Math & Science Professional Learning and Infrastructure Development and Implementation: An Equity-Based Proposal from Educators, Stakeholders and Partners

An Urgent Need to Support Math and Science Student Achievement and Frameworks

Less than 40 percent of California's students met mathematics standards on the 2019 CAASPP (California Assessment of Student Performance and Progress) and fewer than 51 percent of 2020 high school graduates passed the courses needed to be eligible to attend a California State University or the University of California. Too often, students from poorer urban and rural districts have limited quantitative reasoning options and less qualified and experienced teachers.

California's State Board of Education is scheduled to adopt a new framework for mathematics instruction in July 2022. (Frameworks translate content standards into guidance for curriculum and instruction for teachers, administrators, and curriculum developers). When approved, the revised framework has the potential to significantly shift California's approach to instruction to make math more inclusive and accessible and support all students in relevant mathematics learning for their educational and career aspirations, while also maintaining high standards for rigor.[1]

In 2016, California adopted a new science framework based on the Next Generation Science Standards (NGSS). The state did not invest in professional development for educators. Instead, philanthropic support and local investments supported training for California teachers to deliver instruction. Science teachers advise that implementation was and continues to be uneven and inadequate.[2] Support for teachers in the NGSS varies widely by region of the state and district. As a direct result, the majority of California students have little if any exposure to science while in elementary school. When science is taught in elementary grades, it is rarely taught in rural schools and schools with high proportions of students from low-income families and/or students of color, as these schools often lack sufficient facilities, equipment, instructional materials, and teachers with sufficient expertise and professional support to offer a comprehensive science curriculum to all students. In consequence, marginalized student groups are not offered science learning opportunities in the elementary grades and are on average, less prepared for advanced science courses that satisfy the A-G courses required for admission eligibility to California's public universities.

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[1]Rigor refers to a deep, authentic command of concepts, and does not mean making math harder or introducing topics at earlier grades; see Common Core State Standards Initiative for more information.

[2] Grace, J., Vandergon, V., Woodruff, R., Harris, E., A'Hearn, P., King, C., Poland, R., Sikorski, T., Tupper, D., Wygant, H.A. (2021). *Report of Findings: Status of Science Implementation in California 2019-2020*. Folsom, CA: California Association of Science Educators. https://cascience.org/application/files/2816/3458/4826/NGSS_Survey_Report_v1.pdf

State assessment data reflect California students' lack of access to science learning experiences. In 2019, less than 15% of California's Black students and less than 20% of Hispanic or Latino students met or exceeded standards on the California Science Test (CAST) across all tested grade levels. The portion of students meeting standards on the CAST was even lower among English learners (3%) and special education students (8%).[3] In comparison, though still unacceptable, less than 45% of white students and 60% of the state's Asian students met or exceeded standards.

At a moment when Californians are required to live in a new normal, combat current and future threats to public health, address racial injustices, and confront and quickly solve the inequitably distributed environmental effects of an increasingly warmer world, California must take immediate action to invest in science and mathematics education and support scientific and mathematics literacy in the populace to address these paramount challenges.

Proposal: Invest in Implementation and Teacher Professional Learning around the Mathematics and Science Frameworks

The math and science frameworks require a substantial investment in teacher leadership, professional development and materials to realize the full benefits of new approaches to math and science instruction. Without a **coherent, equitable investment**, implementation of the frameworks will be uneven, inconsistent, and inequitable. Local Educational Agencies (LEAs) with additional sources of local revenue or strong partnerships with professional development providers will be better equipped to offer their students standards- and framework-aligned instruction. Students in districts with fewer resources, fewer experienced teachers, and fewer opportunities for professional development will lack access to high quality instruction, which will further exacerbate the equity gaps in access and outcome data.

Our proposal has two parts: (1) build statewide infrastructure to build teacher leadership capacity and provide educator professional development, and (2) provide funding for professional development in LEAs exhibiting the greatest support needs (described in greater detail below) for general education teachers in the elementary grades (TK-5), as well as for teachers who teach English language development, special education, and those who specifically teach math and science courses across TK-12. The deep experience of California's math and science educator leaders informs this plan to empower teachers as leaders in this initiative.

The cost of this investment totals $388.025MM over three years with the breakdown as reflected in the chart below; see subsequent sections for more detailed breakdowns.

[3]Johnson, S. (2020, February 8). Less than a third of students met or exceeded standards on new science test. *Local News Matters.*https://localnewsmatters.org/2020/02/08/less-than-a-third-of-students-met-or-exceeded-standards-on-new-science-test

	Statewide Infrastructure Development	Professional Learning for Educators		Sub Totals By Content Area
Mathematics	$113.5MM	$96.125MM		$209.625MM
Science	$113.5MM	$64.9MM		$178.4MM
	Infrastructure Total	Professional Learning Total		TOTAL INVESTMENT
Sub Total By Component	$227MM	$161.025MM		$388.025MM

I. Build Statewide Infrastructure to Provide Math & Science Professional Development

Total Infrastructure Investment Over Three Years	**$227MM**
California Partnership for Math & Science Education	$62MM - $31MM for Math - $31MM for Science
LEA Math & Science Leadership Development	$165MM - $82.5MM for Math - $82.5MM for Science

California Partnership for Math & Science Education: $62MM

We recommend the state support the existing California Partnership for Math and Science Education (CAPMSE) statewide and regional communities of practices to support teachers in learning to implement the math and science frameworks. In existence since 2015, CAPMSE's communities of practice[4] provide space for professional learning and give teachers, instructional

[4]The idea of a Community of Practice is that by working and interacting regularly together on areas of common concern and passion, participants develop shared knowledge and expertise about how to improve implementation processes and outcomes in relation to those areas. Researcher Etienne Wenger refers to communities of practice as places where learning is a social activity that occurs in the context of lived experience' through 'mutual engagement, joint enterprise, and shared repertoire. For more, see: Perry, R; Salciccioli, M., & Le Fevre, L. (2021). The Value and Promise of California's Statewide Communities of Practice in Math and Science Education. San Francisco, CA: WestEd;.Salciccioli, M. & Perry, R. (2019). Perspectives on California's statewide math and science communities of practice. San Francisco, CA: WestEd; and Wenger, E. (1999). Communities of practice: Learning, meaning, and identity. London: Cambridge University Press.

coaches, and other educator leaders an opportunity to learn from and support one another. They also support coherence, coordination, and equity of access to and participation in professional learning opportunities and collaborative improvement initiatives across organizations and geographic regions. $62MM would be appropriated to CAPMSE via its COE fiscal sponsor to oversee and implement the following over three years:

- $20MM for the operating, programming, capacity building and personnel costs to ensure that CAPMSE's extant COPs continue building educator capacity, knowledge, and skill to implement the math and science frameworks, and to ensure equitable access to framework implementation support. Activities include:
    - ***Coordination and alignment*** of efforts across CAPSME's partner organizations including professional learning providers (e.g., non-profits, County Offices of Education and teacher-led organizations), family and community networks, expanded learning programs, and other education partners. A step in this work will be to develop a landscape professional support map to understand where CAPMSE's partners currently provide support and the nature of that support (e.g., what content, what intensity, what quality, what frequency). The mapping will help to identify areas and LEAs where other statewide initiatives designed to strengthen mathematics and science instruction and learning already exist, identify gaps in the content and reach of those existing efforts, and inform a plan to more evenly and equitably distribute support for LEAs statewide. This work will enable CAPMSE's leadership team (representing a diverse group of statewide partners) to collaboratively plan for an aligned, phased rollout of the mathematics framework that meets the needs of administrators, educators, community members, and students, target regions that have not yet begun to implement the 2016 science framework, and strengthen regions where implementation has been inconsistent and inequitable in anticipation of imminent inclusion of science performance data on the California School Dashboard. This science work also aims to actualize the 2021 Blueprint for Action for Equitable K–12 Science Education in California authored by a coalition of science education and leadership organizations working together under CAPSME's collaboratory structure.
    - ***COP expansion*** including tailored outreach to LEAs in the state that do not currently participate in CAPSME's extant COPs, with particular attention paid to remote, small and/or rural county offices of education (COE) and districts that have not benefited from related participation in statewide initiatives, grants and other opportunities in the past 10 years. Districts and

middle-and small sized, remote county offices of education that offer limited course sequence options as defined by Area C and D of the UC/CSU A-G subject requirements, have the lowest rates of advanced science and mathematics course taking, demonstrate low performance outcomes, lack evidence of science instruction in elementary/K-5 settings (and potentially additional criteria), and that serve high populations of low-income students, youth in foster care, students of color, English learners, and/or students with special needs will be targeted with priority; **the aim will be to expand participation to include equitable representation from 250 districts and/or counties in *each* content area.[5] Every participating LEA will be represented on the COP by *at least one* content specialist (which can include ELD and special education teachers and specialists), Teacher on Special Assignment (TOSA), instructional coach or classroom teacher and *at least one* district or site administrator.** Funding for their time and expertise to participate in this capacity building work will be provided by their LEA through allocations described in the infrastructure section below. These representatives will also co-facilitate their *local-level* professional development leadership teams described in Part II. Activities to support COP expansion will include a landscape analysis to identify and target local education agencies and recruitment and onboarding of districts and counties into existing COP structures including a needs assessment to identify working groups/shared needs.

- ***Continuous improvement and other supports*** designed to build COP member capacity to support LEAs to implement the math and science frameworks, developed and facilitated by CAPMSE's math and science leadership committees which include representation from a diverse set of statewide partners (e.g., informal education organizations, expanded learning organizations, county offices of education and school districts, CTA's Instructional Leadership Corps, and various statewide agencies including CDE). Support provided would be needs-based and likely include programming on innovative staffing models, professional development delivery methods and equitable mathematics and science instruction aligned to the ideas, practices and strategies put forth in the frameworks as well as aligned to the resources and materials developed and described below
- ***Travel and related expenses*** to offset meeting costs, administrative costs, etc.

[5] *CAPMSE's statewide and regional COPs currently represent educators, scholars and leaders from: 48 county offices of education and multiple districts within them; 40+ statewide agencies, collaboratives, science informals, research organizations, and professional learning providers; 15 institutes of higher education.*

- ***Coordination and monitoring*** of distributed funds and other components as articulated above and below

- $32MM distributed across CAPMSE's statewide partners for the design of professional development for use by local educational agencies and with a focus on ensuring science and mathematics instruction is rigorous and relevant for California's linguistically and culturally diverse students, including low-income students, youth in foster care, students of color, English learners, and students with special needs, and on ensuring mastery of the teaching and learning approaches articulated in the frameworks. Distribution of funds will be driven by partners' areas of expertise in mathematics and science, Universal Design for Learning, Special Education, English language development (ELD) and dual language instruction, and informed by the degree to which they already support LEAs and schools via statewide grant programs or other means (CCEE's Learning Acceleration System Grants; CDE's Educator Effectiveness Block Grants; etc.). All professional learning materials and resources will be developed in collaboration with teachers and made available statewide. CAPSME's extant state and regional communities of practice will be leveraged to support implementation and training in LEAs exhibiting the greatest need and gaps in support, as described above.

- $10MM over three years to support family and community organization involvement and collaboration around mathematics and science instruction and to participate in CAPMSE's statewide and regional COP to align efforts statewide. Activities could include but not be limited to funding for family/community convenings/festivals to highlight the new instructional practices and rationale for equity based approach to mathematics and science outlined in the frameworks; partnerships with community-based organizations that serve traditionally marginalized communities to ensure that framework roll-out and implementation is culturally and linguistically affirming and assets-based, and professional learning for family members and family-serving organizations such as learning hubs and parent-led organizations ; other.

LEA Math & Science Leadership Development: $165MM

The leadership development component described below is designed to address the challenges of inequitable access to high quality math and science learning experienced by students in LEAs with fewer resources, fewer experienced teachers, and fewer opportunities for professional development by targeting districts and middle-and small sized small, remote county offices of education that offer limited course sequence options as defined by Area C and D of the UC/CSU A-G subject requirements, have the lowest rates of advanced science and mathematics course taking, demonstrate low performance outcomes, lack evidence of science instruction in elementary/K-5 settings, and also serve high populations of low-income students, youth in foster care, students of color, English learners, and/or students with special needs.

- $165MM in funding allocated directly to LEAs participating in the infrastructure and capacity-building efforts described above: $82.5MM for science leadership team development and $82.5MM for math leadership team development over 3 years (with a goal of 250 participating LEAs in each content area by year 3). As described in the *"COP Expansion"* section, teams would include teacher leaders, classroom teachers and administrators and vary in number pending the size of the district/COE. Participating LEAs would demonstrate commitment to supporting classroom teacher and administrator participation in the program through a variety of means, for example: a commitment to adopting high-quality, standards-aligned instructional materials; funding an ELD and/or Special Education teacher or teacher leader to participate in the COP; stipends and appropriate coverage for additional classroom teachers and administrators to participate in local-level leadership teams described in Part II; etc.

    - Funds would support at least one teacher leader in math ***and*** at least one teacher leader in science (TOSA, classroom teacher or instructional coach) at 50% time and at least one site or district level administrator in math and and at least one site or district level administrator in science at 25% time from a total of ~500 LEAs by year 3 to serve as local framework implementation leaders and statewide COP representatives **(with the goal of reaching 1000 total district level math and science leaders, 500 per content area).** The number of teachers/administrators supported per LEA will vary pending the size of the district/COE. These teams will meet virtually regularly with statewide COP colleagues in small work groups, and twice a year in person at statewide COP convenings sponsored by CAPMSE in collaboration with statewide partners

Part II: Professional Development

Total Professional Learning Investment Over Three Years	$161.025MM
Science	- Leadership Team Costs: $18MM - Teacher Participation Costs: $46.875MM[6]
Math	- Leadership Team Costs: $18MM - Teacher Participation Costs: $78.125MM[7]

[6] *Estimate: 250 districts, each with ~150 science teachers (TK-5 and secondary) (very rough estimate) x cost equivalent of 5 days x $250 per day*
[7] *Estimate: 250 districts, each with ~250 math teachers (TK-5 and secondary) (very rough estimate) x cost equivalent of 5 days x $250 per day*

We propose $161.025MM over three years for the professional development needed to implement the math and science frameworks. Funds would be distributed directly to LEAs (districts and small COEs) exhibiting the highest need for implementation support in math and science, and used to support the involvement of a local team of classroom teachers, teacher leaders, and district and site administrators in the *design of* and *participation in* professional learning. The LEA representatives participating in the state-level capacity building efforts described above would facilitate these local teams. As aforementioned, qualifying LEAs would demonstrate commitment to supporting teacher and administrator participation in the program through a variety of means, for example: a commitment to adopting instructional materials; collaborating with partner organizations in the statewide math and science communities to design professional learning; stipends for additional classroom teachers, TOSAs and/or administrators to participate in local-level leadership teams (beyond those supported through the funding allocations described below). Districts with financial stress could demonstrate commitment through board resolutions supporting science or mathematics education; priority for participation would be based on need.[8]

Funds would be expended over three years (beginning *after funding is delivered* and once infrastructure efforts described above commence):

- Year 1- Develop and support district teams of up to 9 classroom teachers, teacher leaders, TOSAs or instructional coaches (representing TK-12 with expertise in math or science, English language development and/or dual language instruction, and special education) and up to 3 school site and/or district administrators. LEA team members participating in the infrastructure efforts described above would facilitate this team. Teams would work to develop district plans, develop leadership skills, explore relevant ways of delivering embedded professional learning, and deepen knowledge of content and frameworks. Team size will vary pending LEA size. Estimated cost for ~500 districts (combined math & science) with a $2,000 stipend paid to ~12 team members per content area for their time and effort: $12MM.

- Years 2 & 3 - Local level leadership team work continues, PD begins with teachers district-wide or county-wide for small counties. Leadership team cost: $24MM/year for stipends for two additional years. Funds for teacher involvement in professional learning across both content areas would total $125MM for two years. Combined costs for years 2 & 3 would total ~$149MM.

[8] *E.g., LEAs serving high populations of low-income students, youth in foster care, students of color, English learners, and/or students with special needs with the lowest rates of advanced science course taking, low rates of meeting A-G requirements in science, absence of science in elementary/K-5 settings, etc.*