

What Supports Do Teachers Need to Help Students Meet Common Core State Standards for Mathematics?

Findings from the American Teacher and American School Leader Panels

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Key findings

- Most mathematics teachers reported familiarity with state mathematics standards, believed they were moderately or well prepared to help their students meet them, and had received opportunities for professional learning that addressed many topics relevant to standards implementation.
- Relatively large proportions of teachers of science and social studies indicated that they were also expected to address mathematics standards in their instruction, but familiarity was lower among nonmathematics teachers than among mathematics teachers.
- Among those expected to address mathematics standards, the highest-reported professional development needs included differentiation of instruction and complex, inquiry-based modes of instruction, such as problem-solving and argumentation.

SUMMARY ■ Mathematics teachers across the United States have been working to adjust their instruction in response to states' adoption of the Common Core State Standards for Mathematics (CCSS-M) or other standards adapted from CCSS-M. In this report, we document the extent to which U.S. teachers are expected to address new mathematics standards in their instruction, teachers' familiarity with these standards, the professional development (PD) opportunities that teachers report receiving, and the PD opportunities they feel they need to help them implement standards effectively.

Our findings draw on RAND's American Teacher Panel (ATP) and American School Leader Panel (ASLP). The ATP and ASLP are new survey tools that take the pulse of the nation's educators on key issues of education policy and practice through periodic surveys of a representative sample of teachers and principals across the United States. Through these unique panels, RAND collects accurate, longitudinal data regarding educators' perspectives on and implementation of major federal, state, and district policies put in place over the past several years, including those related to standards, assessment, and evaluation.

BACKGROUND

As states across America have adopted new education standards—such as the Common Core State Standards (CCSS) and customized standards that are at least partially aligned with CCSS—teachers and school administrators have been working to adapt curriculum and instruction to ensure that students have the opportunity to meet the new, higher expectations embodied in these standards. For example, an analysis of the Common Core State Standards for Mathematics (CCSS-M) indicated that these standards support a more coherent and focused approach to mathematics instruction than most previously adopted state standards and that they introduce many topics at earlier grades.² Moreover, the Standards for Mathematical Practice in CCSS-M have raised expectations for student skills in areas such as mathematical modeling, requiring many teachers to shift their instructional strategies to incorporate these practices.

This report examines teacher and school leader perceptions about readiness and professional development (PD) needs related to mathematics state standards. A separate report considers readiness and PD needs related to English language arts (ELA) and literacy state standards.³ There are at least two reasons to expect differences in educators' views on capacity and their professional learning needs between ELA and mathematics. First, mathematics teachers may be more accustomed to thinking about standards and aligning their instruction to those standards, compared with ELA teachers, given the prevalence of and attention to standards and processes recommended by the National Council of Teachers of Mathematics over the past several decades.⁴ Second, the CCSS-ELA explicitly emphasize the need for teachers of science and social studies to incorporate those standards into their instruction,⁵ whereas the expectations for teachers of subjects other than mathematics to address CCSS-M are less explicit. Therefore, we might expect mathematics teachers to express greater confidence about their readiness to incorporate standards into their instruction, and we might anticipate differences between mathematics and ELA in the extent to which teachers in other disciplines would be expected to address standards and in their perceived needs for PD.

In this report, we primarily present the self-reported responses from teachers, and we supplement the teacher reports with principals' perspectives where relevant. Most of the results focus on either the full sample of respondents or on those who indicated that they were expected to address state mathematics

standards in their instruction. However, for some data, we also present results separately for respondents who reported working in CCSS states versus non-CCSS states,⁶ for respondents serving schools with different grade spans (elementary, middle, or high school), and for respondents in schools in which more than 50 percent of students received free or reduced-price lunch (FRL) compared with those in schools with 50 percent or fewer receiving FRL (which we refer to as high- and low-FRL schools, respectively).

The findings in this report draw on data from the February 2015 survey of the American Teacher Panel (ATP) and the American School Leader Panel (ASLP). We view these findings as providing a starting point for a longitudinal effort to track teachers' opinions and experience as they become more familiar with the new standards and are able to access resources to improve their capacity to embed these standards in their instruction. ATP and ASLP data and methods for sampling and weighting are described in more detail in the "About This Report" section at the end of this report.⁷

FINDINGS

In CCSS States, Majorities of K–12 Teachers in Each Core Subject Reported Being Expected to Address Mathematics State Standards in Their Instruction⁸

Not surprisingly, almost all mathematics teachers indicated they were expected to address their state mathematics standards (Figure 1). More surprisingly, about 81 percent of science teachers and about 72 percent of social studies teachers in all states also indicated that they were expected to address mathematics standards to some degree or extensively. In addition, more than two-thirds of ELA teachers in CCSS states reported some expectation to address mathematics standards, though the percentage for non-CCSS ELA teachers was lower. Overall, the percentages of nonmathematics teachers who said they were expected to address mathematics standards were lower than the corresponding percentages of non-ELA teachers who said they were expected to address ELA standards, as indicated in our teacher report on supports for ELA standards.⁹ Nonetheless, these findings suggest that the mathematics standards are exerting an influence on instruction that goes well beyond mathematics classrooms.

Teachers' reports of the expectations that they address mathematics standards varied to some degree across grade lev-

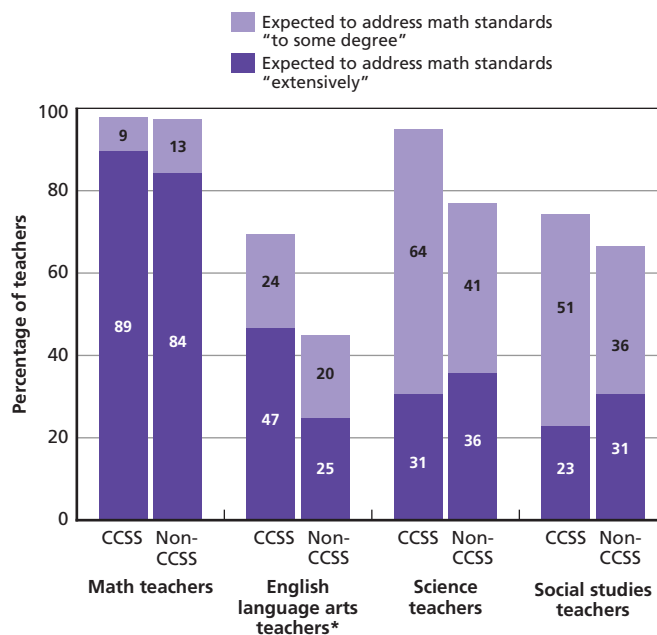
Mathematics standards are exerting an influence on instruction that goes well beyond mathematics classrooms.

els. Only 72 percent of high school mathematics teachers indicated that they were expected to address mathematics standards extensively; this percentage was significantly lower than the percentages of middle (85 percent) and elementary (93 percent) teachers who reported the expectation that they address their mathematics standards extensively. Some high school teachers might perceive the standards as not clearly relevant to instruction for high school courses like calculus or trigonometry. Additionally, high school teachers might feel less pressure to incorporate standards because their students are typically not required to take high-stakes tests as frequently as elementary or middle school students. Elementary teachers were also more likely to report expectations to address mathematics standards in their instruction in nonmathematics subjects compared with their counterparts in the secondary grades.

Among Those Expected to Address Mathematics Standards, Nonmathematics Teachers Were Less Familiar with the Standards Than Were Mathematics Teachers¹⁰

A majority of nonmathematics teachers who were expected to address mathematics standards in their instruction indicated some level of familiarity with the standards. However, almost none in this group indicated that they were familiar enough to develop lessons and assessments and also explain standards thoroughly to colleagues (Figure 2). Among those in CCSS states who do not teach mathematics but are expected to address mathematics standards, high school teachers were significantly more likely than elementary teachers to indicate that they were unfamiliar with standards: 11 percent of these elementary teachers reported being unfamiliar, compared with 46 percent of high school teachers. One possible explanation for this result is that most elementary teachers teach multiple

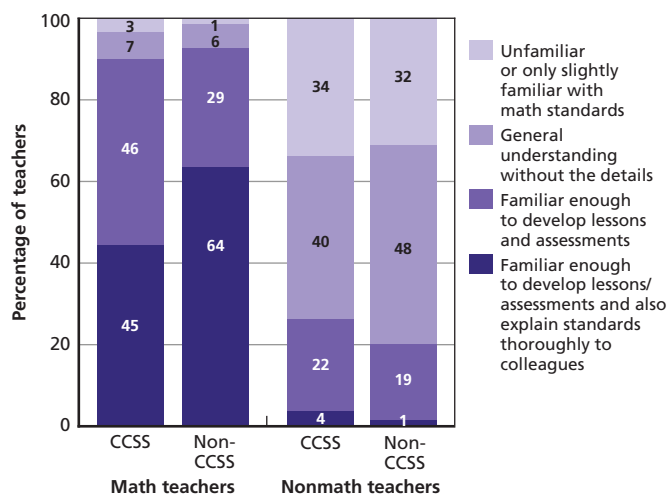
Figure 1. Percentages of Teachers in CCSS and Non-CCSS States Expected to Address Mathematics State Standards in Their Instruction



* Differences in percentages of "extensively" responses between CCSS and non-CCSS ELA teachers are statistically significant ($p < 0.05$).

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Figure 2. Familiarity with Mathematics Standards Among Teachers Expected to Address Those Standards in Their Instruction, in CCSS and Non-CCSS States



NOTE: Differences in responses between math and other teachers are statistically significant in both CCSS and non-CCSS states ($p < 0.05$).

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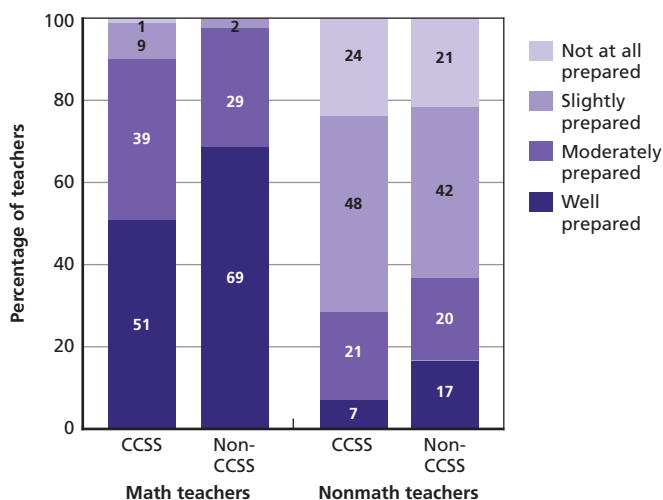
subjects and are likely to receive training related to both mathematics and ELA standards. These results suggest a need for PD or other resources to ensure that nonmathematics teachers who are expected to address mathematics standards—and particularly nonmathematics teachers at the high school level—understand the standards well enough to incorporate them into their instruction.

Principals' familiarity with standards likely plays an important role in allowing them to support teachers' work to address state standards in the classroom, particularly because principals often evaluate teachers' practices and provide guidance regarding instructional improvement and professional learning opportunities. No principals reported being unfamiliar with standards, and at least three-quarters of principals in both CCSS and non-CCSS states indicated that they were at least familiar enough to discuss them with teachers. In CCSS states, a much higher percentage of elementary school principals reported being able to both discuss their state mathematics standards with teachers and support teachers' use of them than did high school principals (59 percent versus 30 percent).

Most Mathematics Teachers Reported Feeling at Least Moderately Prepared to Help Students Meet Mathematics Standards¹¹

Among teachers who said they were expected to teach the mathematics standards, teachers of mathematics were more likely than their counterparts in nonmathematics subjects to indicate that they were prepared to help their students meet the mathematics standards (Figure 3). Additionally, mathematics teachers in CCSS states were significantly less likely to report being well prepared to address the mathematics standards than were mathematics teachers in non-CCSS states. This finding might reflect a difference between these two groups of teachers in the extent to which they believe they need to learn new instructional approaches in response to the standards. Although many non-CCSS states also adopted new standards relatively recently, teachers in those states might perceive the changes as relatively minor compared with the adoption of CCSS and therefore might be more confident about their preparedness than teachers in CCSS states. In addition, the differences between elementary and high school teachers showed a pattern similar to that for the familiarity question presented earlier: Elementary mathematics teachers expressed more positive opinions about their preparedness to address state mathemat-

Figure 3. Feelings of Preparedness to Help Students Meet Mathematics Standards Among Teachers Expected to Address Those Standards in Their Instruction



NOTES: Differences in responses between CCSS math teachers and non-CCSS math teachers are statistically significant ($p < 0.05$). Differences between math and other teachers are statistically significant in both CCSS and non-CCSS states ($p < 0.05$).

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ics standards than did high school mathematics teachers in CCSS states. As expected, nonmathematics teachers who were expected to address mathematics standards were much less likely than mathematics teachers to indicate feeling prepared to help their students meet those standards.

Principals were also asked to estimate the percentage of mathematics teachers in their schools who had adequate knowledge and skills to help students meet state mathematics standards. Most principals estimated that more than 80 percent of their teachers had adequate knowledge and skills; results were similar for CCSS and non-CCSS principals and for principals across different grade spans. Principals were asked a similar question about their nonmathematics teachers. On average, principals indicated a lower percentage of their nonmathematics teachers (about 61 percent for CCSS principals and 66 percent for non-CCSS principals) had adequate knowledge and skills to address the mathematics standards, and, again, results were similar across grade spans.

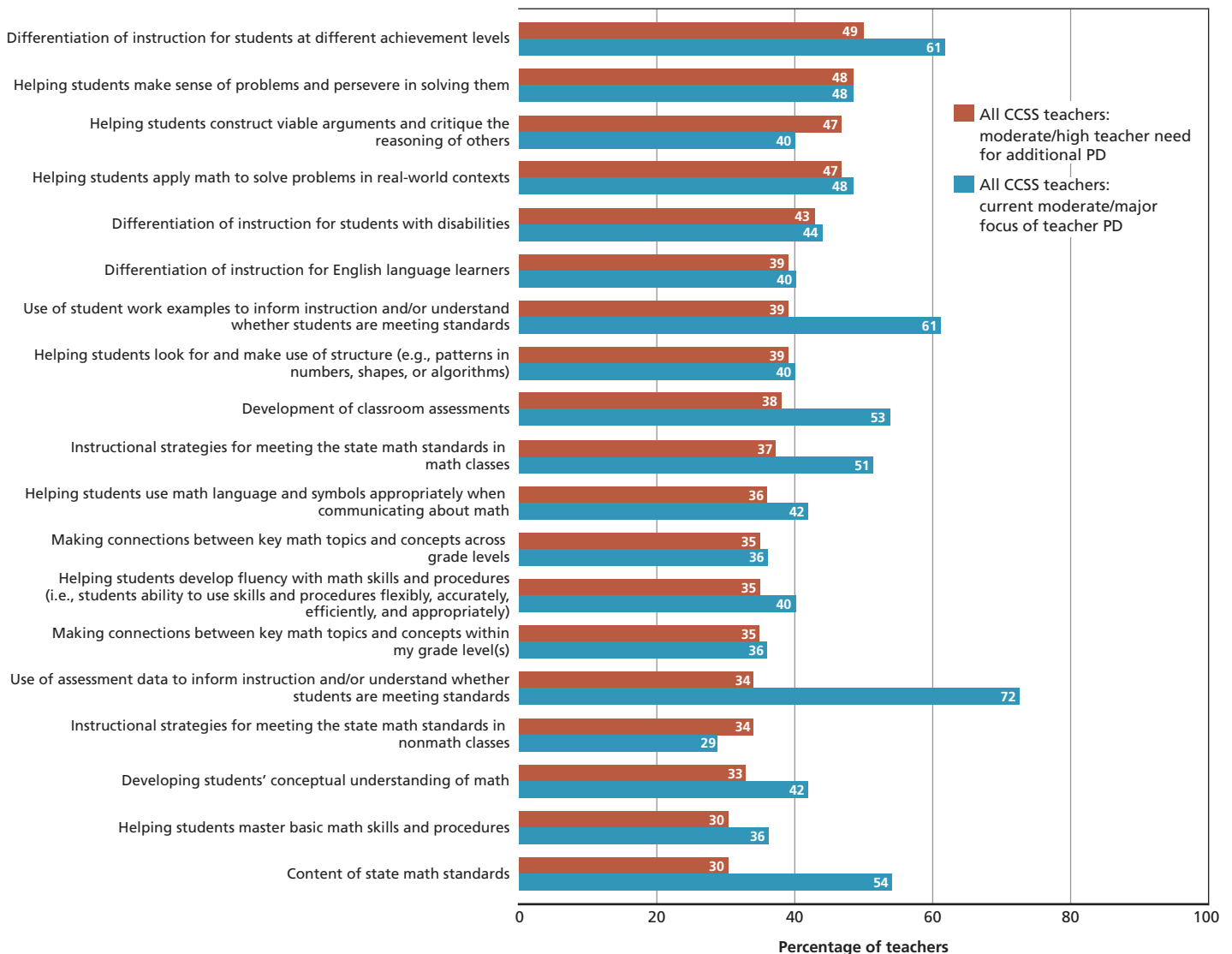
Among CCSS Teachers Who Were Expected to Address Mathematics Standards, the Highest-Reported PD Needs Included Differentiation of Instruction and Complex, Inquiry-Based Modes of Instruction¹²

Although teachers might have high levels of familiarity with and preparation to address the new state mathematics standards, they will likely need standards-related PD that goes beyond conveying general knowledge of standards and begins to target specific instructional needs. In fact, as teachers gain more familiarity with standards, their perceptions regarding their needs for more targeted PD opportunities may increase as they recognize more of what they do not know about the standards. Thus, it is important to examine the extent to which teachers believe they have had adequate opportunities to learn

about specific topics related to the standards and whether they would like to improve their understanding of these topics. The ATP survey asked teachers to reflect on their needs and experiences related to PD using a broad definition of PD that included “workshops, training, coaching, Professional Learning Communities, self-study, and/or other activities that have supported your work.” Such PD could take place within districts through coaching and workshops with instructional leaders and more expert teachers but could also be supported at the state level or through various providers.

As indicated in Figure 4, more teachers reported that they needed additional PD concerning differentiation of instruction for students at different achievement levels than any other topic. This finding may not stem directly from challenges associated with standards implementation, since differentia-

Figure 4. PD Needs and Current Focus of PD Among CCSS Teachers Expected to Address Mathematics State Standards in Their Instruction



tion is a topic that teachers frequently identify as an area of need, though it could reflect in part the need for many teachers to accelerate students' learning progress to meet new, higher standards. Nonetheless, PD on differentiation of instruction was also the highest-reported PD need among ELA teachers and those expected to address ELA/literacy standards in their instruction.¹³ Other topics for which slightly less than half of teachers in CCSS states indicated a moderate or high need for PD were those directly related to the CCSS Standards for Mathematical Practice, including PD to help students construct viable arguments and critique the reasoning of others, make sense of problems and persevere in solving them, and apply mathematics to solve problems in real-world contexts.

Majorities of teachers reported differentiation of instruction, as well as use of student work samples and assessment data, as major or moderate foci of current PD. These findings suggest that many schools and districts are focusing PD on use of information about student performance to meet students' needs, though clearly many teachers would welcome additional PD on differentiation. For most topics, the percentage of teachers reporting that the topic was a focus of PD was higher than the percentage indicating a need for PD, but there were a few exceptions. Teachers were more likely to report a need for PD to help students construct viable arguments and to make connections across grade levels than they were to report receiving PD in those areas.

PD needs varied across grade spans for some topics. High school teachers were more likely than elementary teachers to express a need for PD on use of student work samples and differentiation of instruction for students at different achievement levels. Higher percentages of elementary teachers indicated a need for PD to help students construct viable arguments and critique the reasoning of others than did middle and high school teachers, and elementary teachers were more likely than middle school teachers to indicate a need for PD to help students make sense of problems and persevere in solving them.

IMPLICATIONS FOR STATE AND DISTRICT POLICYMAKERS

Most mathematics teachers who were expected to address state mathematics standards reported familiarity with those standards, believed they were moderately or well prepared to help their students meet them, and had received opportunities for professional learning (e.g., workshops, training, coaching, or other similar opportunities) that addressed many topics relevant

to standards implementation. Given that these findings are self-reports, they likely do not provide a complete picture of teachers' knowledge and preparation. However, they do suggest that, in general, mathematics teachers believe they can implement standards effectively.

Relatively large proportions of teachers of science and social studies indicated that they were also expected to address mathematics standards in their instruction, but self-reported capacity was lower among nonmathematics teachers than among mathematics teachers. This result is not surprising given the emphasis in many schools on content-based PD that is tailored to a particular subject area. However, these results suggest that nonmathematics teachers perceived a need for more mathematics-focused professional learning opportunities. Moreover, high school teachers of subjects other than mathematics may be an important target for expanded teacher learning opportunities, particularly given the fact that many of these teachers reported being expected to address state mathematics standards in their instruction. At the same time, it is noteworthy that we did not find differences in reported capacity or PD needs between teachers in high- and low-poverty schools.

As district and school leaders prioritize among different training and support options for teachers, our results suggest that PD that helps teachers address the needs of all of their students and that emphasizes complex processes, such as problem solving and making arguments, would be especially welcome. Many of these topics are relevant to the Standards for Mathematical Practices in CCSS-M. Such PD is certainly relevant to subjects beyond mathematics. Professional learning opportunities should be offered explicitly for teachers of subjects other than mathematics who are expected to address standards in their instruction. During the early years of new standards implementation, many districts probably focused their efforts on improving the skills of mathematics teachers, but, as those teachers become more comfortable with the standards, there should be opportunities to address the needs of teachers in other subjects.

These results from the RAND American Teacher and School Leader Panels provide early evidence regarding teacher capacity and PD for mathematics standards implementation, and a companion report provides similar evidence about ELA standards.¹⁴ We intend for the findings in these two reports to represent an early look at U.S. teachers' self-reported capacity and PD needs related to standards-aligned instruction, and we will use the ATP and ASLP to understand how teacher capacity and needs change over time as teachers gain experience implementing standards.

ENDNOTES

¹ RAND Education, “The American Teacher Panel & The American School Leader Panel,” undated. As of December 4, 2015: <http://www.rand.org/education/projects/atp-aslp.html>

² W. H. Schmidt and R. T. Houang, “Curricular Coherence and the Common Core State Standards for Mathematics,” *Educational Researcher*, Vol. 41, 2012, pp. 294–308.

³ Julia H. Kaufman, Laura S. Hamilton, Brian M. Stecher, Scott Nafel, Michael Robbins, Lindsey R. Thompson, Chandra Garber, Susannah Faxon-Mills, and V. Darleen Opfer, *What Supports Do Teachers Need to Help Students Meet Common Core State Standards for English Language Arts and Literacy? Findings from the American Teacher and School Leader Panels*, Santa Monica, Calif.: RAND Corporation, RR-1374-BMGF, in press. A previous report also highlighted teacher and school leader concerns about state-mandated assessments: Julie H. Kaufman, Laura S. Hamilton, Brian M. Stecher, Scott Nafel, Michael Robbins, Chandra Garber, Cordaye Ogletree, Susannah Faxon-Mills, and V. Darleen Opfer, *What Are Teachers’ and School Leaders’ Major Concerns About New K–12 State Tests? Findings from the American Teacher and American School Leader Panels*, Santa Monica, Calif.: RAND Corporation, RR-1294-BMGF, 2015. As of November 20, 2015: http://www.rand.org/pubs/research_reports/RR1294.html

⁴ National Council of Teachers of Mathematics, *Curriculum and Evaluation Standards for School Mathematics*, Reston, Va., 1989; National Council of Teachers of Mathematics, *Principles and Standards for School Mathematics*, Reston, Va., 2000.

⁵ Vassiliki Zygouris-Coe, “Disciplinary Literacy and the Common Core State Standards,” *Topics in Language Disorders*, Vol. 32, No. 1, 2012, pp. 35–50; Timothy Shanahan and Cynthia Shanahan, “What Is Disciplinary Literacy and Why Does It Matter?” *Topics in Language Disorders*, Vol. 32, No. 1, 2012, pp. 7–18.

⁶ Teachers in “non-CCSS states” for this report are those in states that had not adopted CCSS at the time of survey administration, which are Alaska, Indiana, Minnesota, Nebraska, Oklahoma, Virginia, and Texas. For more information, see <http://www.corestandards.org/standards-in-your-state>.

⁷ Maximum margin of error is ± 4.7 percentage points for teachers’ responses on the ATP and ± 8.3 percentage points for school leaders’ responses on the ASLP.

⁸ Teachers’ reports of expectations for addressing standards are in response to the survey question, “How much are you expected to address the **mathematics** standards in [each of] the subjects you teach?”

⁹ Reported in Kaufman et al., in press.

¹⁰ Teachers’ reports of their familiarity with standards are based on the survey question, “Which phrase best describes your familiarity with your state standards in **mathematics** for the subject(s) and grade(s) you teach?”

¹¹ Teachers’ reports of their preparation to address standards are based on the survey question, “How prepared are you—in terms of your knowledge and skills—to help your students to meet the state **mathematics** standards for the grade level(s) you teach?”

¹² Teachers’ reports of the current focus for their PD are drawn from two survey questions: “How much has your professional development focused on the following topics thus far this school year (2014–15, including summer 2014)?” and “How much has your professional development focused on the following topics related to **mathematics** thus far this school year (2014–15, including summer 2014)?” Teachers’ reports of their PD needs are drawn from two survey questions: “How much do you need additional professional development on the following topics to support your instruction?” and “How much do you need additional professional development on the following topics to support your **mathematics** instruction?”

¹³ Kaufman et al., in press.

¹⁴ Kaufman et al., in press.

About This Report

This short report presents summary data from web-based surveys administered by RAND Education to the American Teacher Panel (ATP) and American School Leader Panel (ASLP) in February 2015. At the time of the administration of the surveys featured in this current report, the ATP was composed of approximately 1,129 teachers, and the ASLP was composed of approximately 557 school leaders. Respondents were paid an incentive of \$25 for every 30 minutes of survey time. Data for this paper were collected in one survey wave fielded in February 2015. To ensure representativeness, panel members were sampled randomly from across the nation. The teacher sample included all full-time public school teachers in grades K–12 in all subjects, including teachers of special education students and English language learners. The survey data were weighted to account for differential sampling and for nonresponse. Weights were based on a model for nonresponse that incorporates characteristics such as teacher subject and school level, region, size, and rate of free/reduced-price lunch eligibility. This report was updated in October 2016. The current version provides estimates based on updated weights for a small percentage of the respondents. Weights were updated to account for infrequent misclassification in the assignment of school-level characteristics. The data collection and analysis for the February survey was funded by the Bill & Melinda Gates Foundation and the National Education Association. Panel members are asked to complete periodic surveys on key education policy issues in the United States. If you are interested in learning more about the ATP and ASLP, and how you could take advantage of this resource, please contact us at atp-aslp@rand.org.

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