well as algebra and geometry teachers, where 21 percent, 4 percent, 2 percent, and 18 percent, respectively, identified *only* Common Core-aligned standards (i.e., standards aligned with the Common Core for their grade level or the course they taught). By contrast, higher percentages of teachers in some of the lower grades—particularly in kindergarten, second grade, and fourth grade—identified *only* Common Core-aligned standards at their grade level. The difference between upper-grade-level teachers and lower-grade-level teachers on their ability to identify Common Core-aligned standards for their grade level may indicate that upper-grade-level teachers conflate the need for understanding of prior standards with the specific standards to be taught at their grade level or in their specific mathematics subject. Another possibility is that upper-grade-level teachers must understand a greater volume of standards, especially if their state standards include many topics in addition to those emphasized within the Common Core.

TABLE 3
 Percentage of Mathematics Teachers Who Identified Common Core–
 Aligned Mathematics Topics for the Grade Level(s) They Taught

Grade	Percentage (SE) of teachers who chose both aligned topics and nothing else (no distractor topics, and not “I don’t know”)
Kindergarten	65.1 (8.3)
First	11.9 (5.7)
Second	47.8 (7.9)
Third	10.2 (4.3)
Fourth	46.4 (7.7)
Fifth	15.1 (5.6)
Sixth	11.6 (5.2)
Seventh	20.7 (7.9)
Eighth	4.1 (2.6)
Algebra	2.4 (1.4)
Geometry	17.8 (5.8)

A further possibility is that these teachers believe these standards are at their grade level because they may be repeating content from lower grade levels when they feel that their students need more review of that content. For more information on teachers’ responses regarding specific mathematics topics at each grade level, see Table B.2 in the appendix of this report.

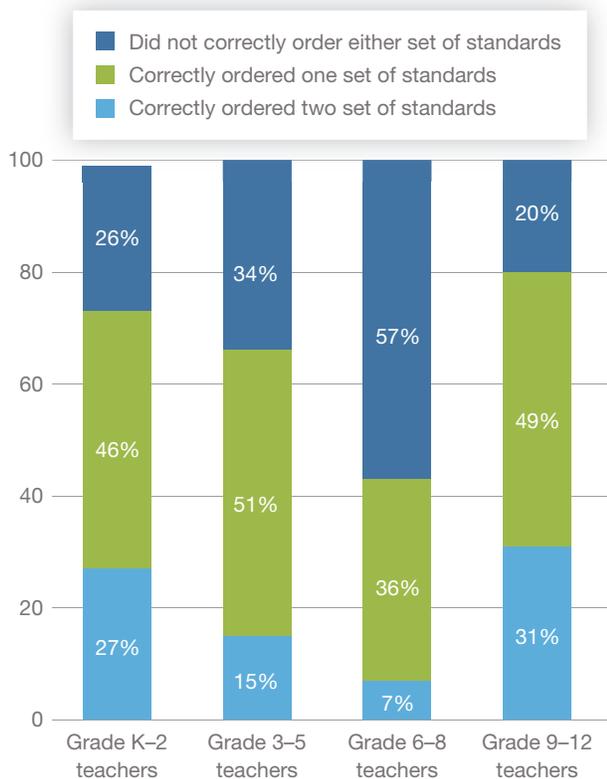
We examined whether use of at least one highly aligned material was related to teachers’ ability to identify standards-aligned topics and no distractor topics for the grade levels they teach (i.e., the outcome was: identified standards-aligned topics and nothing else for grade levels they teach). We did not find any significant relationships between teachers’ use of at least one highly aligned main material and their ability to identify the Common Core–aligned topics at their grade level. The lack of significant relationships could signal some problems with our measures (i.e., our measure of high alignment or knowledge of Common Core topics could be refined). However, these findings could also suggest that using a more “aligned” material—by itself—may not help teachers know which topics they should be teaching at their grade level. For example, teachers could be using other nonaligned materials that

address other topics they think they should teach. In addition, some states or districts may emphasize particular content or standards on top of Common Core content standards.

One other finding worth mentioning is that 6–8 and 9–12 grade teachers in states that had not formally adopted the Common Core were less likely to correctly identify Common Core–aligned topics compared with those in Common Core states, regardless of what materials they reported using, which perhaps stands to reason. For more information on the regression models, see Table B.3 in the appendix of this report.

Teachers’ knowledge of how standards progress across grades. As Figure 3 demonstrates, most teachers could correctly order at least one set of the standards from lowest to highest grade level; however, few were able to correctly order both sets. The issues that teachers had in ordering standards from low to high suggest that at least some teachers do not completely grasp how standards build on one another. This could be the case for a variety of reasons, including that teachers may be addressing too many standards at their grade level, including ones that should have been addressed at prior grade levels.

FIGURE 3
Percentage of Teachers in Each Grade Band Who Correctly Ordered Sets of Standards from Lowest to Highest Grade Level



Furthermore, in our logistic regression models, we did not find a relationship between use of highly aligned materials and being able to order standards accurately from low to high grade levels. This again suggests that regular use of highly aligned materials, by itself, may not support teachers’ understanding about their standards and the progression of standards content from grade to grade.

We combined the high and medium vulnerability categories for the regression models predicting teachers’ ability to order standards accurately from low to high because very few teachers of highly vulnerable populations ordered both sets of standards correctly. Secondary (grades 6–8 or 9–12) teachers with either high or medium proportions of vulnerable students were significantly less likely to be able to order the two sets of standards correctly from lowest to highest

grade level than teachers with lower proportions of vulnerable students. See Table B.4 for more details on the regression models for each grade span.

Teachers’ knowledge of intended aspect of rigor targeted by standards. As shown in Table 4, teachers within and across grade levels varied in their ability to identify the intended aspect of rigor. When the standards involved conceptual understanding, somewhat lower percentages of teachers were generally able to identify the intended aspect of rigor.

Figure 4 suggests that teachers using at least one highly aligned main material at the K–2, 3–5, and 9–12 grade levels identified the intended aspect of rigor targeted by a somewhat greater number of standards (out of eight standards altogether) compared with their peers who did not use highly aligned materials. We ran independent poisson regression models at each grade span to formally test this. We found a significant relationship only between instructional materials and knowledge regarding aspects of rigor for K–2 teachers. Specifically, K–2 teachers who reported using at least one highly aligned main material were more successful at identifying intended aspects of rigor targeted by standards than K–2 teachers who did not report using a highly aligned main material, when holding other variables in the model constant (Rate Ratio: 1.29; $p = .02$). We did not find a significant relationship between use of highly aligned materials and the ability to identify the intended aspect of rigor targeted by standards at other grade levels. Table B.5 provides the results of those regressions in more detail.

To What Extent Do Teachers Report Engaging Students in Standards-Aligned Mathematical Practices?

As shown in Figure 5, more than half of teachers reported student engagement in “use mathematical language and symbols appropriately.” Between one-quarter and one-half of teachers reported student engagement in a range of other standards-aligned practices. However, much lower percentages of teachers reported students engaging to “construct viable arguments and critique reasoning.”

TABLE 4

Percentage of Teachers Correctly Identifying Aspects of Rigor for Standards at Their Grade Band

Standard	Aspect of Rigor	Percentage of Teachers
Grades K–2		
Fluently add and subtract within 20 using mental strategies. By the end of the grade, know from memory all sums of two one-digit numbers	Procedural	69
Relate counting to addition and subtraction (e.g., by counting up 2 to add 2)	Conceptual	49
Determine whether a group of objects (up to 20) has an odd or even number of members	Conceptual, Procedural	68
Understand that the two-digit number represents amounts of tens and ones	Conceptual	73
Measure the length of objects by selecting and using appropriate tools	Procedural, Application	89
Classify objects into given categories, count the number of objects in each category, and sort the categories by count	Conceptual	19
Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than another	Conceptual	25
Explain why addition and subtraction strategies work, using place values and the properties of operations	Conceptual	61
Grades 3–5		
Fluently add and subtract within 1,000 using mental strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction	Procedural	53
Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by parts of size $\frac{1}{b}$	Conceptual	66
Classify the unknown whole number in a multiplication or division equation relating three whole numbers	Conceptual	42
Determine the unknown whole number in a multiplication or division equation relating to three whole numbers	Conceptual	25
Interpret products of whole numbers (e.g., interpret 5×7 as the total number of objects in 5 groups of 7 objects each)	Conceptual	52
Add and subtract mixed numbers with like denominators	Procedural	37
Explain patterns in the number of zeros of the products when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10	Conceptual	62
Measure and estimate liquid volumes and masses of objects using standard units of grams, kilograms, and liters. Add, subtract, multiply, and divide to solve one-step work problems involving masses or volumes that are given in the same units	Conceptual, Procedural, Application	97
Grades 6–8		
Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related	Conceptual	65
Solve linear equations in one variable	Procedural	61
Compute unit rates associated with ratios of fractions, including ratios of length, areas, and other quantities measured in like or different units	Procedural	25

TABLE 4 (CONTINUED)

Standard	Aspect of Rigor	Percentage of Teachers
Identify when two expressions are equivalent	Conceptual	52
Explain what a point (x,y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points (0,0) and (1,r) where r is the unit rate	Conceptual	42
Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways	Conceptual, Procedural, Application	95
Distinguish comparisons of absolute value from statements about order	Conceptual	31
Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram	Conceptual	45
Grades 9–12		
Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations	Procedural	37
Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range	Conceptual	42
Identify and describe the relationship among inscribed angles, radii, and chords	Conceptual	48
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters	Procedural	49
Represent data with plots on the real number line (dot plots, histograms, and box plots)	Conceptual, Procedural, Application	94
Distinguish between situations that can be modeled with linear functions and situations that can be modeled with exponential functions	Conceptual	36
Explain and use the relationship between the sine and the cosine of complementary angles	Conceptual, Procedural	62
Interpret complicated expressions by viewing one or more of their parts as a single entity	Conceptual	46

As noted in Figure 6, higher percentages of teachers using at least one highly aligned main material reported engaging students in many standards-aligned practices compared with teachers who were not using highly aligned main materials. Indeed, in a poisson regression model, teachers with use of at least one highly aligned main material (i.e., regularly using at least one material meeting expectations of EdReports reviews) identified students engaging in standards-aligned practices at a higher rate (Rate Ratio: 1.29) than teachers with no regular use of highly aligned materials. Teachers of low proportions of vulnerable students reported students engaging in standards-aligned practices at a significantly higher rate (Rate Ratio: 1.37) than teachers of high proportions of vulnerable students, holding all other

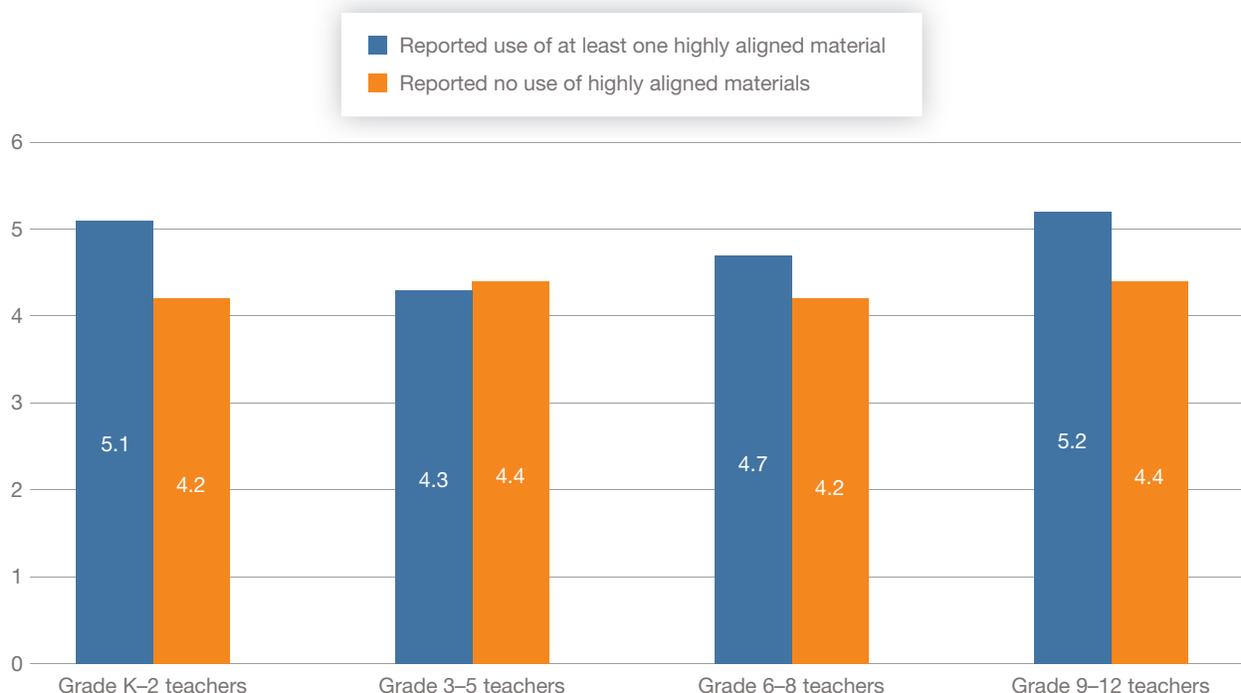
variables in the model constant. See Table B.6 in the appendix for more information on the model from which these findings were drawn.

Summary of Findings

This report is based on survey data from spring 2016, and is a follow-up of a previous report that examined teachers' implementation of state standards based on a spring 2015 survey. Specifically, this report provided data from mathematics teachers across the United States regarding their instructional materials, their understanding of their standards, and their standards-aligned practices. In particular, we considered the extent to which the use of materials aligned with state standards was related to teachers' under-

FIGURE 4

Average Number of Standards for Which Teachers Selected the Intended Aspect of Rigor, Comparing Teachers Using at Least One Highly Aligned Material Versus No Highly Aligned Materials



standing and their instruction. Our measures of teacher knowledge and practice—as well as a measure of standards-aligned materials—focused on three key ideas that are emphasized by the Common Core State Standards and present in most state standards: the expectation that teachers focus on fewer mathematical topics within their grade levels, that they connect standards topics and thinking across grade levels, and that their instruction places a balanced emphasis on three aspects of rigor—conceptual understanding, procedural skill/fluency, and application to real-world contexts. We also examined the extent to which teachers reported their students’ engagement in Standards for Mathematical Practice, which are part of the Common Core and present within most state standards.

We summarize key findings by each of our research questions.

What instructional materials do teachers report using in mathematics classrooms? Most of the materials that teachers reported using for their instruction during the 2015–2016 school year were

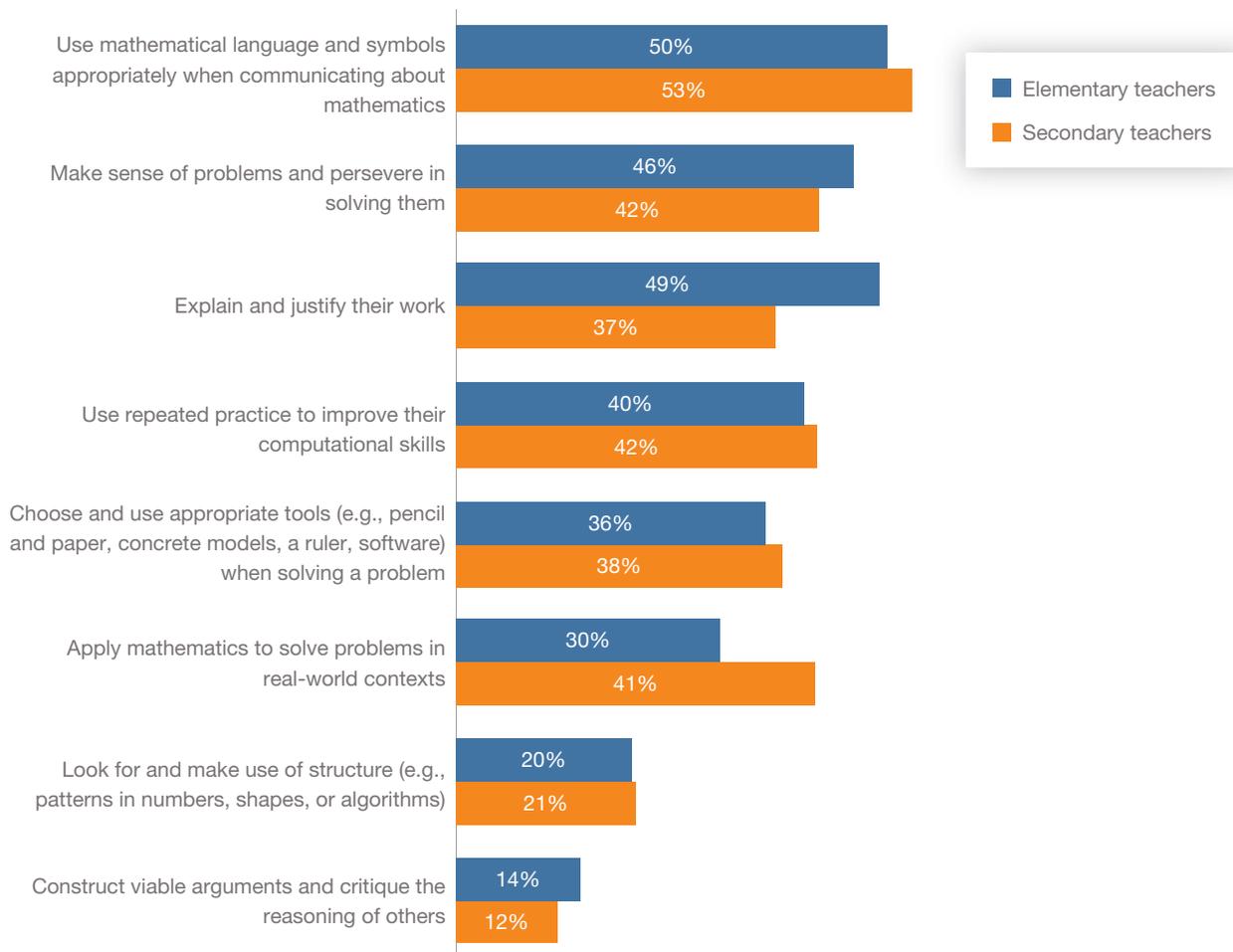
not highly aligned with Common Core State Standards, using a measure of alignment derived from reviews of EdReports, an independent organization that has conducted many reviews of published textbooks for their alignment with the Common Core. Specifically, 16 percent of elementary mathematics teachers and 5 percent of secondary mathematics teachers reported using materials with a high degree of alignment. Zero teachers in states that have not formally adopted the Common Core reported use of at least one highly aligned main material. Teachers in grades K–2 and 3–5 were far more likely to report use of at least one highly aligned main material than teachers in grades 9–12, holding other factors in our model constant.

What do teachers know about the content and approaches aligned with their state standards?

A majority of teachers were able to identify Common Core–aligned topics at their grade level. At the same time, many teachers—particularly at higher grade levels—also selected many topics not aligned

FIGURE 5

Percentage of Teachers Engaging Students in Standards-Aligned Mathematics Practices to a Great Extent



with the Common Core they believed should also be addressed at their grade level. Less than one-third of teachers were able to order two sets of standards from the lowest to the highest grade level, although most teachers could order at least one set of standards correctly.

Teachers had varying degrees of success in identifying the intended aspect of rigor targeted by various standards, particularly if those standards were focused on conceptual understanding.

To what extent do teachers report engaging students in standards-aligned mathematical practices?

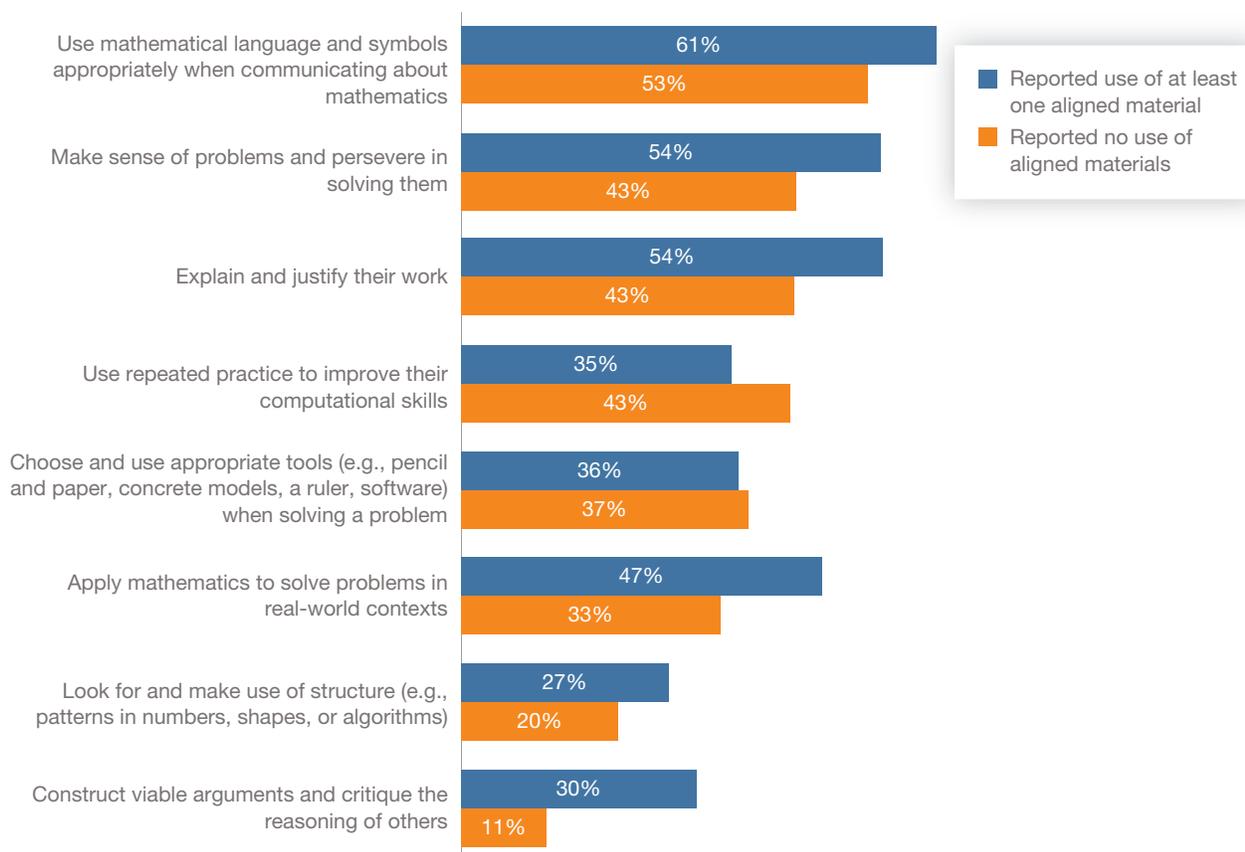
Over one-third of teachers reported that their students engaged in various standards-aligned practices to a great extent, including appropriate use of mathematical language and symbols, making sense of problems

and persevering in solving them, explaining and justifying their work, choosing and using appropriate tools, and applying mathematics to solve problems in a real-world context. On the other hand, roughly 20 percent or fewer teachers reported asking students to look for and make use of structure or construct viable arguments, which are two Standards for Mathematical Practice emphasized by the Common Core.

We were able to draw some conclusions about the relationship among the instructional materials teachers report using, their knowledge of standards, and the practices in which they engage their students. We found some initial evidence of relationships between teachers' reports about which instructional materials they used and their understanding and practice. On the one hand, teachers with use of at least one highly aligned

FIGURE 6

Percentage of Teachers Engaging Students in Each Mathematical Practice “To a Great Extent,” With Comparisons Between Teachers With and Without High Alignment of Materials



main material did not do better at identifying Common Core-aligned mathematical content or ordering standards from lowest to highest grade level at all grade spans. On the other hand, teachers with use of at least one highly aligned main material did do better at identifying aspects of rigor targeted by particular standards, but only at the K–2 grade level. Finally, teachers with use of at least one highly aligned main material reported more student engagement in standards-aligned mathematical practices than teachers with no use of highly aligned main materials, while accounting for grade span, vulnerability, urbanicity, and whether the teacher is working in a CCSS state. These findings suggest that use of highly aligned materials may support some elements of teachers’ instruction, but may not support teachers’ knowledge of content aligned with their standards at specific grade levels.

Conclusions and Implications

There are a number of possible explanations for why we did not always find a consistent relationship between teachers’ use of highly aligned curriculum and their knowledge of standards-aligned mathematics content, including that measurement error from our self-report survey is attenuating the relationship. In addition, it may be that the EdReports’ assessment of alignment does not capture all aspects of curriculum content, the definition of high alignment used in this report was too conservative, or that our measure of teachers’ knowledge of standards-aligned content is incomplete. These findings may also imply that curriculum materials are not always the most important factor predicting teachers’ knowledge and practice. Other factors that we did not measure in our surveys,

like teacher beliefs, their professional development, or messages they get from their district, may be better predictors than teachers' curriculum materials.

We also hypothesize that the lack of consistent relationships between teachers' knowledge of standards-aligned content and use of at least one highly aligned main material might be related to teachers' use of a number of different materials for their instruction. On average, mathematics teachers reported using about three published mathematics textbooks, and that does not include online materials or other resources they might use regularly. In addition to finding a relationship between alignment of instructional materials and teachers' knowledge and practice, we also found that teachers with low numbers of vulnerable students (i.e., ELL students, high school-level FRL, and students with IEPs) reported engaging their students in a higher number of standards-aligned practices than teachers serving highly vulnerable populations.

Thus, depending on the grade levels taught, the use of highly aligned materials not only matters for teachers' knowledge of state standards but also matters for the extent to which teachers reported that their students engaged in standards-aligned practices. However, further research could provide more insights on how the use of instructional materials might better support teachers' understanding of their standards and their instruction, especially for those teachers with more vulnerable students. While nearly all states emphasize the Common Core-aligned content and approaches we asked about in our survey and that EdReports reviews for, some states have additional standards, and not all states emphasize all the approaches and practices we asked about.

Thus, while our data provide a picture of the extent to which teachers respond in ways that are aligned with Common Core and most state standards, they may not accurately capture how much teachers know about their standards in states that do not emphasize the Common Core.

Despite this limitation, our findings suggest that teachers need a better understanding of their grade-level mathematics standards if they are to engage their students in practices aligned with those standards, and instructional materials may support teachers' understanding. That said, having districts and states provide teachers with aligned curriculum is only the first step in helping them gain this knowledge. Specifically, our findings suggest that standards-aligned materials may support teachers in some areas more than others. In particular, instructional materials by themselves cannot give teachers clear information about what content is most aligned with their standards, particularly if they are using or being asked to use many different materials for their instruction. States and districts may thus consider ways to help teachers focus on topics aligned with standards at particular grade levels, by emphasizing both what teachers should be teaching and what topics are best left for other grade levels to address.

Teachers also need access to high-quality materials that would allow them to meet the needs of all students, and they need help in distinguishing whether these materials are aligned. Teachers' high levels of enthusiasm for the standards that we have seen in our previous research and that of others suggest that teachers are eager to engage their students in these standards if they only had the knowledge and tools they need to do so.

Appendix A. Table of Instructional Materials Addressed in Survey and Rated by EdReports.org

TABLE A.1
 “Meeting Expectations” (+) or “Not Meeting Expectations” (–) for Each Gateway

Instructional Material	% Alignment Focus and Coherence	% Alignment Practices and Rigor	Alignment
EngageNY materials	Not rated	Not rated	+
Bridges in Mathematics (The Math Learning Center)	+	+	+
Envision Math (Pearson Scott Foresman)	–	–	–
Eureka Math (Great Minds)	+	+	+
Everyday Mathematics/Everyday Learning (McGraw Hill)	–	–	–
Go Math (Houghton Mifflin Harcourt)	–	–	–
Harcourt Math or HPS Math (Houghton Mifflin Harcourt)	Not rated	Not rated	N/A
Investigations in Number, Data & Space (Pearson Scott Foresman)	–	–	–
LearnZillion Full Math Curriculum (LearnZillion)	Not rated	Not rated	N/A
Math Connects (MacMillan/McGraw Hill)	Not rated	Not rated	N/A
Math Expressions (Houghton Mifflin Harcourt)	+	–	–
Math in Focus or Singapore Math (Great Source-Houghton Mifflin Harcourt)	–	–	–
Saxon Math (Houghton Mifflin Harcourt)	–	–	–
Agile Mind (Agile Mind)	+	+	+
Bridge to Algebra or Carnegie Learning (Carnegie Learning)	–	–	–
Big Ideas Math (Big Ideas Learning LLC)	–	–	–
College Preparatory Math (CPM)	Not rated	Not rated	N/A
Connected Mathematics (Pearson Prentice Hall)	–	+	–
Glencoe Math (McGraw Hill)	–	–	–
Holt McDougal Mathematics (Holt McDougal-Houghton Mifflin Harcourt)	–	Not rated	–
Prentice Hall Math (Pearson Prentice Hall)	–	–	–
Springboard Math (College Board)	–	–	–
Algebra I (Pearson Prentice Hall)	Not rated	Not rated	N/A
Algebra II (Pearson Prentice Hall)	Not rated	Not rated	N/A
Algebra I (McDougal Littell)	Not rated	Not rated	N/A
Algebra II (McDougal Littell)	Not rated	Not rated	N/A

Appendix B. Tables with Descriptive Data and Regression Models

TABLE B.1
Logistic Regression Results (n = 571)—Outcome: Use of at Least One “Main” Instructional Material That Meets Expectations

	Adjusted Odds Ratio	
	(aOR)	(SE)
(Intercept)	0.03	(0.02)***
Teachers of low vulnerability students (vs. high)	1.17	(0.51)
Teachers of medium vulnerability students (vs. high)	1.76	(0.84)
Urban, cities, towns, suburbs (vs. rural)	0.66	(0.31)
Grade K–2 teachers (vs. grade 9–12)	5.22	(2.92)**
Grade 3–5 teachers (vs. grade 9–12)	5.99	(3.27)**
Grade 6–8 teachers (vs. grade 9–12)	1.22	(0.64)

NOTE: An asterisk indicates a significant p -value: *** $p < .001$, ** $p < .01$, * $p < .05$.

TABLE B.2
Percentage of Mathematics Teachers Who Identified Common Core–Aligned Mathematics Topics for the Grade Level(s) They Taught

	Topic	Percentage of Teachers
K Grade	Understand meaning of addition and subtraction	93
	Compare numbers	85
	Develop understanding of fractions as numbers	15
	Tell and write time from analog and digital clocks to the nearest five minutes using a.m. and p.m.	11
	I don't know	3
	Teachers who chose both aligned topics and no distractor items	65
1st Grade	Add and subtract within 20	96
	Measure lengths indirectly and by iterating length units	68
	Identify arithmetic patterns (including patterns in the addition or multiplication tables) and explain them using properties of operations	67
	Extend understanding of fraction equivalence and ordering	33
	I don't know	4
Teachers who chose both aligned topics and no distractor items	12	

TABLE B.2 (CONTINUED)

	Topic	Percentage of Teachers
2nd Grade	Understand place value	97
	Represent and solve problems involving addition	94
	Identify line of symmetry in two-dimensional figures	41
	Apply and extend previous understandings of multiplication and division to multiply and divide fractions	16
	I don't know	3
	Teachers who chose both aligned topics and no distractor items	48
3rd Grade	Develop understanding of fractions as numbers	92
	Multiply and divide within 100	87
	Understand meaning of addition and subtraction	80
	Display numerical data in plots on a number line, including dot plots, histograms, and box plots	64
	I don't know	3
	Teachers who chose both aligned topics and no distractor items	10
4th Grade	Extend understanding of fraction equivalence and ordering	90
	Generalize place value understanding for multidigit whole numbers	88
	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates	35
	Understand ratio concepts and use ratio reasoning to solve problems	20
	I don't know	9
	Teachers who chose both aligned topics and no distractor items	46
5th Grade	Apply and extend previous understandings of multiplication and division to multiply and divide fractions	77
	Understand the place value system	73
	Recognize and draw shapes having specific attributes, such as a given number of angles or a given number of equal faces	57
	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation	29
	I don't know	10
	Teachers who chose both aligned topics and no distractor items	15
6th Grade	Understand ratio concepts and use ratio reasoning to solve problems	90
	Apply and extend previous understandings of arithmetic to algebraic expressions	74
	Perform operations with numbers expressed in scientific notation	63
	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points	62
	I don't know	9
	Teachers who chose both aligned topics and no distractor items	13

TABLE B.2 (CONTINUED)

	Topic	Percentage of Teachers
7th Grade	Use properties of operations to generate equivalent expressions	83
	Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers	75
	Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane	51
	Generate the prime factorization of numbers to solve	31
	I don't know	10
	Teachers who chose both aligned topics and no distractor items	21
8th Grade	Define, evaluate, and compare functions	83
	Understand and apply the Pythagorean Theorem	71
	Represent and analyze quantitative relationships between dependent and independent variables	63
	Understand that a set of data collected to answer a statistical question has a distribution, which can be described by its center, spread, and overall shape	41
	I don't know	14
	Teachers who chose both aligned topics and no distractor items	4
Algebra	Create equations and inequalities in one variable and use them to solve problems	85
	Solve quadratic equations in one variable	69
	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients	77
	Use polar coordinates to describe locations on a plane	18
	I don't know	12
	Teachers who chose both aligned topics and no distractor items	2
Geometry	Experiment with transformations on the coordinate plane	90
	Explain and use the relationship between the sine and the cosine of complementary angles	63
	Identify the slope and the intercept of a linear model in the context of the data	70
	Derive the formula for the sum of a finite geometric series and use the formula to solve problems	27
	I don't know	8
	Teachers who chose both aligned topics and no distractor items	18

NOTE: Items shaded in gray are Common Core topics for the grade level.

TABLE B.3

Logistic Regression Results—Outcome: Teacher Identified Common Core Topics and Did Not Select “Distractor” Topics

	Model 1 (n = 181) K–2 Teachers aOR (SE)	Model 2 (n = 193) 3–5 Teachers aOR (SE)	Model 3 (n = 129) 6–8 Teachers aOR (SE)	Model 4 (n = 127) 9–12 Teachers aOR (SE)
(Intercept)	2.03 (1.72)	1.17 (0.96)	0.30 (0.29)	0.54 (0.57)
Teachers of low vulnerability students (vs. high)	0.65 (0.45)	0.85 (0.54)	0.22 (0.18)	1.14 (1.11)
Teachers of medium vulnerability students (vs. high)	1.97 (1.38)	0.38 (0.26)	0.01 (0.01)***	0.26 (0.25)
Urban, cities, towns, suburbs (vs. rural)	0.72 (0.47)	0.63 (0.42)	15.56 (11.31)***	0.49 (0.44)
Teachers using at least one aligned main material (vs. teachers not using at least one aligned main material)	1.31 (0.87)	1.73 (0.95)	1.05 (0.86)	0.56 (0.51)
Teachers not in Common Core states (vs. teachers in Common Core states)	0.38 (0.26)	0.91 (0.58)	0.05 (0.50)**	1.e-08 (0.00)***

NOTE: An asterisk indicates a significant p -value: *** $p < .001$, ** $p < .01$, * $p < .05$. Also, no teachers in non-Common Core states had at least one aligned main material, which is why that group is not present in the regressions.

TABLE B.4

Logistic Regression Results—Outcome: Ordered Both Sets of Common Core Topics Accurately

	Model 1 (n = 172) K–2 Teachers aOR (SE)	Model 2 (n = 164) 3–5 Teachers aOR (SE)	Model 3 (n = 111) 6–8 Teachers aOR (SE)	Model 4 (n = 98) 9–12 Teachers aOR (SE)
(Intercept)	0.08 (0.07)**	0.04 (0.04)**	0.00 (0.00)	0.01 (0.02)***
Teachers of low vulnerability students (vs. high and medium)	1.86 (1.03)	1.75 (1.23)	12.33 (10.73)**	9.38 (6.84)**
Urban, cities, towns, suburbs (vs. rural)	2.85 (2.29)	2.93 (2.48)	8.24 (7.81)*	6.33 (6.78)
Teachers using at least one aligned main material (vs. teachers not using at least one aligned main material)	3.35 (2.44)	1.54 (1.18)	2.25 (1.96)	1.64 (1.70)
Teachers not in Common Core states (vs. teachers in Common Core states)	2.28 (1.66)	1.53 (1.33)	1.56 (1.93)	6.08 (5.76)

NOTE: An asterisk indicates a significant p -value: *** $p < .001$, ** $p < .01$, * $p < .05$. The vulnerability variable is excluded from these regressions because no 3–5 grade or 6–8 grade teachers serving high vulnerability students ordered both sets of Common Core topics accurately. Also, no teachers in non-Common Core states had at least one aligned main material.

TABLE B.5

Poisson Regression Results—Outcome: Number of Aspects of Rigor Questions Teachers Answered Correctly

	Model 1 (n = 180) K–2 Teachers Rate Ratio (SE)	Model 2 (n = 168) 3–5 Teachers Rate Ratio (SE)	Model 3 (n = 111) 6–8 Teachers Rate Ratio (SE)	Model 4 (n = 105) 9–12 Teachers Rate Ratio (SE)
(Intercept)	4.27 (0.62)***	3.73 (0.59)***	4.86 (1.0)***	4.94 (0.88)
Teachers of low vulnerability students (vs. high)	1.06 (0.11)	1.11 (0.15)	1.00 (0.16)	0.88 (0.10)
Teachers of medium vulnerability students (vs. high)	0.92 (0.10)	1.17 (0.17)	0.90 (0.16)	0.67 (0.10)**
Urban, cities, towns, suburbs (vs. rural)	0.96 (0.12)	1.03 (0.11)	0.90 (0.12)	1.24 (0.20)
Teachers using at least one aligned main material (vs. teachers not using at least one aligned main material)	1.29 (0.14)*	1.08 (0.12)	0.93 (0.11)	1.02 (0.09)
Teachers not in Common Core states (vs. teachers in Common Core states)	1.12 (0.13)	1.15 (0.11)	0.81 (0.12)	0.81 (0.14)

NOTE: An asterisk indicates a significant p -value: *** $p < .001$, ** $p < .01$, * $p < .05$. Also, no teachers in non-Common Core states had at least one aligned main material.

TABLE B.6

Poisson Regression Results (n = 561)—Outcome: The Number of Standards-Aligned Practices (Ranging from Zero to Seven) for Which Teachers Reported Student Engagement “To a Great Extent”

	Rate Ratio (SE)
(Intercept)	1.85 (0.43)**
Teachers of low vulnerability students (vs. high)	1.37 (0.20)*
Teachers of medium vulnerability students (vs. high)	1.19 (0.18)
Urban, cities, towns, suburbs (vs. rural)	1.08 (0.14)
Grade K–2 teachers (vs. grade 9–12 teachers)	0.95 (0.15)
Grade 3–5 teachers (vs. grade 9–12 teachers)	0.95 (0.14)
Grade 6–8 teachers (vs. grade 9–12 teachers)	1.04 (0.16)
Teachers using at least one aligned main material (vs. teachers not using at least one aligned main material)	1.29 (0.16)*
Teachers not in Common Core states (vs. teachers in Common Core states)	1.02 (0.15)

NOTE: An asterisk indicates a significant p -value: *** $p < .001$, ** $p < .01$, * $p < .05$. Also, no teachers in non-Common Core states had at least one aligned main material.

Notes

¹For example, the Alaska State Standards include the Standards for Mathematical Practice, which are part of the Common Core (see, for example, Alaska Department of Education & Early Development [2012]). The Texas Essential Knowledge and Skills for Mathematics include “process standards” that “describe ways students are expected to engage in content,” language similar to what is included in the Standards for Mathematical Practice within the Common Core State Standards (Texas Education Agency, 2012).

²The Standards for Mathematical Practice include eight practices that teachers should be developing for their students via their instruction. Examples of these practices include making sense of problems and persevering in solving them, constructing viable arguments, and critiquing the reasoning of others. More information about the Standards for Mathematical Practice can be found at CCSS (2018b).

³The Louisiana Department of Education shared documents with us that identified key aspects of rigor addressed by standards we also asked about in our survey.

⁴To view all math reports, see EdReports (undated-a).

⁵We also did a supplementary analysis where we defined alignment based on the number of points EdReports gave to a particular material at each grade level, divided by the total possible points that material could have received. Each teacher was assigned a “percent alignment” average based on percent alignment among all the materials he or she reported using regularly for instruction. We decided to present results from our initially defined variable because it required fewer assumptions. Results were somewhat consistent with those found using our high alignment variable. Thus, this report focuses only on the extent to which “high alignment” is related to teachers’ knowledge and practice.

⁶With the emergence of web-based surveys, response rates have been in decline. Nulty (2008) found that responses to web-based surveys ranged between 20 and 47 percent. Similarly, a meta-study of 68 surveys in 49 studies by Cook, Heath, and Thompson (2000) found an average 40-percent response rate among national survey studies.

⁷The grade band in which teachers were placed represents the band where the majority of their classes are taught. In cases where a teacher taught an equal number of classes in more than one grade band, he or she was randomly assigned to one of the bands.

⁸These states were identified for exclusion using the Common Core State Standards Initiative (CCSS) documentation (2017a).

⁹To allow the sample of teachers to represent all teachers in the United States (at the state level), sampling weights were estimated based on any nonrandom characteristics of the sampling. Each survey respondent’s weight was calculated using inverse probability weighting where a weight was equal to the inverse of a respondent’s probability of being a survey respondent. With the ATP sampling design, respondents were invited to be part of the panel, but only some of them voluntarily agreed to be in the panel. A proportion of those who had agreed to be on the panel responded to the spring 2016 survey that is the focus of analysis for this report. Each of those selection stages were not random.

Thus, the probability of responding was estimated as the product of the probability of being invited to participate, the probability of enrolling, and the probability of responding. In addition, the weights obtained using the inverse probability weight mechanism were adjusted based on the distribution of teachers within states with different characteristics using a calibration procedure that allowed the weighted sample to be similar to the population characteristics. Standard errors on different variables were computed using these sampling weights. To account for uncertainty, replicate weights were created and Taylor series linearization procedures were used for estimations.

¹⁰The composite measure represents the number of standards-aligned practices for which teachers reported student engagement “to a great extent.” The only practice in Figure 6 that we did not consider standards-aligned was “use of repeated practice to improve their computational skills,” as it is the only practice not clearly emphasized in the Standards for Mathematical Practice within the Common Core. The other practices in Figure 6 are all taken from the Standards for Mathematical Practice within the Common Core. Thus, the range for our composite measure is zero to seven practices.

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About This Report

In this report we use data from a spring 2016 survey of the ATP to provide evidence of teachers' perceptions about their state mathematics standards, the alignment of curriculum materials being used with those standards, and their instructional practices. This 2016 survey is a follow-up of a similar survey conducted in the spring of 2015. At the time of the administration of the spring 2016 survey, the ATP was composed of approximately 3,524 teachers. To ensure representativeness, panel members were sampled randomly from across the nation. The population for this sample included full-time public school teachers in grades K–12 in all subjects, including teachers of special education students and ELL students.

The survey data were weighted to account for differential sampling and nonresponse. Weighting involved modeling both selection probabilities (i.e., what was the chance that a particular individual was contacted for inclusion in the panel?) and response probabilities (i.e., given that they were selected, what was the probability that they responded to our survey?). Variables taken into account in the weighting included teacher background (gender, professional experience, etc.) and school-level characteristics (school size, level, urbanicity, socioeconomic status, etc.).

For the spring 2016 survey, panel teachers of core subjects (mathematics, English language arts, science, and social studies) responded at higher rates than teachers of other subjects; teachers from the Midwest responded at higher rates than teachers from other regions; and teachers from the Northeast responded at lower rates than teachers from other regions. No other major subgroup differences were observed or accounted for through additional weighting.

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