

Strong Professional Learning Systems for Math Instruction in California: What Do We Know Today?

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This knowledge brief is part of a continuing series designed to inform California education leaders about key policy issues related to teachers and teaching in the Golden State. The brief outlines the current policy environment surrounding math instruction in California, summarizes California information from a nationwide teacher survey on teachers' experiences with professional learning during the 2019/20 school year, and highlights options for instructional supports for California math teachers.

California Context: Revision of the State Mathematics Framework in 2021/22

California adopts statewide curriculum frameworks to provide common guidance to K–12 educators, parents, and publishers of instructional materials. The frameworks 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 be able to do. The frameworks also provide direction to publishers about the state's criteria for selecting appropriate instructional materials that will help students meet those expectations.

A revision of the *2013 Mathematics Framework for California Public Schools: Kindergarten Through Grade Twelve* (math framework) is up for review

in 2021 and adoption in 2022, and various leadership groups are involved in the process, including the California State Board of Education (SBE), the California Department of Education (CDE), and the Instructional Quality Commission (IQC), which is an advisory body to the SBE. An initial draft of the revised math framework was released in January 2021.¹ Following two rounds of public review and comment, a final version is expected to be adopted statewide in May 2022.

A broader focus

The January 2021 draft math framework is positioned differently than the 2013 framework. The 2013 framework focused primarily on students' mastery of the new standards. Although this is still an important priority, the revised framework also seeks to more strongly emphasize the needs of culturally and linguistically diverse students and to present “experiences that provide access to the coherent body of understanding and strategies of the discipline” (CDE, 2021, Ch. 1, p. 23). To accomplish these goals, the January 2021 draft highlights, among other things, the need to “respond to issues of inequity in mathematics learning” (Ch. 1, p. 8), including shedding “fixed notions about student ability” (Ch. 1, p. 9), “eliminating option-limiting tracking” (Ch. 1, p. 9), and promoting the understanding “that all students are capable of accessing and mastering school mathematics” (Ch. 1, p. 20). In short, the math framework revision is targeting broad, fundamental shifts in both attitudes and practices regarding math statewide.

¹ Links to each chapter of the initial draft of the framework can be found at the CDE site [Mathematics Framework: 2021 Revision of the Mathematics Framework](#).

Local structures and systems

Such shifts will necessitate changes to California's existing local structures and systems that support math instruction. Because local contexts vary in terms of needs and capacity, making such shifts will be more difficult in some places than in others, especially in places with fewer resources. According to the January 2021 draft math framework, local education systems must provide more “relevant, authentic mathematical experiences that make it clear to all students that mathematics is a powerful tool for making sense of and affecting their worlds” (Ch. 1, p. 20). Enacting such experiences at scale will require, among other shifts, more innovative professional learning in math, not only to shape teachers' standards-aligned instructional practices in the classroom, but also to help them develop school- and classroom-level strategies related to inclusion, cultural relevance, and English language development (CDE, 2021).

This knowledge brief aims to inform state and district leaders about options for effective professional learning for California educators in advance of the adoption of the final math framework in May 2022. The brief summarizes California math teachers' survey responses from spring 2020 about the professional learning they received during the 2019/20 school year — both before and during the period of school closures due to COVID-19 — and then describes various types of professional learning supports and key steps education leaders can take to prepare for the successful implementation of the final math framework. The brief also compares views of California math teachers with those of non-California math teachers and with those of California teachers who teach other subjects.

What Are California Math Teachers Saying About Their Professional Learning?

The survey results presented in this brief were collected from K–12 teachers across the country in spring 2020 through the American Instructional Resources Survey (AIRS), 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 to afford state-level representativeness.² A total of 5,978 U.S. teachers responded to the spring 2020 AIRS (a 55 percent survey completion rate), with 418 responses received from California teachers. Among the 418 respondents from California, 148 were identified as math teachers (35 percent), which is similar to the proportion of math teachers in the full U.S. sample.

Overall, California math teachers expressed positive responses about their professional learning experiences in 2019/20. When California math teachers were asked about the extent to which their professional learning activities in 2019/20 helped them engage in instructional practices that more effectively meet student needs, 88 percent responded that they indeed did so “to a moderate” or “to a great” extent, which is nearly identical to the share of non-California math teachers (89 percent) who indicated these two most positive responses. Similarly, 81 percent of California math teachers, versus 82 percent of non-California math teachers, reported that their professional learning in 2019/20 helped them use their instructional materials more effectively to meet student needs to a moderate or to a great extent.

² Survey respondents are given a calibrated weight to ensure that responses reflect the national population of teachers, and these calibrated weights are used in all analyses displayed within this brief. Not all respondents responded to every item, so the per-item sample varied. The margins of error for the results presented generally range from 5 to 10 percentage points.

However, closer analysis of the positive responses reveals that fewer California math teachers than non-California math teachers selected the most favorable response regarding their 2019/20 professional learning. Although at first glance the California math teacher reports seem the same as those of the

non-California math teachers, California math teachers were less likely than non-California math teachers ($p < .05$) to indicate that their professional learning activities helped them engage in instructional practices and use their instructional materials to meet student needs to a great extent (Table 1).

Table 1. Percentage of math teachers who reported that their professional learning activities were highly effective in improving certain practices

My 2019/20 professional learning activities helped me to a great extent to . . .	California math teachers ($n = 146$)	Non-California math teachers ($n = 1,882$)
Engage in instructional practices that more effectively meet student needs	24%	31%
Use my instructional materials more effectively to meet student needs	17%	28%

Source: RAND American Educator Panels, American Teacher Panel, 2020

California math teachers spent fewer hours engaged in professional learning activities in 2019/20 than non-California math teachers did, and fewer hours than their English language arts and science counterparts in California did. Math teachers were asked to estimate the number of hours of professional learning they had received since the end of the 2019/20 school year that were focused on their math teaching. Thirty percent of California math teachers reported receiving more than two days of professional learning during this period, versus 45 percent of non-California math teachers and 39 percent of English language arts (ELA) and science teachers³ in California⁴ (Table 2).

California math teachers were less likely than non-California math teachers to report that their use of their math materials improved when they accessed online professional learning that they had found on their own. Fourteen percent of California math teachers, versus 28 percent of non-California math teachers, indicated that their use of their instructional materials improved to a great extent through online professional learning that they had found on their own.

California math teachers were less likely than non-California math teachers to report that participating in collaborative learning with peer math teachers helped them improve their use of their math materials. The results from the survey administered in spring 2020 are similar to those of the surveys administered in spring 2018 and spring 2019, with some exceptions.

³ The authors of this brief explored differences in teachers' perceptions of their professional learning by subject area. The perceptions of math teachers differed from those of ELA and science teachers, which may be related to the different timelines for the adoption of the ELA/ELD framework and the Next Generation Science Standards (NGSS). However, because math teachers are the teachers impacted by the revised math framework and so are the focus of this brief, ELA and science teachers are grouped together for comparisons in these analyses.

⁴ The survey authors also explored variation among math teachers by grade span, and the results were similar.

Table 2. Percentage of teachers who reported number of hours of professional learning since the end of the 2018/19 school year

Since the end of last school year (2018/19), can you estimate roughly how many hours of professional development you received altogether that were focused on your [ELA/math/science] teaching?	California math teachers (n = 146)	All California teachers (n = 415)	California ELA/science teachers (n = 269)	Non-California math teachers (n = 1,882)
0 hours	7%	7%	6%	5%
Less than 8 hours	31%	32%	33%	28%
8-16 hours	32%	26%	22%	23%
17-32 hours	12%	15%	18%	24%
33-48 hours	9%	10%	11%	11%
49-64 hours	6%	6%	6%	4%
65+ hours	3%	4%	4%	6%

Source: RAND American Educator Panels, American Teacher Panel, 2020

For example, unlike in previous years, a smaller percentage of California math teachers (27 percent) than non-California math teachers (34 percent) indicated that collaborative learning with other teachers, such as professional learning communities (PLCs), that focused on their math teaching helped them improve their use of their instructional materials to a great extent. Similarly, a smaller percentage of California math teachers (25 percent) than non-California math teachers (33 percent) indicated that collaborative learning focused on the use of their instructional materials helped them improve their use of their materials to a great extent.

California math teachers' views were more positive on the topic of coaching; they were more likely than non-California math teachers to report that coaching helped them improve their use of their math materials. At the same time, as in previous years, California math teachers (27 percent) were more likely than non-California math teachers (19 percent) to report that coaching focused on their teaching helped them improve their use of their instructional materials to a great extent. Moreover, 33 percent of California math teachers also indicated that coaching focused on the use of their instructional materials helped them improve their use of their materials to a great extent, versus 18 percent of non-California math teachers.

Table 3 shows the percentage of teachers who indicated how different types of professional learning activities helped them improve their use of their instructional materials to a great extent.

Table 3. Percentage of teachers who indicated that different types of professional learning activities helped them improve their use of their instructional materials to a great extent

This school year (2019/20), to what extent have the professional learning activities in which you participated helped you improve your use of your main materials?	California math teachers (n = 147)	All California teachers (n = 417)	California ELA/science teachers (n = 269)	Non-California math teachers (n = 1,880)
Online learning I access on my own	16%	20%	23%	18%
Collaborative learning with other teachers (e.g., professional learning communities) focused on [ELA/math/science] teaching	27%	28%	28%	34%
Collaborative learning with other teachers (e.g., professional learning communities) focused on use of my main [ELA/math/science] instructional materials	25%	27%	29%	33%
Coaching focused on my [ELA/math/science] teaching	27%	18%	9%	19%
Coaching focused on use of my main [ELA/math/science] materials	33%	19%	9%	18%
Workshops or trainings focused on use of my main [ELA/math/science] materials	21%	17%	14%	17%
Other (specified) in-person trainings that I access on my own	14%	20%	26%	28%
Workshops or trainings focused on [ELA/math/science] teaching	18%	12%	8%	15%
General (not subject-specific) workshops or trainings	8%	7%	5%	10%

Source: RAND American Educator Panels, American Teacher Panel, 2020

Although California math teachers may be less effusive about their professional learning experiences and may have received fewer professional learning hours in 2019/20 than teachers in other contexts, they are nonetheless more likely than their peers to report that instructional coaching has helped them improve their use of their instructional materials to a great extent. Given the strong evidence regarding the positive impacts of coaching interventions compared with other types of professional learning (see, for example, Campbell & Malkus, 2011), there may be an opportunity to build upon California's existing math coaching systems moving forward as the expectations of the math framework revision reach the field.

Looking Ahead: Considerations for California Math Educators' Professional Learning

Considering the fundamental shifts in math attitudes and practices sought by the January 2021 draft framework (and the aligned instructional materials that will follow its adoption) and acknowledging California math teachers' views of their recent professional learning, it seems clear that systems of professional learning across the state will need to adjust and adapt in the next few years. And given California's size and decentralized funding and governance structures, county offices of education, regional alliances, and school districts will play a significant role in supporting professional learning (Finkelstein & Moffitt, 2018). The efforts of these entities should improve the dispersion of professional learning and related supports for the framework rollout, as they have in the past.

Recent research has identified the characteristics of strong professional learning and effective formats for its delivery. The most beneficial professional learning features teachers actively engaging with colleagues to dive deeply into content and curriculum, providing practical examples, rich feedback and reflection, and sustained engagement over time (Darling-Hammond et al., 2017). This type of learning can be delivered effectively in different ways, such as through instructional coaching, PLCs, or lesson

study, a research-based inquiry cycle of collaboratively researching, creating, teaching/observing, and then revising a lesson (CDE, 2021).

Two key steps education leaders can take to support the implementation of the final math framework are to build local administrators' capacity to improve teaching and learning and to leverage available resources in order to promote reflection and inquiry.

Build leadership capacity to improve math teaching and learning

After the California State Board of Education adopted the Common Core State Standards in Mathematics (CCSS-M) early in the last decade and the standards were rolled out to the field, some school and district leaders across the Golden State were initially unaware of where to find and how to use the available resources designed to support standards implementation, including the mathematics curriculum framework adopted in 2013. But this changed once professional learning was delivered regarding how to use the framework and its related resources (Finkelstein & Moffitt, 2018). Some California principals lauded the framework's helpful examples of standards-aligned instruction, while others noted that its length and complexity made it challenging for educators to use (Finkelstein & Moffitt, 2018). Evidence also suggests that in recent years California's principals have at times struggled to understand the instructional shifts called for by the CCSS-M and to determine how to help teachers make those shifts in the classroom (Perry et al., 2020).

In 2020, WestEd's Rebecca Perry, Frances Reade, and Stacy Marple published a knowledge brief, summarizing several years of their research,⁵ that emphasized the importance of building school and district leaders'

⁵ This knowledge brief was derived from the multi-year evaluation of Math in Common (MiC), an initiative launched by the S. D. Bechtel, Jr. Foundation in 2013. MiC provided funding to 10 diverse California school districts (Dinuba, Elk Grove, Garden Grove, Long Beach, Oakland, Oceanside, Sacramento City, San Francisco, Sanger, and Santa Ana) to share strategies for implementing CCSS-M in grades K–8, to discuss successes and challenges, and to collaboratively work toward improving implementation of the standards. WestEd's various MiC reports are available online at [MiC Summative Evaluation Reports](#) and [WestEd Resources: MiC Formative Evaluation Reports](#).

capacity for improving teaching and learning in math in new ways. Although such leaders do not necessarily need to develop the same level of math content expertise as lead teachers or instructional coaches, Perry and her colleagues advised that local leaders' professional learning experiences should help them develop new, relevant knowledge of the math standards and frameworks and the key instructional shifts needed at different grade levels. These learning experiences should also support these leaders in instituting reliable systems and schedules for meaningful classroom observations, feedback, and progress monitoring at their school sites (Perry et al., 2020).

The January 2021 draft math framework also stresses the critical role played by local administrators. For example, according to the framework, these local leaders can help “create and sustain a multi-layered system of support for teachers in their pedagogy and professional learning” (CDE, 2021, Ch. 9, p. 41) and can support their teachers “with the resources, time, insight, and encouragement to become ever-more effective practitioners of their craft” (Ch. 9, p. 51).

The design of local professional learning systems can be informed by periodic needs assessments and staff surveys to identify the topics that are most needed and desired by educators; sensing needs in this way can help professional learning developers remain flexible and adaptive as they monitor local changes (CDE, 2021, Ch. 9, p. 45). Local systems can also be shaped through knowledge sharing with peer leaders from other districts (centered around, for example, system design or the choice of technical assistance providers); such peer interactions can be highly valued by leaders (Perry et al., 2020).

21st Century California School Leadership Academy

One potential new forum for teams of leaders to work with and learn from one another about math improvement is the **21st Century California School Leadership Academy (CSLA)**. Funded by the California Department of Education, CSLA provides professional learning to California's educational leaders at no cost to participants. Supports include leadership coaching and an emphasis on improving instruction and achievement outcomes (including through distance learning) for English learners, students with disabilities, students from low-income families, and other students who are underserved historically. Beginning its program work in 2020, CSLA delivers services to leaders through regional academies — headquartered in Alameda, Kern, Placer, Riverside, Sacramento, San Diego, Shasta, Sonoma, and Tulare Counties — and is coordinated by the graduate schools of education at UC Berkeley and UCLA and by the California Subject Matter Project.

Leverage math vignettes and related resources for local reflection and inquiry

Both the 2013 math framework and the January 2021 draft math framework are long documents — over 500 and 900 pages, respectively — with multiple chapters. And the January 2021 draft math framework is organized around a set of new organizing concepts (e.g., “Drivers of Investigation,” “Content Connections”) that local leaders will need to understand and navigate as they reflect on and reconsider the design of their local systems of professional learning in math in the coming years.⁶ Practical guidance will be valued by the field.

⁶ Key concepts referenced in the January 2021 draft math framework include “Big Ideas” in math that link understandings and provide focal points for students' investigations, “Drivers of Investigation” that describe why learning math is important, “Content Connections” through the grade levels that describe what is to be learned and how, and the “Standards for Mathematical Practice” that describe the varieties of expertise (processes and proficiencies) that math teachers at all levels should seek to develop in their students.

As California administrators supervise the implementation of the math framework, the instructional vignettes (currently in Chapter 9 of the January 2021 draft math framework) can help them develop an awareness of what effective conversations and instructional practices look like in classrooms and schools, and they can reflect on the ways that they can nurture these types of experiences for their math teachers. For example, to ground the framework's organizing concepts in local contexts, 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.

Teaching Vignettes From the 2021 Draft Math Framework

The [lesson study vignette](#) developed by the California Action Network for Mathematics Excellence and Equity (CANMEE)⁷ describes how the 2nd grade teachers at 54th Street Elementary participated in a lesson study focused on building the agency of their multilingual students. The teachers engaged in a 30-hour cycle of study, plan, do/test, and reflect. Feedback was provided to the teachers by both an external math expert and the school's English language development specialist, and the teachers also invited other stakeholders, including their colleagues at the school and students' parents, to observe the public lesson. The teachers reflected together afterward, considered

⁷ CANMEE is a collaboration of the California Mathematics Project (CMP) and other state and national organizations that operates as a networked improvement community (NIC) and relies on lesson study to support and sustain excellence and equity in math education.

the various stakeholders' comments, and identified ways to improve practice moving forward. They valued the specific focus on a local problem of practice and the external input provided, and all participants observed increased math agency among their focal students as a result of the lesson study process.

The [professional learning vignette](#) from the partnership of Tulare County and Youcubed⁸ describes a blended (online/in-person) model of professional learning for teachers and leaders across the 11 school districts that are part of the Central Valley Networked Improvement Community (CVNIC). Teachers focused on 5th grade math during the yearlong partnership, which included an online course in which each lesson was followed by a peer-group meeting facilitated by a county office of education leader. These in-person meetings engaged the teachers with rich, visual math tasks that showed the connected nature of math. Students were surveyed about their thoughts on math throughout the year, and county officials observed classrooms at different intervals. By the end of the school year, the students of the teachers in the network scored higher on the mathematics portion of the California Assessment of Student Performance and Progress (CAASPP), with particular improvements reported among girls, English language learners, and students who are economically disadvantaged.

Additional vignettes on coaching and professional learning will be included in a subsequent framework draft.

⁸ Youcubed is a nonprofit organization based at Stanford University that focuses on promoting math success through growth mindsets and innovative teaching. Partner districts work with Youcubed to design sustained, growth-mindset-based professional learning opportunities. Youcubed also provides extensive online courses and resources.

Conclusion

The coming months are an opportune time to reexamine the professional learning infrastructure around math teaching in California. In addition to the reconceptualized instructional guidance and the emphasis on equity put forth in the January 2021 draft math framework, California counties, local education agencies (LEAs), and schools are also rebuilding their policies and systems for the 2021/22 school year and acknowledging lessons learned from the pandemic and its differential impacts on certain groups of students. Schools are not just reopening, they are restarting, which presents an opportunity for innovation and new thinking. Moreover, recent state budget proposals include significant funding increases for education, including for professional development in the content areas. With key planning and foresight, these funds can be targeted to drive instructional improvement across the Golden State in 2022 and beyond.

Other Key Math Resources

Various other supports exist across California for supporting professional learning in math. The following resources have been cited in the January 2021 draft framework and elsewhere.

The [California Mathematics Project](#) (CMP) is a state-supported K-16 network dedicated to providing students with a rich, rigorous, and coherent mathematics curriculum taught by math teachers who foster all students' proficiency in mathematics — achieving equity in quality. The 19 regional sites of the CMP are co-led by university faculty and teacher leaders, creating high-quality professional learning focused on pedagogical and content knowledge development.

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, examining 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.

The [California Collaborative on District Reform](#), housed at the American Institutes for Research (AIR), seeks to inform district-level efforts to improve instruction and outcomes for all students in the state by bringing together practitioners, policymakers, researchers, and funders in ongoing evidence-based dialogue and collective problem-solving. Central to this effort is the identification of persistent and pernicious opportunity gaps between advantaged students and students who are underserved historically, as well as strategies for addressing and eliminating these gaps.

The [Instructional Leadership Corps](#) (ILC) is a collaboration between the California Teachers Association, the Stanford Center for Opportunity Policy in Education, and the National Board Resource Center at Stanford. Since fall 2014, the ILC has developed and offered educator-driven professional learning to a network of teachers and leaders to deepen their understanding of instructional standards, advance collaboration, and share resources, including multiple tools and guides for leading professional development and advancing instructional capacity. Beginning in the 2021/22 school year, ILC will enter a new phase, building on lessons learned, focusing on strengthening partnerships, and embedding practitioner-led professional learning in local associations across the state.

References

California Department of Education. (2021, January). *California mathematics framework, first field review draft*. <https://www.cde.ca.gov/ci/ma/cf/>

Campbell, P. F., & Malkus, N. N. (2011). The impact of elementary mathematics coaches on student achievement. *The Elementary School Journal*, 111(3), 430–454.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development*. Learning Policy Institute. https://learningpolicyinstitute.org/sites/default/files/product-files/Effective_Teacher_Professional_Development_REPORT.pdf

Finkelstein, N. D., & Moffitt, S. L. (2018). Implementing the Common Core State Standards in California schools: A work in progress [Research brief]. *Getting Down to Facts II*. Stanford University and PACE. https://gettingdowntofacts.com/sites/default/files/2018-09/GDTFII_Brief_Standards_0.pdf

Perry, R., Reade, F., & Marple, S. (2020). *Building leadership capacity to improve math teaching and learning: Lessons from the Math in Common Initiative*. WestEd. <https://www.wested.org/resources/math-in-common-lessons-learned/>

RAND American Educator Panels, American Teacher Panel. (2020). *2020 American Instructional Resources Survey (AIRS)* [Data set]. RAND Corporation.

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