

What California Math Teachers Are Saying About Instruction and Professional Learning Today

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This brief is part of a continuing series for *California education leaders on key policy* issues related to teachers and teaching. With California in the process of revising its K-12 math framework and with educators and students grappling with lost *instructional time during the COVID-19* pandemic, now is an opportune moment to examine ways to better understand and support effective math instruction in the Golden State. Accordingly, this brief summarizes California-specific findings from a nationwide survey on math teachers' perceptions of their materials, instruction, and professional learning. These insights into teachers' perspectives, along with a curated collection of resources and sources of support, can be used to inform timely improvements to math education in California.

Current Context of Math Education in California

Revision of the state mathematics framework

Over the past decade, in efforts to support teachers in better preparing students for postsecondary success, California has adopted new subject-specific K-12 academic standards and related curriculum frameworks with accompanying lists of approved instructional materials. The curriculum frameworks provide common guidance to K-12 educators and families and support the implementation of the state's academic content standards. Together, the state's content standards and curriculum frameworks describe what California expects its K-12 students to know and demonstrate. The frameworks also provide direction for publishers about the state's criteria for selecting appropriate instructional materials that will help students meet those expectations and for district administrators responsible for designing and setting local policy on student course placement and sequences.

Since 2020, various leadership groups¹ have been involved in the process of revising the 2013 *Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (the 2013 math framework). The California Department of Education (CDE) released an initial draft of the revised math framework in January 2021 for field

¹ The groups are the California State Board of Education, the California Department of Education, and the Instructional Quality Commission (an advisory body to the State Board of Education).

review; a second field review draft followed in March 2022.² A final version of the math framework revision is expected to be adopted statewide in 2023,³ with an associated materials list to follow in 2024.⁴

The 2013 math framework focused primarily on students' mastery of the then-new college- and careerreadiness standards. In recent years, California researchers have been advocating for increased coherence and connections among the concepts in the K-12 curriculum to advance a more intuitive understanding of mathematics among studentsfor example, focusing on units of study or performance tasks organized around key concepts (Bitter & O'Day, 2010; Knudson, 2014; Knudson et al., 2015). As researchers with the California Collaborative on District Reform emphasized, the state's local school districts "bear primary responsibility for addressing teacher capacity needs [while] wide variation exists in their preparation to do so" (Knudson et al., 2015, p. 6).

Within the context of this recent research in California, the March 2022 draft math framework revision focuses less on individual standards and more on investigations, connections, and professional learning, with instructional activities that are designed around "big ideas" that fit within a multiyear progression of learning and that promote student engagement (CDE, 2022, pp. 28–29). The draft math framework revision also describes the imperative for TK–12 instruction to foster outcomes in math that are more equitable (CDE, 2022, pp. 33). In short, the math framework revision is

targeting broad, fundamental shifts statewide in both attitudes and practices regarding math.

Effects of the COVID-19 pandemic on math learning

While the math framework revision has brought teaching and learning in math to the forefront of recent education policy discussions in California, newly released National Assessment of Educational Progress long-term trend (NAEP LTT) assessment⁵ results underscore the urgency of effective math education. In a special administration of the NAEP LTT assessment designed to examine student learning during the COVID-19 pandemic, the average math score for age 9 students across the nation in 2022 was seven points lower than the average math score for these students in 2020;6 this represents the first-ever math score decline (The Nation's Report Card, 2022). The NAEP LTT assessment results are not reported by state or district but by regions of the country. While all four regions of the country showed math score declines, the West region showed the smallest average score drop, at 5 points, compared to the Midwest (9 points), the Northeast (8 points), and the South (7 points) (The Nation's Report Card, 2022). And while math scores dropped for all students, the drop was larger among Black students (13 points) and Hispanic students (8 points) than among White students (5 points) (The Nation's Report Card, 2022). These results reinforce the need for innovative supports to improve math instruction and help students, especially non-White students, rebound from pandemic-related learning loss.

² Links to each chapter of the second field review draft of the revised math framework can be found at the CDE site Mathematics Framework: Revision of the Mathematics Framework.

³ As of October 2022, CDE and State Board of Education (SBE) staff are working to review and analyze the second round of review comments and develop responsive recommendations. As has been the case with other projects calling for additional capacity, the CDE and SBE staff are working with the Region 15 Comprehensive Center (R15CC), operated by WestEd, to complete the review and analysis of the feedback from the second field review. The R15CC is part of the federally funded national Comprehensive Center Network and provides capacity-building technical assistance, content expertise, and other services to support state education agencies and their regional and local constituents in Arizona, California, Nevada, and Utah.

⁴ More information about the timeline can be found at the CDE site Mathematics Framework Revision Timeline.

⁵ It is important to distinguish differences between the NAEP LTT and the main NAEP assessments in reading and math. These differences include the following: (a) NAEP LTT assessments are administered to students sampled by age, while main NAEP assessments are administered to students sampled by grade; (b) NAEP LTT assessments in reading and math are updated less frequently than main NAEP assessments in these subjects and are less reflective of changes in curriculum; and (c) the instruments and methodologies of NAEP LTT and main NAEP assessment programs are different (as such, it is not possible to directly compare the latest NAEP LTT results to the assessment results presented in other main NAEP reports) (The Nation's Report Card, 2022).

⁶ The NAEP LTT assessments are administered from October to May and reported in the summer.

"If there's a big disruption in school, it's going to disrupt math more [than reading], because kids aren't doing math at home. . . . In general, when we change schooling—and usually we're changing schooling to try to improve outcomes—it tends to be easier to improve outcomes in math than it is to improve outcomes in reading."

Brown University Professor
Susanna Loeb (Chotiner, 2022).

The need to better understand and support math instruction in California

Given the proposed shifts to math education described in the draft revised math framework, along with the reverberations of lost instructional time from the COVID-19 pandemic, now is an opportune time to seek ways to improve math education in California. Accordingly, it is vital that the California education leaders responsible for supporting math teachers understand these teachers' current perceptions of their materials, their instruction, and their professional learning to be able to tailor effective support for them moving forward (including scaling up what is working and filling in gaps as needed).

This knowledge brief summarizes California-specific findings from a nationwide survey of teachers—providing insights into teachers' thoughts on their instruction, their materials, and the supports available to them. The brief also compares views of California math teachers with those of non-California math teachers to illustrate the uniqueness of the current math instructional context in the Golden State.⁷ The survey findings are followed by a list of state and local resources for supporting math education and math professional learning.

Spring 2022 Survey Results From Math Teachers

The survey results presented in this brief were collected from K-12 teachers across the country in spring 2022 through the Learn Together Survey (LTS), which is part of the RAND Corporation's American Teacher Panel (ATP). The ATP surveys were originally launched in 2014, with multiple ATP surveys administered several times per year in all U.S. states and the District of Columbia. Educators in California, Florida, New York, and Texas are oversampled in these surveys to afford state-level representativeness based on the teacher population. A total of 3,606 U.S. teachers responded to the spring 2022 LTS, with 435 responses received from California teachers. Among the 435 respondents from California, 216 (50%) indicated that they taught math in 2021/22.8

California math teachers expressed optimism that all students can master key math concepts and indicated that they are prioritizing conceptual content and less frequently leveling students by ability than are teachers in other states.

Teachers were asked how they prioritize different types of content when they teach math. A higher proportion of California math teachers (70%) than teachers in all other states combined (61%) said that they place a high priority on *conceptual content* that focuses on high-level math concepts or underlying math theory; this prioritization was the case in both the elementary (72%) and secondary grades (66%) in California. This suggests that there may be a readiness among today's California math teachers to tackle, as the draft math framework emphasizes, the "big ideas" in math that "link numerous mathematics understandings into a coherent whole and provide focal points for students' investigations" (CDE, 2022, p. 15).

⁷ All the differences presented between groups of teachers in this brief are statistically significant at the .05 level.

⁸ Among these 216 responding California math teachers, 70 (32%) indicated that they teach in grades 6–12 (middle and high school teachers) and not in grades K–4, and 146 (68%) reported that they teach at grades K–5 (elementary teachers) and not at grades 7–12.

In addition to more strongly emphasizing conceptual math content, California secondary teachers also indicated that they less frequently differentiate instruction by grouping students with similar levels of math ability together (i.e., "leveling") than non-California teachers do. In California, only 39 percent of middle and high school math teachers reported that they level students into ability groups at least monthly, compared to 54 percent of middle and high school math teachers in other states. Math teachers in the elementary grades reported more frequently leveling students by ability, with just under 80 percent of teachers in California and in other states indicating that they did so at least monthly.

Irrespective of their instructional strategies, math teachers across states (and grade spans) expressed a positive outlook regarding their students' math potential, with 84 percent of California math teachers and 79 percent of math teachers in all other states combined agreeing that "all my students can master key math concepts." That mindset is a foundational orientation in the draft math framework revision.

According to California teachers, the state's current professional learning environment is characterized more by peer teacher collaboration than by individual coaching from the district.

Math teachers in California reported that they are collaborating with one another, particularly in elementary schools. Overall, 57 percent of California math teachers (61% of elementary teachers and 51% of middle and high school teachers) agreed that they have adequate time to collaborate with other teachers and that this collaboration is helpful to them. A majority of California math teachers also agreed that they often collaborate with the other teachers on their grade-level teams (84%) or with math teachers in other grade levels (63%) to help students improve their math achievement. These figures were similar to those from non-California states. However, collaboration across grade levels in California depended on the grade span of the school, with more cross-grade collaboration reported among California middle and high school math teachers (80%) than among math teachers in California's elementary schools (54%).

According to the 2022 LTS results, individual teacher coaching is less common than peer collaboration in California. Twenty-five percent of California math teachers (and 32% of math teachers in non-California states) agreed that they receive individual coaching from their districts that is helpful to them. This infrequency of helpful individual coaching aligns with findings from previous ATP surveys of California math teachers (Makkonen & Lewis, 2020).

Survey results suggest that there is a need for more effective math professional learning opportunities, particularly in the middle and high school grades.

Overall in California and in all other states combined, half of math teachers (51%) reported that they need more support for delivering high-quality math instruction, with little variation by grade span. California middle and high school math teachers expressed a less a favorable view of their math professional learning during the 2021/22 school year compared to other groups; 42 percent agreed with the statement that these professional learning opportunities were useful for improving their math instruction. In comparison, 63 percent of middle and high school math teachers in other states, and 63 percent of California elementary math teachers, agreed with this statement.

California math teachers are not relying on their district leaders for classroom materials.

California last adopted an approved K–8 instructional materials list for mathematics in January 2014. As a result, the use of (and reliance on) math curricula across California's districts and schools varies a great deal today. Survey findings suggest that California math teachers have a high level of autonomy in their work. More than 80 percent of math teachers in both California and in other states (and across grade levels) indicated that their principals are effective at supporting teacher autonomy in making instructional decisions. California math teachers were less likely than math teachers in other states to report that district leaders typically make the decisions about which math materials are used in their classrooms (38% as compared to

46%, respectively). Within California, district-led decisions about instructional materials were more commonly reported among elementary math teachers (48%) than among high school math teachers (17%) and middle school math teachers (32%).

Although California math teachers had positive perceptions of their math curricula, they reported that their professional learning opportunities do not tend to be aligned with those curricula.

Eighty-two percent of California math teachers indicated that there is consistency in curriculum, instruction, and learning materials among teachers within grade levels at their schools, while 74 percent said that curriculum, instruction, and learning materials are well coordinated across grade levels at their schools. These results were similar across grade spans and were consistent with results from other states.

However, lower proportions of California math teachers than math teachers in other states stated that their *math professional learning opportunities* were well aligned with the math curriculum materials they use (60% versus 68%, respectively). The discrepancy was most pronounced at the secondary level; 48 percent of California's middle and high school math teachers agreed with this statement about their professional learning in 2021/22 compared to 67 percent of middle and high school math teachers in all other states. This finding is notable in light of recent research indicating that professional learning that helps teachers learn to use and implement their curricula is particularly effective for students (Lynch et al., 2019).

To improve their students' academic performance, California math teachers reported relying on their own observations and self-created classroom tasks, assignments, or projects.

The most frequently cited sources of information that math teachers use to improve their students' academic performance were their observations of students (cited by 55% of California math teachers and 52% of non-California math teachers) and their own self-created classroom tasks, assignments, or projects (cited by 45% in California and 39% in all other states combined). For that same survey item, California math teachers, compared to non-California math teachers, less frequently cited periodic diagnostic assessments (such as MAP or STAR) that measure students' achievement growth (27% versus 39%, respectively) or classroom tasks, assignments, or projects that were provided in their curriculum materials (32% versus 35%, respectively) (Table 1).

California math teachers in different grade spans reported relying on different sources of information to improve their students' academic performance. As shown in Table 1, math teachers in the secondary grades reported more often relying on their own (self-created) tests and assignments as well as their conversations with students, while California's elementary math teachers were more likely than middle and high school math teachers to use periodic diagnostic assessments and materials provided in their curriculum materials.

Table 1. Sources of Information Used by Teachers to Improve Student Academic Performance

Source of information	California math teachers (n = 215)	Math teachers in other states (n = 1,490)	Elementary math teachers in California (n = 145)	Middle/high school math teachers in California (n = 70)
Teacher observations of students	55	52	54	56
Classroom tasks, assignments, or projects created by the teacher	45	39	43*	50*
Classroom tasks, assignments, or projects provided in curriculum materials	32	35	34*	26*
Diagnostic tests that measure students' achievement growth (e.g., MAP, STAR)	27*	39*	35*	13*
Conversations with students	26	25	17*	43*
Tests/quizzes created by the teacher	26	21	15*	47*
Tests/quizzes provided in curriculum materials	23	23	28*	13*
Conversations with other teachers or administrators	21	16	23	20
Conversations with parents, guardians, or other family members	12	12	12	11

Source: RAND American Educator Panels, American Teacher Panel, 2022.

Note: The figures in the table represent the percentages of teachers who selected that source of information as a top-three source that they used in 2021/22 to improve the academic performance of their students.

^{*}Different from corresponding group at p<.05 significance level

Looking Ahead: Resources and Sources of Support for California Math Teachers

The importance of the math framework revision and the urgent need to accelerate the learning of students most impacted by lost instructional time during the COVID-19 pandemic underscore the need for changes to California's existing local structures and systems that support math instruction. According to the March 2022 draft math framework, "A broad system of support is needed to ensure that all students have access to mathematics instruction that reflects authentic contexts and real-world problems, is rich with connections between mathematical ideas and with students' lives, and builds over time" (CDE, 2022, p. 2).

The coming months are an opportune time to reexamine the professional learning infrastructure around math teaching in California. Considering the fundamental changes in math attitudes and practices that are elevated by the math framework revision (and the aligned instructional materials that will follow its adoption)—and acknowledging California math teachers' views of their materials, instruction, and supports—local and regional systems of professional learning across the state will likely need to be adjusted and adapted accordingly in the next few years.9 At the same time, California's decentralized math curriculum environment and wide variation in local needs and capacity will make it more challenging to consistently execute the revised math framework's vision.

Recent research has identified the characteristics of strong professional learning and effective formats for its delivery. The most beneficial professional learning provides practical examples and opportunities for rich feedback and reflection; features teachers actively engaging with colleagues to dive deeply into content and curriculum; and sustains engagement over time (Darling-Hammond et al., 2017). This type of learning can be delivered effectively in different ways, such as through instructional coaching, professional learning communities (PLCs), or lesson study (a research-based inquiry cycle of collaboratively researching, creating, teaching/observing, and then revising a lesson) (CDE, 2022). County offices of education, regional alliances, and school districts will need to play a significant role in strengthening local math professional learning (Finkelstein & Moffitt, 2018). These entities will need to continue to expand and deepen the types of professional learning and related supports that are available to math teachers and instructional leaders in advance of and following the adoption of the math framework revision (Burr et al., 2021). This section describes available resources, supports, and professional learning that California's education leaders can leverage to promote quality reflection and inquiry and improved instruction among math teachers in the coming months.

⁹ Professional learning for instructional coaches (typically former classroom teachers) will likely need to be thoughtfully adjusted as well, especially for new coaches. Coaching has its own Instructional Practice Coaching Standards and requires a whole new skill set for working with adult learners.

Math Framework Teaching Vignettes

As California's instructional leaders work to implement the revised math framework, the instructional vignettes (which are currently embedded throughout the March 2022 draft)10 can help them develop an awareness of what effective conversations, instructional practices, and culturally relevant pedagogy look like in classrooms and schools. Education leaders can reflect on the ways that they can nurture these types of experiences for their math teachers. For example, local leaders and math educators in different roles could gather as a PLC in the coming months to carefully review the vignettes and reflect on the professional learning resources, activities, and structures that would be necessary for their local instructional systems to improve math teaching and learning (Burr et al., 2021).

California Mathematics Project

The California Mathematics Project (CMP) is a K–16 network whose mission is to "develop and enhance K–12 teachers' content knowledge and instructional strategies aligned with the California math standards and framework." The CMP oversees 19 regional sites located on University of California, California State University, and independent college and university campuses across the state.

California Action Network for Mathematics Excellence and Equity

The California Action Network for Mathematics Excellence and Equity (CANMEE) is a collaboration between the CMP and state and national groups and organizations focused on excellence and equity in math education. CANMEE has developed a two-page lesson study for equity and excellence in math that lays out an effective process to study the implementation, calibration, and dissemination of math lessons. Communities of practice called lesson study teams can use this resource alongside CANMEE's Lesson Study Team Guide and other related tools and resources.

The Silicon Valley Mathematics Initiative

The Silicon Valley Mathematics Initiative (SVMI) is a comprehensive effort to improve math instruction and student learning. The initiative is based on high performance expectations, ongoing professional development, examination of student work, and improved math instruction. SVMI includes a formative and summative performance assessment system, pedagogical content coaching, and leadership training and networks. Its professional development offerings and other resources are available to member districts and schools throughout California. In 2022/23, SVMI is offering a series of professional learning sessions using its materials to focus on key elements of the math framework revision.

¹⁰ Examples of the vignettes include "Number Talk with Addition, Grade 2" (in chapter 3: Number Sense), "Personalized by Teachers" (in chapter 9: Structuring School Experiences for Equity and Engagement), and "Lesson Study" (in Chapter 10: Supporting Educators in Offering Equitable and Engaging Mathematics Instruction).

The Instructional Leadership Corps

The Instructional Leadership Corps (ILC) is a statewide community of professional educators focusing on strengthening partnerships and embedding practitioner-led professional learning in local associations across the state. Building on lessons learned over 7 years of work, the ILC offers resources such as tools for practice, a video collection, webinars, and a handbook.

21st Century California School Leadership Academy

The California Collaborative for Educational Excellence (CCEE) is state agency assisting local educational agencies through universal, targeted, and intensive supports resources, including professional learning for educators (not just in math). CCEE's 21st Century California School Leadership Academy (21CSLA) is a no-cost, statewide professional learning initiative for administrators and other school leaders in seven regions. Research and resources are available free of charge on the 21CSLA website. Additionally, CCEE's recently updated Playbook for Accelerating Learning represents a change in approach to supporting students who have experienced learning gaps.

Discussion

The survey results shared in this brief suggest some commonalities among California's math teachers that offer promise for the coming changes called for in the math framework revision. For example, compared to teachers in other states, California's math teachers tend to more often emphasize conceptual content and collaborate with their peers and less frequently group students by ability or rely on district leaders for classroom materials or curriculum-focused professional learning. However, California's math teachers are not a monolithic group. The student composition in their classrooms varies. And the teachers vary in terms

of their preparation, experience, location, and beliefs about their students. The state's local professional learning systems can build on their leaders' contextualized understandings of teacher needs and capacity while still advancing the common principles of effective instruction and promoting more equitable outcomes for students, as reflected in the draft math framework.

Key among the updated framework's emphases are the central role of classroom discourse and the importance of using rich, open tasks in teaching and learning math. The survey results described in this brief suggest that professional learning in such areas may well suit California's math teachers. Math teachers in California are focused on promoting conceptual understanding and are more likely than non-California math teachers to make their own decisions, as opposed to relying on curriculum materials and diagnostic assessments, to improve student academic performance. That is, California math teachers tend to rely on their own observations and conversations with other teachers, administrators, and families and create their own tasks, assignments, projects, and assessments. They appear ready for something new. And today's instructional environment presents opportunities to explore and build upon California teachers' current efforts: How frequently are they creating new math assignments and assessments for students? Are they focusing on particular groups of kids? What tools are they using? And what types of behaviors are they looking for?

Because of the COVID-19 pandemic, education challenges today are more acute than ever. Many students have been severely impacted by unequal access to quality content and resources. Ensuring that all students in California have equitable access to learning environments in which they can thrive will require the state's education leaders to elevate teacher voices; implement new high-quality, standards-aligned curricular materials; and work to strengthen instructional supports and curriculum-centered professional learning in the months to come.

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