Toward an Instructional Infrastructure to Support Instructional Improvement in PreK-3 Mathematics:

Four Districts' Experiences with the California Education Partners

Cynthia E. Coburn, *Northwestern University*
Abigail Stein, *Carnegie Mellon University*
Angel Xiao Bohannon, *NORC at the University of Chicago*
Laila Bárcenas, *Northwestern University*
Melanie Muskin, *Northwestern University*

Northwestern | SESP
VANDERBILT UNIVERSITY
UCLA School of Education & Information Studies

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Executive Summary

Learning in pre-kindergarten (pre-k) is often disconnected from learning in elementary which can compromise student learning and fail to take advantage of the gains children made in preschool. This situation may be especially dire in mathematics, as preschool and elementary school teachers are typically more comfortable with—and spend more time teaching—literacy than mathematics. Prior research has documented the challenges of bringing together pre-K and elementary, especially related to building connections between pre-K and elementary (we call this continuity) and connections across different instructional supports (we call this alignment). School districts are now attempting to bridge the disconnect between pre-K and elementary by creating stronger pathways for students from pre-K through their early elementary years to sustain the gains made in preschool.

This report shares the findings from our study of California Education Partners, a not-for-profit organization that partnered with midsized California school districts to launch the Pre-K to 3 Coherence Collaboration from Fall 2020 until Spring 2023. Our study investigated the experiences of four school districts who participated in the collaboration. This report focuses on the degree to which school districts made changes in what we call their infrastructure for instructional improvement during the course of the Pre-K to 3 Coherence Collaborative. We define infrastructure for instructional improvement as the multiple supports that school districts use to coordinate and maintain instruction quality. Here we focused on six elements of each district's infrastructure: instructional frameworks, pedagogical approaches and instructional materials, student assessments, teacher learning, school leader learning, and instructional oversight.

At the end of the initiative, we found that all four districts in our study made multiple changes in their infrastructure for mathematics during the initiative, although to varied extents. For example, all four districts made changes to their pedagogical approaches, instructional materials, and teacher learning, although some went further and made changes to their instructional frameworks (Avalon, Birchwood, and Cedarville districts), school leader learning (Avalon, Cedarville, and Diamond districts), and system for instructional monitoring (Cedarville and Diamond districts). We found that:

1. The majority of changes across all four districts were substantive rather than merely added on top of ongoing structures and practice.
2. The changes in all four districts were more likely to be consistent with the vision of mathematics promoted by California Education Partners than not.
3. All four districts increased the degree to which the elements of their infrastructure were aligned.
4. All four districts made changes to their pedagogical approaches and instructional materials by adopting California Education Partners' signature practice: Counting Collections. Two districts went further and incorporated the high-leverage pedagogical practices (a broader set of mathematical practices fostered by California Education Partners) into their expectations for teacher pedagogy beyond the Counting

Collections activity.

5. And, crucially, we found that all districts extended the changes they made to include pre-K, except for the district that eliminated pre-K from their district in the final year in order to expand their TK offerings.

We found that the nature and level of changes that districts made in the consistency, alignment, and continuity of their infrastructure for mathematics was due, in part, to their participation in the initiative, their pre-existing district capacity, and the role of their district leadership in the Pre-K to 3 Coherence Collaboration.

Participation in the initiative. Districts embraced the focus of the initiative and worked to integrate pre-K and TK-5 into elements of their infrastructure. They were able to work on a broader and more systemic range of infrastructure elements given California Education Partners' encouragement, and also incorporated specific approaches and strategies they learned about through the Pre-3 Coherence Collaboration.

Pre-existing district capacity. Districts' baseline capacity and prior experience with the specific approaches to mathematics played an important role in the substantiveness of change they made. Districts were more likely to bring the lessons from the initiative into elements of their infrastructure in ways that transformed them when they started out with established and functional elements.

Role of district leadership. Finally, leadership mattered. Fostering systemwide district change seemed to require not only participation of leaders who had the authority to orchestrate changes, but also those who were on board with the specific approaches to mathematics that was the focus of the initiative.

This study has implications for educational leaders, policy makers, and those who wish to support districts in improving instruction for their youngest learners and bridging the pre-K to elementary divide, especially in mathematics. First, **districts can create systems of support that bridge pre-K and elementary**. This report provides existence proofs that, while challenging, it is possible to strengthen district systems for supporting high-quality mathematics instruction across the pre-K to elementary divide. Second, **external providers can support districts in building infrastructure for pre-K to 3**. Even as their approach was emergent and evolving, California Education Partners assisted districts in making substantial progress. Several features of the initiative's approach seemed to make a difference: simultaneous focus on both teaching and learning in classrooms and district systems, a broad view of district systems necessary to support instructional improvement, elevating the voices of pre-K leaders and teachers, learning opportunities and support to multiple levels of the system, and taking the lessons about job-embedded professional development to the system level. Third, **moving toward pre-K to elementary alignment and continuity is a developmental process**. Districts with pre-existing capacity were more able to make changes in their infrastructure that touched more elements, were more substantive, and more aligned. However, districts that started without a given

element of their infrastructure in place were sometimes able to establish them. Finally, **district systemic change requires district systemic leadership**. Building an infrastructure for instructional improvement in mathematics requires systemic change. As such, leadership with positional authority that spans these realms appears to be crucial for aligned and consistent changes.

Building a district infrastructure for pre-K to elementary mathematics is challenging work. But it is work that has the potential to support teachers in making instructional improvement that creates more seamless pathways in support of student learning across the pre-K to elementary divide.

Introduction

Learning in pre-kindergarten is often disconnected from learning in the primary grades. Teachers at different grade levels typically use different curricular materials and instructional strategies, repeat material that students already know, or provide instruction for which children are insufficiently prepared.[1] The disconnect between pre-K and early elementary school can compromise student learning and fail to take advantage of the gains children made in preschool.[2] This situation may be especially dire in mathematics, as preschool and elementary school teachers are typically more comfortable with—and spend more time teaching—literacy than mathematics.[3]

School districts in California and across the country are now attempting to create stronger pathways for students from pre-K through their early elementary years. These efforts, often known as pre-K to 3 initiatives, seek to sustain the gains made in preschool by ensuring access to high-quality and connected educational experiences from pre-K to 3rd grade.[4] These districts are aligning standards and assessments, establishing single site leadership for pre-K to Grade 5 schools, and developing a repertoire of professional development strategies that bring together pre-K, transitional kindergarten (TK), and kindergarten teachers.[5] The dawn of universal TK in California has presented another opportunity to consider ways of building bridges across the pre-K/elementary divide for our youngest learners.

Prior research on efforts to foster pre-K to 3 has documented the challenges of bringing together pre-K and elementary. These challenges include the existence of separate departments for early childhood and elementary instruction at both the state and district levels, with few connections between them leading to the provision of parallel and uncoordinated supports for teachers at different levels of the system.[6] The parallel, uncoordinated, and at times conflicting systems of support for pre-K and elementary are held in place by separate funding streams and regulations, as well as differing educator beliefs about what constitutes high-quality instruction in the early childhood versus elementary space[7]. This state of affairs makes what we call continuity—connections between pre-K and elementary—challenging to achieve. At the same time, we know from research on K-12 education that coordination across the various elements of instructional support (i.e. standards, curriculum, instruction, professional learning, and more)—which we call alignment—is important for instructional improvement.[8] These findings point to the need for a more robust and coordinated infrastructure for instructional improvement in districts that stretch from pre-K through elementary.

1 Cohen-Vogel et al., 2021; Engel, Claessens, & Finch, 2013; Bassok et al., 2016
2 Engel et al., 2013; Reynolds, Magnuson, & Ou, 2006
3 Copley, 2004; Platas, 2008
4 Kauerz, 2006; Bogard & Takanishi, 2005; Graves, 2006
5 Marietta & Marietta, 2013; Nyhan, 2015; Valentino & Stipek, 2016
6 Coburn et al., 2018; Stein & Coburn, 2023
7 Stein & Coburn, 2023; Whyte & Coburn, 2022
8 Whyte et al., 2016

In Fall 2020, California Education Partners, a not-for-profit organization dedicated to enabling California school districts to surface solutions and promote change that enable their students to thrive, launched an initiative to foster pre-K to 3 coherence in mathematics instruction in small to midsized school districts across California. Among other things, the Pre-K to 3 Coherence Collaboration sought to build coordinated and aligned district systems to support high-quality teaching and student learning in mathematics across the preschool and elementary divide. They recruited 10 California school districts to engage with them in a three-year initiative, which they considered a pilot program to adjust and refine their approach. Indeed, they referred to these districts as "pilot districts."[9]

This report shares findings from our study of California Education Partners' work with the pilot districts. From January 2021 until August 2023, we documented the supports that California Education Partners provided to the pilot districts, and the challenges and opportunities, successes and areas for improvement that four of these districts experienced as they sought to develop district systems to foster instructional improvement in mathematics from pre-K to 3. We focus on the degree to which each district made changes in their instructional infrastructure in mathematics, or "the coordinated roles, structures, and resources that school systems design and use to support and coordinate instruction, maintain instructional quality, and enable instructional improvement".[10] An instructional infrastructure typically includes a district's mathematics framework, curriculum and pedagogy, assessments, teacher and school leader learning opportunities, and instructional monitoring. In most districts, these elements focus solely on K-12 instruction. The districts in the Pre-K to 3 Coherence Collaboration sought to extend these elements to include pre-K, focus them on high-quality mathematics instruction, and create greater connections between the elements so that they were mutually supportive.

We found that, even as the districts navigated the COVID-19 pandemic and its aftermath, all four districts in the study made substantial changes to their district-level infrastructures for instructional improvement in mathematics. The majority of the changes were consistent with the vision of high-quality mathematics instruction that districts learned about during professional learning opportunities provided by the initiative. All districts increased the degree to which at least some elements of their infrastructure were aligned with one another. And, crucially, we found that nearly all districts extended any changes they made in their district supports for instructional improvement to include pre-K. At the same time, there was variability in the nature and level of changes districts were able to make. We argue that the changes that districts made and their variability within and across districts was related to the scaffolding and support provided by the Pre-K to 3 Coherence Collaborative, districts' pre-existing capacity, and the degree to which those leading the initiative in the district had positional authority to make system-wide changes.

9 Following the pilot district cohort, California Education Partners has continued their work with three subsequent cohorts of districts.

10 Cohen, Spillane, & Peurach, 2018, p. 205

While districts across the country are attempting to work against the historic separation between pre-K and elementary to bring systemic supports for high quality instruction to their youngest learners, we know more about the challenges than about the kinds of supports that enable districts to make such changes. This report, in charting the achievements of four districts involved in the Pre-K to 3 Coherence Collaboration, provides insight into pathways to develop systems of instructional improvement at the district level that bridges the pre-K to elementary divide.

Methods

This analysis draws on 2.75 years of data focused on understanding the supports that California Education Partners provided to four small to midsized California districts to foster district systems to support early childhood mathematics, and how these four districts shifted their systems of support in response. We selected four of the 10 initial pilot districts that varied in size and prior experience with California Education Partners to participate in our study.

The study unfolded during the height of the pandemic, from January 2021-September 2023.[11] In spite of pandemic conditions, all four districts remained committed to and were actively engaged in the initiative. Our research effort, though, had to be responsive to schools' and districts' changing needs and conditions. We had to repeatedly rethink our research design in response to the windy road of the pandemic and the challenges it posed for public schools. Most pertinent for the analysis we present here, data collection at the district level was uneven across the four districts in the first six months of data collection (January-June 2021). We were able to complete the full round of interviews in two of the four districts, but interviewed fewer people in the other two districts, limiting what we learned from interviews in that first six months. Fortunately, we were able to observe district activities and convenings which had switched to be virtual. We also have full access to all project documentation for all four districts during that first year.

To understand the supports that California Education Partners provided to districts, we observed 110 hours of convenings and professional development sessions, collected and analyzed California Education Partners' documents (n=851), and interviewed California Education Partners staff twice a year for all three years and consultants once a year in years 2 and 3 (n=41). To understand the ways in which districts changed their infrastructure for supporting early childhood mathematics from 2020-2023, we drew on twice annual interviews with each district's leadership for the initiatives (called the improvement team in most districts) as well as annual interviews with district superintendents for a total of 105 interviews. We supplemented these interviews with district documents, including the documents that they worked on as part of the initiative, observations of improvement team meetings, initiative meetings and professional development, as well

11 The Pre-K to 3 Coherence Collaboration began Fall 2020. We began data collection in January 2021 after the grant supporting this work was fully executed.

as perspectives of California Education Partners' staff and consultants who worked most closely with each district. (For more detail about our methods, please see Appendix A.)

Strategies for Fostering Pre-K to 3 Alignment and Continuity

To understand how participation in the Pre-K to 3 Coherence Collaboration helped districts to strengthen their infrastructure to support mathematics instruction across the pre-K and elementary divide, it is necessary to understand the kinds of experiences that districts had as part of the Pre-K to 3 Coherence Collaboration.

California Education Partners' Pre-K to 3 Coherence Collaboration aimed to build participating districts' capacity to support pre-k to 3rd grade coherence in mathematics, with the goal of improving classroom practice and subsequently, student outcomes. They took a systemic approach to instructional change, with the intention of simultaneously supporting pre-K to 3 teacher learning and improving district policies and structures. They brought together a network of school districts using a "collaborative, continuous improvement" approach so districts could collectively learn together, as well as share and test promising practices for fostering pre-K to 3 coherence[12]. In these efforts, California Education Partners aimed to center the expertise and perspectives of educators, given their beliefs that "the professionals already working in our public school system are the ones most capable of improving outcomes for each student".[13]

California Education Partners also aimed to ground pre-K to 3 coherence efforts in research evidence on pre-K to 3 mathematics instruction, "match[ing] district leaders with researchers" so that districts could "secure research evidence to guide their decisions".[14] For example, California Education Partners worked closely with several university-based researchers with expertise in mathematics teaching and learning and early childhood education throughout the initiative. Among other things, these university-based researchers led ongoing professional development learning opportunities for teachers and school leaders involved in the initiative. In collaboration with these research partners, California Education Partners worked to foster a vision of mathematics instruction rooted in cognitively guided instruction[15] and aligned with Common Core State Standards-Mathematics. Specifically, they encouraged districts to move toward classroom instruction that builds on what students already know about math, provides opportunities for students to collectively make meaning of mathematics, elicit students' mathematical thinking as they solve problems, use students' mathematical thinking to inform instructional decisions, and position each student to see themselves as capable in mathematics.

12 California Education Partners, 2024
13 California Education Partners, 2024
14 California Education Partners, 2024
15 Carpenter et al., 1999; Carpenter et al., 2016

Strategies for fostering preK-3 alignment and continuity	
1. Intentional recruitment	Intentionally recruited small or medium-sized districts that served large populations of historically marginalized students, had their own preschool programs, had superintendent buy-in, and represented a mix of new and alumni districts.
2. Creation of district Improvement Teams	Required districts to form teams to take leadership of the initiative that typically included an upper-level district leader, head of early childhood education, district leadership in math education, pre-K to 3 teachers, and school leaders. The composition varied by district.
3. Convenings	Held convenings for participating district improvement teams three times a year to learn together, reflect on their current work, and plan next steps. District teams shared ideas, engaged in continuous improvement activities, built shared understandings of their pre-K to 3 district systems, and collectively learned about mathematics instruction.
4. Shared Learning Opportunities (SLOs)	Along with university partners, offered virtual professional development to all teachers, school leaders, and district leaders in participating districts focused on high-quality mathematics instruction.
5. Coached team leads	Provided monthly individualized coaching to improvement team leads using an "I do, we do, and you do" approach.
6. Superintendent convenings	Brought superintendents from districts participating in any California Education Partners project together twice to provide updates and professional learning opportunities.
7. Continuous improvement approach	Used continuous improvement as a vehicle for analyzing district systems; identifying, testing, and adapting promising practices for fostering PK-3 coherence; and supporting collective learning across multiple districts around a shared aim.
8. Develop a common assessment	Encouraged districts to adopt a common assessment to routinely collect data and track student learning.
9. Analyze and build district systems to improve pre-K to 3 coherence	Encouraged districts to analyze and adapt their current systems and build new ones to better connect early childhood and elementary to support mathematics instruction.

By analyzing 34 interviews[16] with California Education Partners' staff and agendas from 30 meetings and convenings across the three years, we identified nine core strategies that California Education Partners used with the pilot districts. (See Table 1 for a description of the strategies.) California Education Partners started by **intentionally recruiting** (strategy 1) small or medium-sized California districts that served large populations of historically marginalized students, had their own preschool programs, had superintendent buy-in, and represented a mix of districts who had worked with California Education Partners in the past and ones new to their work. They asked participating districts to form what they

16 This number differs from the total number of interviews collected because we chose to analyze data only from those staff and consultants who had insight into California Education Partners' strategies.

called an **improvement team** (strategy 2) to guide the district efforts. The composition of the improvement team varied by district, but typically included an upper-level district leader (e.g. assistant or associate superintendent), the head of early childhood education, district leadership in mathematics education, teachers (including pre-K teachers) and school leaders.

Throughout the initiative's three years, the pilot districts participated in on-going learning routines. First, California Education Partners held **convenings** (strategy 3) three times each year that brought together improvement teams from all pilot districts to learn together to reflect on their current work, participate in professional learning, and plan next steps. During the convenings, district teams often shared ideas with each other, engaged in continuous improvement activities, built shared understandings of their pre-K to 3 district systems, and collectively learned about high-quality mathematics instruction. Second, California Education Partners also offered what they called **shared learning opportunities (SLOs)** (strategy 4) between the convenings. These virtual offerings, facilitated by university-based research partners with expertise in math teaching and learning, provided professional development on high-quality mathematics teaching and learning to teachers, school leaders, and district leaders beyond the district improvement teams. Third, California Education Partners staff **coached team leads and district improvement teams** monthly (strategy 5). Coaching involved an "I do, we do, and you do" approach where California Education Partners staff would, for instance, model how to facilitate a meeting, co-facilitate the meeting with the team lead, and then have the team lead facilitate. Fourth, the superintendent in each district was invited to attend **superintendent convenings** (strategy 6) twice a year. These convenings, which brought together superintendents from the Pre-K to 3 Coherence Collaboration districts as well as those involved in other initiatives with California Education Partners, were designed to keep superintendents updated on initiative developments while also providing opportunities for superintendents to connect with each other and engage in professional learning.

Because California Education Partners were navigating pandemic realities, and because they were intentionally experimenting and refining strategies for supporting districts' efforts to improve mathematics instruction from pre-K to 3, the specific strategies they used during learning routines—and their relative emphasis—shifted somewhat across the three years.

In year 1, California Education Partners led participating districts through a **continuous improvement approach** (strategy 7) as a vehicle to develop pre-K to 3 coherence. They engaged districts in a root cause analysis, had them develop aim statements, design driver diagrams, identify tests of change, gather data related to their change ideas, and developing implementation plans for carrying out the work. Because few districts routinely collected data on student learning in mathematics pre-K to 3 at the start of the initiative, California Education Partners staff worked with their university-based research partner to develop a **common assessment** (strategy 8) called the Learning from Children Growth Assessment and encouraged districts to adopt it as a way to track the degree to which their tests of change contributed to student learning, if at all.

In partnership with university-based researchers, California Education Partners also worked to develop districts' capacity to provide high-quality mathematics instruction in the early grades by providing professional development during convenings and SLOs that was focused on students' mathematical thinking and problem solving. They offered and provided training on a pedagogical approach called Counting Collections as a tool to help teachers enact these approaches.[17] Counting Collections is a pedagogical activity that asks students to count to figure out how many objects are in a collection and make a representation of what and how they counted.[18] California Education Partners' research partners recommended Counting Collections as a focal activity. This research partner explained, "The choice of Counting Collections was very purposeful for creating space to have specific and detailed conversations about the teaching and learning of mathematics and how to make that coherent." The idea was to provide teachers preschool through grade 3 with a math task that elicited student discourse and focused on problem-solving, and which enabled teachers to practice pedagogical approaches that were not commonly used in traditional mathematics curricula while gaining a greater understanding of students' mathematical thinking. A common task also allowed teachers across grades to share their experiences teaching in a way that was new to many of them. Ultimately, the goal was that teachers would incorporate insights gained from Counting Collections, including pedagogical insights and insights about students' mathematical thinking, into other aspects of their teaching. A California Education Partners' staff member explained at the time: "The goal is to basically use Counting Collections as a vehicle to start to disrupt your [classroom instructional] system a little bit."

Finally, California Education Partners helped participating districts analyze and adapt their current **district systems** (strategy 9), as well as build new systems in order to foster pre-K to 3 coherence. More specifically, in year 1, they encouraged districts to take steps to break down the silos in between early childhood education and elementary, encouraging more interchange between pre-K and elementary at the school and district level.

In Year 2, California Education Partners shifted their focus on **continuous improvement** (strategy 7), moving away from specific tools and processes toward what they referred to as the principles and ideas that undergirded continuous improvement. For instance, California Education Partners shifted away from a focus on the specific continuous improvement tool of plan-do-study-act cycles to the general principle that educators could learn about what works in their specific contexts by iteratively testing change ideas and collecting data on these tests. They continued to encourage districts to adopt a **common assessment** (strategy 8) in mathematics across the early grades. However, faced with the political and operational complexity that districts experienced in adopting the Learning from Children Growth Assessment, California Education Partners shifted to working with districts to identify their own assessment to use to track student learning in mathematics across the early grades. As one California Education Partners staff explained: "We can't have every district do [the Learning from Children Growth Assessment]...Can we take

17 Franke et al., 2018

18 DREME, n. d

whatever the district is already doing, and make that in a way that supports conversations, that supports pre-K through three coherence?"

Also in year 2, California Education Partners continued to work with districts to build teacher capacity to provide high quality mathematics instruction in the early grades via professional development in the **convenings** and **SLOs** (strategies 3 and 4). However, they shifted from a focus on Counting Collections specifically, to Counting Collections as a vehicle for fostering a broader set of mathematical practices which they called high-leverage pedagogical practices. They did this in part because they found that teachers were focusing on the specific activity rather than the general teaching strategies it was designed to promote. The high-leverage pedagogical practices were:

1) Elicit students' mathematical ideas,

2) Use what is learned from students' strategy use to make decisions about what task to pose next,

3) Allow students to use tools and representations of their own choosing,

4) Have conversations in math class where students share their ideas with one another,

5) Ask follow up questions that are specific to what the students said or did, and

6) Position each student to see themselves as capable in mathematics.

California Education Partners also encouraged districts to think more comprehensively about the range of **district systems** that would need to be aligned to foster pre-K to 3 coherence (strategy 9), creating what they called the Coherence Framework to guide districts' efforts. The Pre-K to 3 Coherence Framework articulated four main levers for fostering pre-K to 3 coherence: clear expectations for pre-K to 3 grade level standards, common high-leverage pedagogical practices, monitoring pre-K to 3 student progress to guide decision-making, and building teacher and administrative capacity. They also encouraged the districts to begin to think about scaling up some of their successful practices to more classrooms and schools.

In Year 3, California Education Partners continued with their approaches to **continuous improvement** principles (strategy 7), to encourage districts to adopt a **common assessment** in early mathematics (strategy 8), and to focus on building district capacity in mathematics by incorporating high-leverage pedagogical practices in the **convenings**, **SLOs**, and **team lead coaching** (strategies 3, 4, and 5). However, this effort shifted to include a greater emphasis on developing school leader capacity to support teachers' efforts. For example, the SLOs focused on school leaders rather than teachers and California Education Partners encouraged districts to incorporate a focus on the high-leverage pedagogical practices into school leader learning routines. They continued to encourage districts to work toward greater alignment in their **district systems** (strategy 9) to support pre-K to 3 coherence, focusing especially on creating a district mathematics vision and aligning instructional systems. Finally, California Education Partners shifted their efforts on district systems to focus on sustainability. To that end, California Education Partners asked im-

provement teams to plan how to sustain pre-K to 3 coherence work and spread it across more of their respective districts after the initiative ended.

The Four Districts in the Study

We partnered with four districts in the pilot cohort to learn about their efforts and experiences with the Pre-K to 3 Coherence Collaboration. At the time of the study, **Avalon Unified School District** served approximately 7,000 students pre-K through grade 12. Over 90% of its student population was Latine with 86% of students qualifying for free and reduced lunch. A quarter of students were English Language Learners and 15% of students had Individualized Education Programs (IEPs). See Table 1 for an overview comparison of district demographics. Avalon had worked with California Education Partners on another project. They chose to join the Pre-K to 3 Coherence Collaboration to bolster continuity and alignment across pre-K to 3 math because they were dissatisfied with the number of English Language Learners in third grade who were proficient in mathematics according to the math Smarter Balanced Assessment System (SBAC). A top district leader explained that the initiative seemed like a good match for the district's instructional goals, which included "problem-solving, focus on language in math, Counting Collections, numeracy, and a big focus on making sure that our students who are learning an additional language have opportunities to talk about the math and talk about their thinking around that."

The smallest district in our study, **Birchwood School District** was a single school district with a pre-K to 8 school that served around 300 students. Over 90% of the district's students were Latine and 55% of students identified as English Language Learners. Birchwood students were predominantly socioeconomically disadvantaged with nearly 92% qualifying for free and reduced lunch. Birchwood joined the Pre-K to 3 Coherence Collaboration because they felt their math scores reflected a need for more exposure to academic language so that all students, including multilingual learners, could see themselves as capable mathematical thinkers and communicators. According to one district leader at the time: "Our students did not know how to communicate what they were learning in math or communicate how they were solving math problems…A big piece on the Smarter Balanced Assessments and in the Common Core State Standards is being able to explain their thinking, explaining how they got

Table 1. District demographics

District	# Pre-K to 12 Students	% Latine Students	% free and reduced lunch	% English Language Learners	% IEP	% students experiencing homelessness
Avalon	7,000	90%	86%	25%	15%	5%
Birchwood	300	90%	92%	55%	12%	2%
Cedarville	11,000	62%	64%	26%	15%	20%
Diamond	16,000	94%	90%	50%	17%	14%

there. Just as important as answering the question." Birchwood leaders were familiar with California Education Partners because they had participated in a prior initiative with them.

At the time of the study, **Cedarville School District** served over 11,000 students, pre-K to 12. Cedarville had the most racially and ethnically diverse student population of the four districts with 62% Latine, 19% White, 5% Black, and 4% Asian. Twenty six percent of students were English Language Learners and 15% of students had IEPs. Of the four districts, Cedarville had the most socioeconomic diversity with 64% of students qualifying for free and reduced lunch. Around 20% of students were experiencing homelessness. Cedarville was new to working with California Education Partners. They chose to participate in the initiative because they sought to improve their 3rd grade math scores and believed they could do so by spending more instructional time on rigorous and authentic math tasks in the early grades. District leaders also hoped that would help them spread their districtwide math vision by strengthening connections between their assessment system, math curriculum, and professional learning opportunities.

Finally, **Diamond School District** was the largest in our study with over 16,000 students at the time. Ninety-four percent of students enrolled were Latine with over 50% identified as English Language Learners. Nearly 90% of students qualified for free and reduced lunch and 14% of students were experiencing homelessness. Just over 17% of students had IEPs. Diamond joined the Pre-K to 3 Coherence Collaboration because they felt their teachers could benefit from learning more about how to teach math in the early grades. Diamond also participated in the initiative to forge connections between its elementary schools and early childhood programming. According to the superintendent, the initiative "was [a] project that responded to the need for something concrete that can give life to this idea of pre-K as part of the school district. Pre-K as not an added or this thing for the little ones…This was another venue to give that professional value to the pre-K teachers and the pre-K director, the early ed director."

Changes in Instructional Infrastructure in Early Childhood Mathematics

From Fall 2020 until Spring 2023, the four districts in our study worked with California Education Partners to foster greater connections between pre-K and elementary teaching and learning in mathematics. As part of this work, they endeavored to build stronger infrastructure for instructional improvement in mathematics to support high quality mathematics instruction across the pre-K to elementary divide and, ultimately, students learning. We found that all four districts in our study made multiple changes in their infrastructure for mathematics during the initiative, although some made more extensive and substantive changes than others. The districts made these changes despite unprecedented turbulence (e.g., COVID, school closings, leadership turnover, dramatic state-level policy shifts).

To investigate changes in infrastructure, we analyzed each district's infrastructure prior to the start of the initiative and at the end. Recall that we define infrastructure as "the coordinated roles, structures, and resources that school systems design and use to support and coordinate instruction, maintain instructional quality, and enable instructional improvement".[19] For information about each district's infrastructure prior to the start of the initiative, we drew on data gathered by California Education Partners about each district's initial capacity, supplementing that data with retrospective interviews with district leaders. To understand the nature of each district's infrastructure at the end of the initiative, we analyzed district leaders' interviews and artifacts that reflected district policies. We then analyzed the nature of changes in each element and the connections between them over time. We focused on six elements of each district's infrastructure:

1. *Instructional framework.* The district's vision for high-quality mathematics instruction.
2. *Pedagogical approaches and instructional materials.* The adopted or district-developed mathematics curriculum and any specific pedagogical practices that are encouraged.
3. *Student assessments.* The summative or formative evaluations of student progress in mathematics and any plans for using the data sanctioned by the district.
4. *Teacher learning.* Professional learning opportunities or other forms of support for teachers to improve their mathematics instruction.
5. *School leader learning.* Professional learning opportunities or ways in which school leaders are mobilized to improve mathematics instruction in their school.
6. *Instructional oversight.* The processes by which mathematics instructional quality and student learning are measured, tracked, and acted on.

We analyzed all changes in the district's mathematics infrastructure, regardless of whether they were specifically related to the Pre-K to 3 Coherence Collaboration, because all districts in the study were engaged in mathematics improvement that went beyond their work with the Pre-K to 3 Coherence Collaboration. For example, Cedarville adopted a mathematics curriculum the second year of the initiative and worked on its implementation with an outside provider unrelated to California Education Partners. We considered this curriculum adoption when we analyzed changes to their pedagogical approaches and instructional materials.

We analyzed the changes in infrastructure along four dimensions: substantiveness, consistency, alignment, and continuity. By *substantiveness*, we refer to the degree to which changes were add-ons or altered pre-existing ways of doing things. By *consistency*, we mean the degree to which the changes were consistent with mathematics instruction fostered by California Education Partners. Consistency is important to the pre-K to 3 work because strong infrastructures cohere around explicit goals for students' mathemati-

19 Cohen, Spillane, & Peurach, 2018, p. 205

Definitions of the dimensions of infrastructure change

Substantiveness: *The degree to which changes were add-ons or altered pre-existing ways of doing things.*

Consistency: *The degree to which the changes were consistent with mathematics instruction fostered by California Education Partners*

Alignment: *The degree to which the changes linked together different infrastructure elements*

Continuity: *The degree to which the changes better connected and scaffolded teaching and learning across grade levels from pre-K to the third grade*

cal learning and a clear vision of mathematics instruction.[20] By ensuring that infrastructure elements are all consistent with California Education Partners' vision for student learning and teachers' instruction, all teachers from pre-K to the third grade will receive clear and consistent messages about how to focus and deliver instruction as well as the materials and professional learning opportunities to do so. By *alignment* we mean the degree to which the changes linked together different infrastructure elements. Alignment ensures that elements work together and mutually support consistent approaches to mathematics.[21] Studies show that alignment is associated with change in teachers' classroom practice and increased student learning.[22] Finally, we define *continuity* as the degree to which the changes better connected and scaffolded teaching and learning across grade levels from pre-K to the third grade. Continuity refers to how well instruction in each grade builds on and extends what children have learned in the previous grade using similar high-quality instructional strategies. Continuity is important because there is evidence that students who have more seamless educational experiences as they move across grades have better educational outcomes[23]. See Appendix A for more information on data collection and analysis.

We found that all four districts made changes to multiple elements in their mathematics infrastructure. The majority of those changes were substantive rather than add-ons. They were more likely to be consistent with the vision of mathematics promoted by California Education Partners than not. All districts increased the degree to which the elements of their infrastructure were aligned, although fewer stretched beyond instruction, assessment, and teacher learning to include other elements of infrastructure. And, crucially, we found that all districts extended the changes they made to include pre-K, except

20 Cobb et al., 2018
21 Whyte et al., 2016
22 Newman et al, 2001; Polikoff et al., 2012; Wonder-McDowell et al., 2011
23 Engel et al., 2013

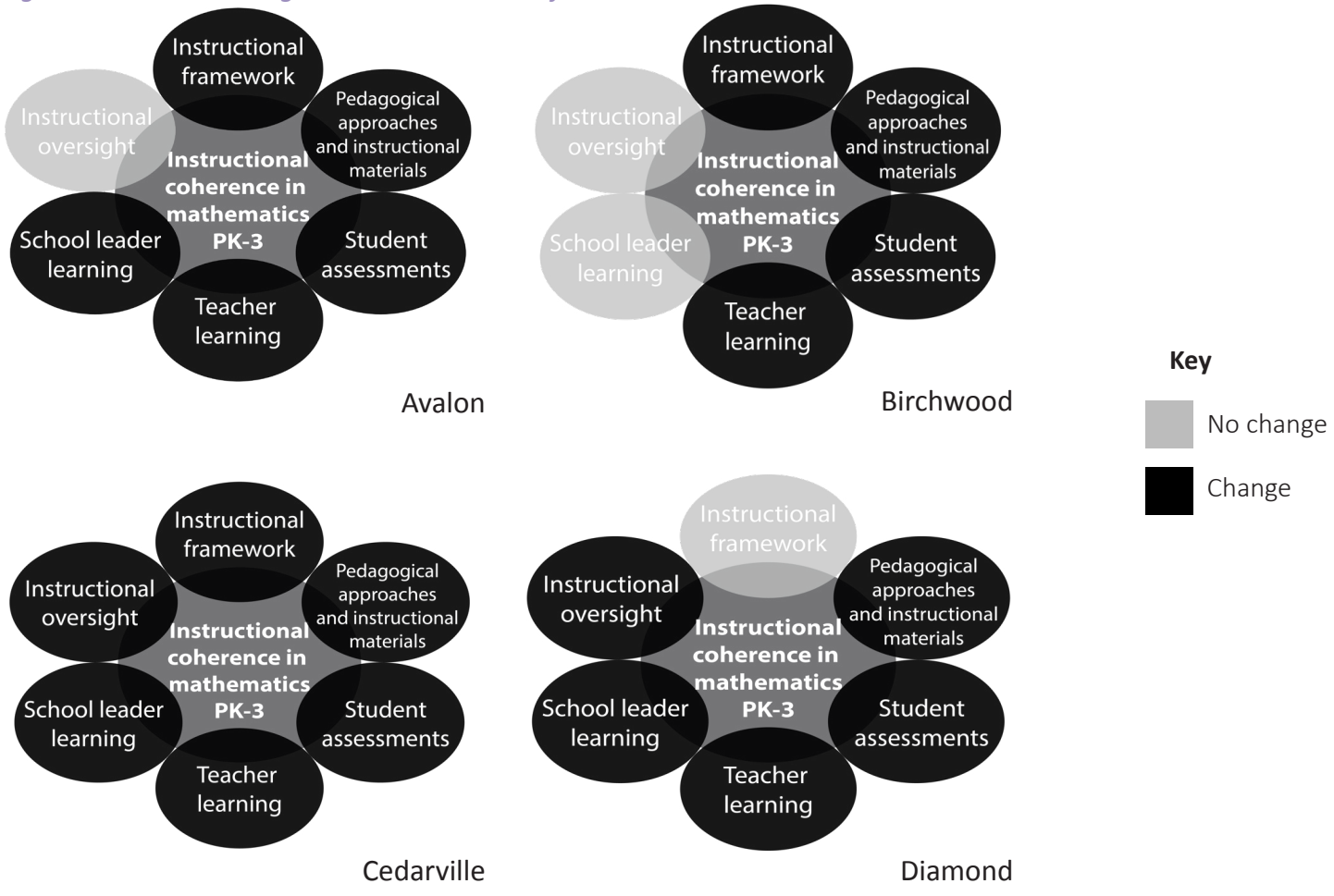
for the district that eliminated pre-K from their district in the final year in order to expand their TK offerings.

Changes in mathematics infrastructure

All four districts made multiple changes in their infrastructure for mathematics during the initiative (see Figure 1). For example, all four districts made changes to their pedagogical approaches and instructional materials by adopting Counting Collections as a signature practice. Two districts went further and incorporated the high-leverage pedagogical practices into their expectations for teacher pedagogy in math beyond the Counting Collections activity. For example, a district leader in Cedarville described their focus on the high-leverage pedagogical practices in year 3:

> At the elementary level, we have the P3 coherence [collaboration], which, really, has been focusing on bringing the high-leverage pedagogical practices into classrooms and into student experiences. That's been a very clear focus, and we've been doing that... through coaching models, through lesson studies, through district-wide preschool through third grade articulation meetings and book studies, and deepening the work, and access for students, and doing that through some of those venues.

Figure 1. Districts' changes in mathematical infrastructure



Two districts also adopted curricula at the same time that they were involved in the Pre-K to 3 Coherence Collaboration.

All four districts also made changes to their teacher learning opportunities during the initiative. For example, Diamond brought in instructional coaches from an outside organization who worked with teachers around the high-leverage pedagogical practices. As one staff member from California Education Partners explained:

> Essentially what [research partner providing the professional learning has] done is they try to do two rounds of lesson lab at the school site. They're focusing this year specifically on their TK through third grade teachers, engaging them in this experience. In the fall they do the—in one day, they do an AM session, a PM session, and then the coach for that day does an hour PD with the whole staff. Again, we were like: how do you take the ideas from summer [PD offered by the district]? They learned these things, but how do you carry them throughout the school year? That was one approach.

The two districts that adopted new curricula also worked with publishers to provide teacher learning opportunities related to the new curricula.

Despite the multitude of changes to multiple elements of the districts' infrastructure for mathematics, there were also some elements in some districts that did not change. For example, Cedarville and Diamond made changes to their system for instructional oversight while Avalon and Birchwood did not. Diamond was also the only district that did not make changes to their instructional framework. They did not have a mathematics vision at the start of the initiative and did not create one during the initiative.

Substantiveness of change

Remarkably, districts' changes to elements in their infrastructure tended to be quite substantive (see Table 2). We categorized the substantiveness of district change as either an add-on or a change that transformed the element. If the change added a new practice or approach to an existing way of doing things without changing the existing way of doing things, we called this "add on." For example, Cedarville started the initiative with an assessment system that involved a lot of separate assessments that did not necessarily cohere. They found it difficult to gain traction on moving toward an assessment system that was aligned to the vision of mathematics that was represented in their own mathematics framework and other elements and included pre-K. In year 3, they were able to add what they referred to as "street data"—formative assessments that gave teachers insight into students mathematical thinking— to their assessment system pre-K to 3. Because they added street data to their already existing assessment system without making other changes to the system, which they considered to be problematic, we coded this change as "add on."

In contrast, we viewed the district's development of a new instructional framework as "transformational." By our definition, "transformational" changes served to shift existing

ways of doing things by integrating mathematics into an element that was content-neutral, making the element more systemic, or changing the core approach. For example, at the start of the initiative, Avalon had an instructional framework that was, by their own account, fairly general and content neutral. During the initiative, they developed a mathematics-focused version of their framework that was specific about the kinds of teaching and learning they were striving for as a district. This framework emphasized the high-leverage pedagogical practices promoted by California Education Partners. The change went beyond adding on a specific activity or focus to shift the nature of the element itself.

As illustrated in Table 2, districts transformed 14 of the 20 elements they changed during the initiative. Table 2 also illustrates that Avalon and Cedarville were more likely to make changes that transformed elements than Birchwood and Diamond.

Table 2. Substantiveness of change in elements

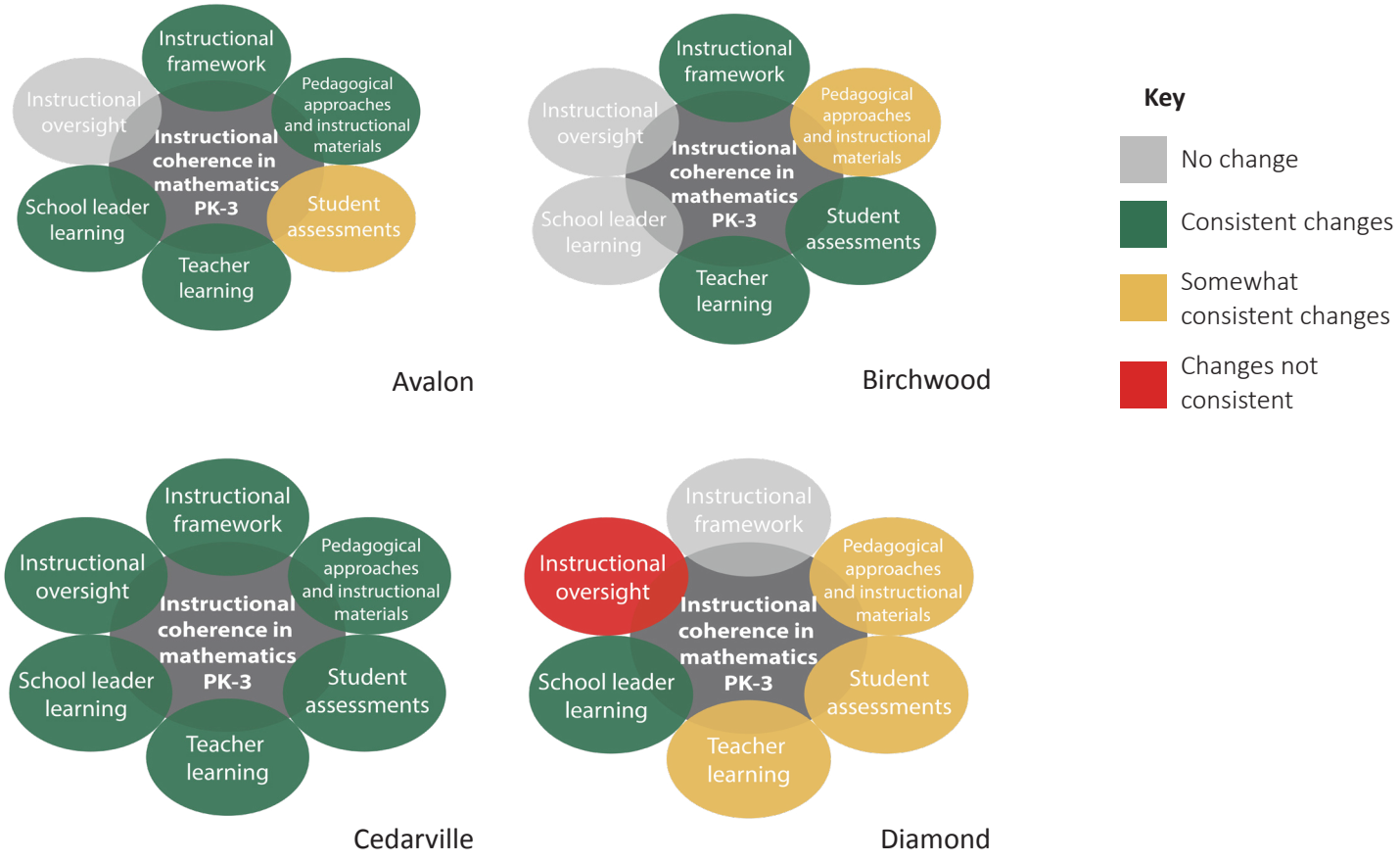
District	No change	Add on	Transform
Avalon	1	0	5
Birchwood	2	3	1
Cedarville	0	1	5
Diamond	1	2	3
Total	4	6	14

Consistency of changes

While all four districts made changes in multiple elements of their mathematics infrastructure, many of which were substantive, not all the changes were consistent with California Education Partners' vision of early childhood mathematics. As shown in Figure 2, most of the changes districts made in their infrastructure in Avalon, Birchwood, and Cedarville were consistent with the vision of mathematics fostered by the initiative. For example, Cedarville incorporated the high-leverage pedagogical practices encouraged by California Education Partners into their mathematics instructional framework. The district also provided guidance to teachers to enable them to use their newly adopted curriculum in ways that were consistent with this vision of mathematics. They set expectations that all teachers use Counting Collections. Their emphasis on "street data," although an add-on, was consistent with California Education Partners' emphasis on student thinking and problem-solving. They also shifted their instructional oversight system such that classroom walkthroughs incorporated the high-leverage practices into their observation rubrics and focused more on formative forms of feedback that illuminated what students were thinking.

At the same time, some districts made changes to their infrastructure that were somewhat consistent or inconsistent, as indicated by yellow and red in Figure 2. For example, at the same time that Diamond engaged in professional development related to the high-leverage pedagogical practices with the Pre-K to 3 Coherence Collaboration, they also focused on the implementation of a new supplemental curriculum promoting a basic-skills version of math fluency, coupled with a new mathematics assessment focused

Figure 2. Districts' consistency across infrastructure changes



on speed, which they saw as a way to boost standardized test scores. Because the district encouraged teachers to use Counting Collections on the one hand and the basic skills fluency curriculum on the other, we consider these changes in infrastructure to be mixed in consistency with the approach to mathematics emphasized by the California Education Partners. The district also created a system to monitor and oversee student usage of the new fluency curriculum but did not include attention to Counting Collections as part of this oversight. One district leader explained how and why they monitored implementation of the new supplementary curriculum:

> We're also pulling the data from [the supplementary fluency program] and their student participation rates. We can dial down all the way by student, but we're doing it for teachers so they can see how their usage correlates to our district bench mark assessment. We're correlating [scores on the fluency assessment] with progress on the benchmark assessment so they can see the impact of [supplementary fluency program]. We're using our benchmark assessment because that is correlated to California Assessment Program, the CAASPP. We're showing teachers to do [the supplementary fluency program], it's gonna reflect in the benchmark and the benchmark will show them where the kids are in the CAASPP.

We considered the change in instructional oversight in Diamond to be inconsistent, as indicated by the red oval in Figure 2.

Changes in alignment

The degree to which the four districts created better alignment between elements of their infrastructure also varied. Recall that alignment is the degree to which the changes linked together different infrastructure elements. As shown in Figure 3, all four districts made changes that created stronger alignment between pedagogical approaches & instructional materials, student assessments, and/or teacher learning. For example, Birchwood expected all teachers to use Counting Collections in their classroom and the Learning from Children Growth Assessment. Professional learning for teachers focused on both practices. In short, all three elements were connected, creating greater alignment.

Figure 3. Districts' alignment across infrastructure changes

Three of the four districts—all except Birchwood—forged connections between elements that stretched beyond pedagogy and curriculum materials, assessment, and teacher learning. For example, Avalon, Cedarville, and Diamond made connections to school leader learning. Cedarville and Diamond extended alignment to instructional oversight. For example, Cedarville incorporated expectations around pedagogical practices into their instructional rounds, consistently focused those rounds on mathematics, and utilized an observation rubric that they learned about through the initiative. In this way, Cedarville focused district monitoring on the approaches to classroom instruction they were encour-

aging teachers to adopt and enact. Cedarville also made connections to their instructional framework by incorporating the high-leverage pedagogical practices and ensuring they were a clear and consistent focus for teacher learning opportunities.

Not all of these new connections were consistent with the approach to mathematics fostered by the initiative, which we indicate in Figure 3 with a red line between the elements. For example, although Diamond created stronger connections between assessment and monitoring, they did so in ways that strengthened alignment in a mathematics approach (timed fluency tests) that was inconsistent with the approach to mathematics encouraged by the Pre-K to 3 Coherence Collaboration.

Changes in continuity

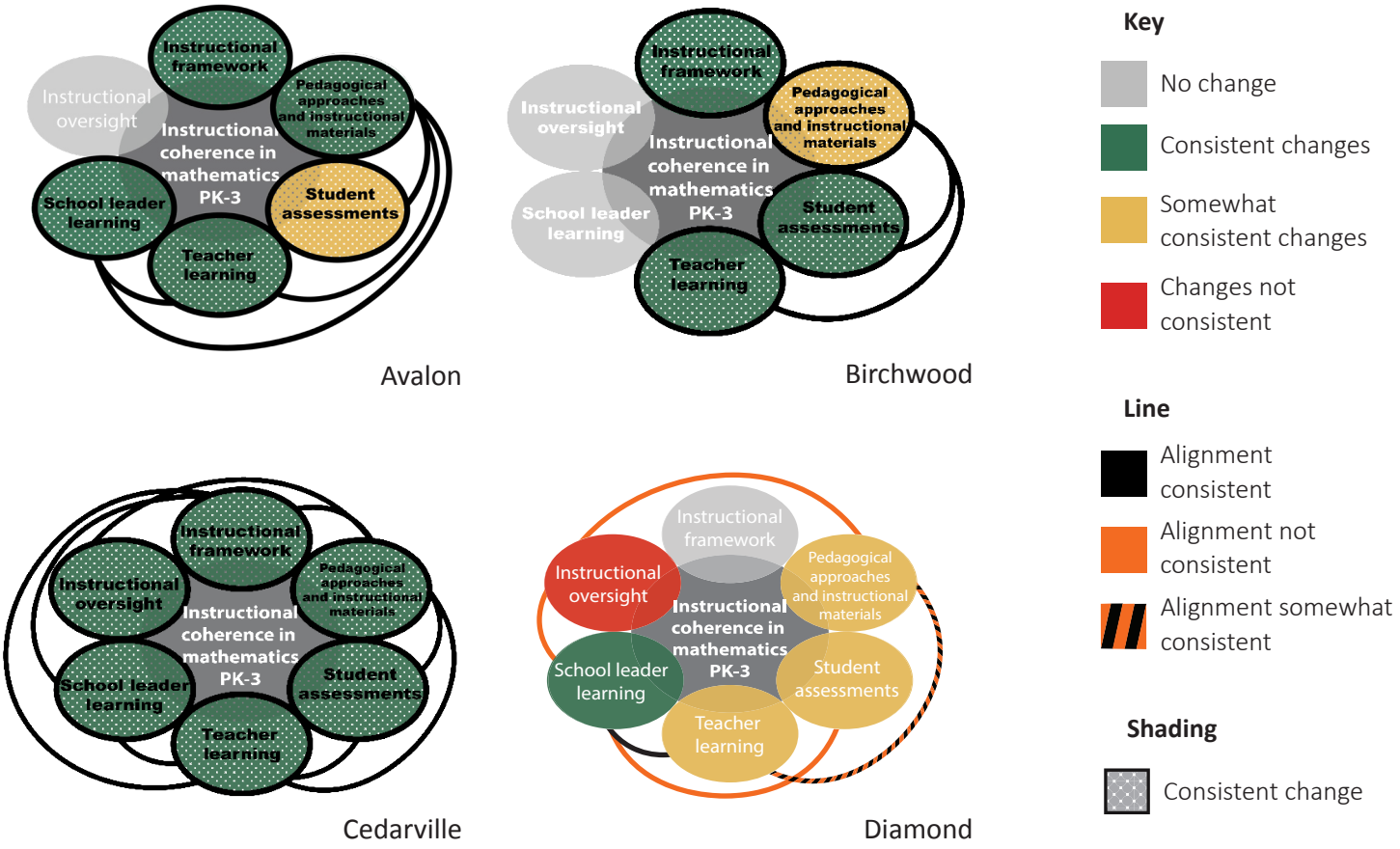
All districts except Diamond made substantial gains in extending their mathematics infrastructure to include pre-K, fostering continuity. Recall that continuity is the degree to which the changes better connected and scaffolded teaching and learning across grade levels from pre-K to the third grade. Given what we know about the challenges of bringing the pre-K system and the TK-12 systems together,[24] this is no small feat. As shown in Figure 4, all infrastructure changes made in Avalon, Birchwood, and Cedarville created stronger continuity between pre-K and TK-3. For example, as Avalon shifted their instructional framework from a content neutral and fairly general instructional framework to one for mathematics that was more detailed, they extended it to pre-K. When Avalon adopted Counting Collections as a signature practice and set expectations related to the high-leverage pedagogical practices, they extended this expectation to pre-K with the goal of creating learning environments that feel seamless and connected as students move through the grades. They also made significant changes to their assessment system to better align with the new expectations for classroom instruction and worked to bring pre-K into the system in thoughtful ways so they could track student growth across the early years of their education. Regarding teacher learning, the primary district math coach transitioned from coaching K-5 teachers to an expanded coaching role that included pre-K and TK. Although professional development in Avalon did not bring teachers together across grade levels, coaching for pre-K to 3 teachers had a common focus on Counting Collections and the high-leverage pedagogical practices. Changes to school leader learning also brought pre-K into the fold through monthly learning opportunities facilitated by the district math coach around Counting Collections, the high-leverage pedagogical practices, and how to implement these practices at their individual sites.

Diamond did not achieve continuity because they eliminated their pre-K program in the final year of the initiative. In response to California's newly passed universal TK policy, they shifted four year olds in their pre-K program into TK, using existing pre-K spaces for TK classrooms. That said, they had made strides in building continuity between pre-K and elementary prior to eliminating pre-K. For example, they had included pre-K teachers in their teacher learning opportunities for the first time. However, because they no lon-

24 Stein & Coburn, 2023

ger had pre-K teachers in the final year of the study, we do not consider them as having achieved continuity at the end of the initiative.

Figure 4. Districts' continuity across infrastructure changes



Summary

Achieving better consistency, alignment, and continuity in infrastructure is a difficult task for districts.[25] The task is even more difficult when districts must bridge two historically separate systems: pre-K and K-12.[26] All four districts in this study made significant strides in this regard, making changes in their infrastructure for instructional improvement in mathematics that transformed the way they supported teachers in improving mathematics instruction. The majority of these changes were consistent with the vision of mathematics instruction encouraged by the initiative. They also created better alignment across elements, which research has shown to foster instructional change[27] and increased student learning.[28] And, perhaps most important given the objectives of the initiative, they created greater connections between pre-K and TK-3, which we call continuity.

25 Hatch, 2001
26 Stein & Coburn, 2023
27 Polikoff et al., 2012
28 Newman et al, 2001; Wonder-McDowell et al., 2011

There was some variability in the changes that districts were able to make during the three years of the initiative. Districts were more likely to make changes to their curriculum and pedagogical practices, assessment, and teacher learning, than school leader learning, instructional framework, and instructional monitoring. While most changes transformed pre-existing ways of doing things, some changes were more modest in scope as districts added a specific practice or approach to pre-existing ways of doing things. While most of the changes were consistent with high quality mathematics instruction, there were two districts that made changes that were of mixed consistency, and one district that made changes in multiple elements that were inconsistent. Finally, while most districts made changes in elements that created greater alignment with other elements, some districts created new elements or made changes to existing ones without aligning them to other elements in their infrastructures.

Explaining Changes in Infrastructure

We argue that the nature and level of changes that districts made in the consistency, alignment, and continuity of their infrastructure for mathematics was due, in part, to their participation in the initiative, their pre-existing district capacity, and the role of their district leadership in the Pre-K to 3 Coherence Collaboration. We close this section with a discussion of the role of district size in efforts to create a more supportive infrastructure for pre-K to 3 mathematics.

Participation in the Pre-K to 3 Coherence Collaboration

Recall that we analyzed any changes that districts made to their mathematics infrastructure regardless of whether they were related to the work that districts did with California Education Partners. Still, we found that many of the changes districts made were a direct result of their engagement with the Pre-K to 3 Coherence Collaboration. We considered changes to be related to participation in the Pre-K to 3 Coherence Collaboration if district leaders reported a direct connection, we witnessed districts making decisions related to infrastructure during our observations of convenings and professional development, or the changes districts made involved specific approaches emphasized in the initiative.

First, three out of the four districts made substantial progress in extending different elements of their infrastructure to include pre-K. The fourth district—Diamond—did as well prior to eliminating pre-K in year 3 of our study. We argue that this progress is a direct result from participating in the pre-K to 3 Coherence Collaboration. District leaders in all four districts reported that they joined the initiative explicitly to work on building stronger pathways between pre-K and elementary and the work with the initiative was the first time they endeavored to strategically connect the two systems. Indeed, a focus on pre-K was thread through nearly all of the California Education Partners strategies, from how they recruited districts to the composition of the improvement team (including

early childhood teachers and leaders) and activities in the SLOs, convenings, and coaching with team leads. This focus appeared to pay off as the districts made significant strides in building bridges between pre-K and elementary in multiple elements of their infrastructure for instructional improvement in mathematics.

Second, we also saw the influence of the initiative through all four district's focus on elements of their infrastructure that stretched beyond curriculum, assessment, and professional development. For years, districts across the country have been working to create greater alignment among elements of their instructional infrastructure. However, those efforts have largely focused on aligning a subset of their infrastructure to state standards: curriculum, assessment, and teacher professional development.[29] Further, these elements of infrastructure are typically a bit easier to align since in many districts they are under the auspices of a single department (typically, Curriculum and Instruction or Education Services). California Education Partners focused district leaders' attention on a broader set of elements implicated in supporting instructional improvement in mathematics, as reflected in the topics of their convenings and in a key tool they developed to assist districts in their work on their district infrastructure: the District Coherence Framework. The framework and convenings encouraged district improvement teams to focus on other elements such as school leader learning, instructional frameworks, and, in some districts, instructional oversight. Indeed, three out of four districts made changes to and forged alignment between the more traditional elements (curriculum, assessment, and teacher professional learning) and those beyond, such as school leader learning, instructional oversight, and instructional framework.

Third, we saw California Education Partner's influence in the specific ways that districts made changes to elements of their instructional infrastructure. That is, districts incorporated specific instructional strategies, assessments, or tools into various elements or undertook specific activities to improve a given element that they learned about during their work with the initiative. For example, all four districts adopted Counting Collections as a district-wide practice and two out of the four incorporated the Learning from Children Growth Assessment into their district assessment plans, specific practices that were suggested by California Education Partners and supported in the SLOs and/or convenings. Three of the four districts also redesigned their school leader learning system during the initiative's third year as they participated in activities related to school leader learning in the SLOs and convenings. District leaders also took specific activities from the Pre-K to 3 Coherence Collaboration convenings and replicated them back in their districts. For example, a district leader from Birchwood described engaging their teachers in an activity they learned about at a convening intended to help teachers take a critical look at the alignment between their curriculum and the standards, an activity that ultimately shifted how they used their curriculum:

> We have done some work with the lesson planning that we went through at the last California Education Partners convening around the "red light, green light activity" where they take their core curriculum, and then they take the standards, and

29 Burns et al., 2019

> they compare the two. Our teachers have trained other teachers in that process, and so they're using that as they plan lessons for the next week of really focusing on those lessons from the core curriculum that address standards specifically. If it doesn't, then they don't need to do it. The teachers have really liked that activity.

In many instances, California Education Partners' initial points of emphasis during the initiative shaped districts' change decisions and those decisions tended to stick. Indeed, we saw a trend toward more change in infrastructure elements and more connections between elements for points of emphasis that California Education Partners encouraged earlier in the initiative compared to later. For example, from the start of the initiative, California Education Partners intentionally encouraged districts to take up Counting Collections as an activity to introduce teachers to new pedagogical approaches and give them insight into children's thinking and reasoning across the grade levels. In the second year, California Education partners encouraged districts to move beyond Counting Collections to an understanding of how Counting Collections can promote the high-leverage pedagogical practices. While all four districts adopted Counting Collections as a signature practice, only two districts—Avalon and Cedarville—were able to move beyond Counting Collections to incorporate the high-leverage pedagogical practices into multiple elements of their infrastructure. We also see this pattern of early emphasis being especially influential in the degree to which districts forged alignment between elements. For example, the instructional framework and school leader learning were focused on much later in the initiative and across all four districts we saw fewer connections made between these elements and others in the infrastructure.

Districts' pre-existing capacity and prior experience

Districts' pre-existing capacity and prior experience also played a role in the changes they made to their mathematics infrastructure. More specifically, districts were more able to make substantive change in a given element when they had some pre-existing capacity with that element; that is, that the element was established and functional. In addition, districts' prior experience with the specific approaches to mathematics encouraged by the initiative also seemed to enable districts to move beyond Counting Collections to integrate the underlying high-leverage pedagogical principles into their elements in all math instruction.

Pre-existing capacity. Districts were more likely to shift a given element of their infrastructure in substantive ways that fostered alignment when the district had baseline capacity in that element. At the same time, pre-existing capacity did not appear to influence the degree to which districts were able to make changes that built bridges between pre-K and TK-3 systems (continuity). With the exception of Diamond, who eliminated their pre-K, if a district worked on an element during the course of the initiative, they incorporated pre-K into it. To analyze the role of district capacity at the start of the initiative, we categorized each element in each district at the start of the initiative in one of three ways: 1) did not exist; 2) emergent or incoherent; and 3) established and functional. We

defined emergent as when a district had a practice in place, but it was not systemic or routine. We defined it as incoherent if an element was in place, but disorganized and lacking in coherence. We defined an element as established and functional if it was systemic and regularized. In some cases, we considered elements established and function even if it was not focused mathematics at all, much less the approach to mathematics encouraged by the pre-K to 3 Coherence Collaborative. Next, we analyzed the relationship between pre-existing capacity and degree of substantiveness (no change, add on, transform), change in alignment, and change in continuity. (For more information on analysis, see Appendix A.)

Table 3. Role of pre-existing capacity in substantiveness of change in element

Capacity of element at start of initiative	Change in element by end of initiative		
	No change	Add on	Transform
Did not exist (n=7)	4	2	1
Emergent or incoherent (n=3)	0	2	1
Established and functional (n=14)	0	2	12
Total	4	6	14

As is illustrated in Table 3, districts were far more likely to make changes that transformed a given element when they had established and functional capacity in that element at the start of the initiative. Districts transformed 12 out of 14 elements that started off as established and functional. By contrast, districts were most likely to change elements that were emergent or incoherent by adding on (2 of 3) rather than transforming them (1 of 3). Finally, just over 50% of elements that did not exist at the start of the initiative still did not exist at the end (4 of 7). However, when districts did establish a new element, they were more likely to do so by adding a single practice (2 of 3) than creating a systemic approach or transforming them (1 of 3).

We also analyzed the relationship between pre-existing capacity and change in alignment. We found that pre-existing capacity did affect alignment, but to a lesser degree than its impact on the substantiveness of change. The vast majority of changes that districts made in elements created greater alignment (18 of 20 elements), regardless of the pre-existing capacity of the element (see Table 4). Simply put, if districts made a change in an element, they tended to do so in ways that created connections to other elements leading to greater alignment. At the same time, there was a greater chance that a change would lead to alignment when the ele-

Table 4. Role of pre-existing capacity in change in alignment

Capacity of element at start of initiative	Change in element by end of initiative		
	No change	Add on	Transform
Did not exist (n=7)	4	1	2
Emergent or incoherent (n=3)	0	0	3
Established and functional (n=14)	0	1	13
Total	4	2	18

ment already existed (that is, if were emergent/incoherent or established and functional). Changes in 16 of 17 emergent/incoherent or established and functional elements lead to alignment, compared to 1 out of 3 elements that did not exist at the start of the initiative.

Interestingly, districts made changes to foster continuity—that is, to better connect pre-K to elementary—regardless of the pre-existing capacity of the element. If the districts intentionally worked on a given element of their infrastructure and made changes during the initiative, they did so in ways that incorporated pre-K into the element (see Table 5).

Table 5. Role of pre-existing capacity in change in continuity

Capacity of element at start of initiative	Change in element by end of initiative		
	No change	Change did not foster continuity	Change fostered continuity
Did not exist (n=7)	4	0	3
Emergent or incoherent (n=3)	0	0	3
Established and functional (n=14)	0	0	14
Total	4	0	20

Prior experience with similar approaches to mathematics instruction. Districts with pre-existing experience with Counting Collections and/or similar approaches to mathematics instruction (e.g. Cognitively Guided Instruction), even when these approaches were not systemic across the district, were able to move beyond incorporation of Counting Collections to focus on underlying pedagogical principles reflected in the high-leverage pedagogical practices. Two districts in our study had prior experience with mathematics approaches consistent with that fostered by the Pre-K to 3 Coherence Collaboration: Avalon and Cedarville. Both of these districts had provided professional development on like approaches in the past, providing access to learning opportunities to some district leaders and teachers. Cedarville also had a pre-existing mathematics framework that was consistent with the approach. Two districts—Birchwood and Diamond—had not had prior experience with similar approaches to mathematics, having historically promoted more traditional approach to mathematics. Avalon and Cedarville threaded the high-leverage pedagogical practices through multiple elements of their infrastructure. By contrast, Birchwood and Diamond focused on integrating the single pedagogical practice—Counting Collections—into the elements of curriculum and pedagogical practices, teacher learning, and, in the case of Diamond, school leader learning. We consider all of these changes to be consistent with the approach to mathematics emphasized by Pre-K to 3 Coherence Collaboration (as indicated in Figure 4). But both Avondale and Cedarville went further than the other two districts, integrating the underlying pedagogical principles into multiple elements of their infrastructure.

Role of district leadership in initiative

Finally, we found that the role of the individual who spearheaded the Pre-K to 3 Coher-

ence Collaboration in each district shaped the consistency of the changes to the mathematics infrastructure. Recall that consistency is the degree to which the changes were consistent with mathematics instruction fostered by California Education Partners. In three of the four districts, the district team lead for the initiative had positional authority. By positional authority we mean authority bestowed to individuals because of their specific rank or role in the school district. In Avalon and Cedarville, the Associate Superintendent headed the initiative, and in Birchwood the Superintendent led the efforts. Conversely, in Diamond, the Director of Early Childhood led the work. We know from previous work that individuals within the early childhood system rarely have positional authority in districts.[30] The Director of Early Childhood in Diamond was on board with the goals of the Pre-K to 3 Coherence Collaboration but due to her lack of positional authority she was not able not steer those in consistent directions. In fact, a district leader with positional authority was not on board with the initiative's goals and was driving a different agenda focused on mathematics fluency and improving standardized test scores. This, in part, explains why Diamond struggled to make changes that were consistent with the primary thrusts of the Pre-K to 3 Coherence Collaboration.

A note about size

Birchwood was unique in our sample because of its small size. It is a one-school district. We argue that the small size of Birchwood played a role in their efforts to foster alignment, continuity, and consistency in two ways: the importance of certain elements in their instructional infrastructure, and the relative ease and speed with which they were able to make changes.

First, because of Birchwood's small size, district leaders argued that certain elements of a traditional infrastructure were less important. District leaders reflected that they did not need a formalized school leader learning system because there were only two individuals who served as school leaders. For that reason, they did not elect to create a school leader learning system as part of the initiative. Second, Birchwood was able to make changes in infrastructure quickly and often with greater ease than the other three districts because of their small size. Birchwood's two district leaders who could make decisions without filtering them through the district-level bureaucracy that often slows decision-making in larger districts. They also did not need to communicate priorities and decisions across multiple schools as other districts in the study had to, a task that requires extensive planning and coordination. Furthermore, exactly half of the pre-K to 3 teachers in Birchwood were on the Pre-K to 3 Coherence Collaboration improvement team, meaning they received ongoing professional development just by virtue of being in that position. The approach to teacher learning in the district was thus a very different task than in other districts where a tiny percentage of the overall teachers in the district were on the leadership team for the initiative.

30 Stein & Coburn, 2023

Summary

Many of the changes that the four districts in this study made were a direct result of their participation in the Pre-K to 3 Coherence Collaboration. Districts embraced the focus of the initiative, working to integrate pre-K and TK-5 into elements of their infrastructure for instructional improvement in mathematics. While many initiatives seek to improve teaching and learning by focusing mainly on curriculum, assessment, and professional development, the Pre-K to 3 Coherence Collaboration took a broader and more systemic view. They encouraged districts to work on additional elements of their infrastructure for instructional improvement, including their instructional frameworks, school leader learning, and instructional monitoring systems. Most districts in this study were able to incorporate these additional elements of infrastructure into the work, making shifts intended to better support teachers in improving mathematics instruction for their youngest learners. Districts also incorporated specific approaches and strategies they learned about in the Pre-3 Coherence Collaborative's professional learning opportunities into their infrastructures.

Districts' baseline capacity and prior experience with the specific approaches to mathematics played an important role in the substantiveness of change they made. Districts were more likely to bring the lessons from the initiative into elements of their infrastructure in ways that transformed them when they started out with established and functional elements. At the same time, baseline capacity was less important in districts' efforts to foster alignment and continuity. If a district worked on an element at all during the three years in our study, they did so in ways that included both pre-K and elementary. Districts were able to foster alignment for most but not all of the elements they worked on, especially if the element was either established or emergent/incoherent at the start of the initiative. Finally, pre-existing experience with similar approaches to mathematics prior to the initiative enabled districts to move beyond specific pedagogical approaches to integrate underlying pedagogical principles into their infrastructure for instructional improvement in mathematics.

Finally, leadership mattered. Fostering systemwide district change seemed to require not only participation of leaders who had the authority to orchestrate changes, but also was on board with the specific approaches to mathematics that was the focus of the initiative.

Discussion and Implications

Districts in California and across the country are working to foster pre-K to 3 alignment and continuity to better support their youngest learners.[31] Yet, we know that it is difficult to bridge the historic divide between pre-K and elementary,[32] especially in mathematics. This report profiles the experiences of four California school districts that made substan-

31 Coburn et al. 2018; Marietta & Marietta, 2013; Nyhan, 2015; Stein & Coburn, 2023; Valentino & Stipek, 2016

32 Stein & Coburn, 2023

tial progress in developing an infrastructure to support early mathematics instruction that stretched across the pre-K and elementary divide with the support of the Pre-K to 3 Coherence Collaboration. They did so under the most challenging of circumstances: the COVID-19 pandemic and its aftermath, while managing school consolidation, lingering teacher burnout and student chronic absenteeism, and more. In documenting their efforts and achievements, this study has implications for educational leaders, policy makers, and those who wish to support districts in improving instruction for their youngest learners and bridging the pre-K to elementary divide, especially in mathematics.

Districts can create systems of support that bridge pre-K and elementary. Existing research on pre-K to 3 alignment and continuity teach us that building district systems to support pre-K to elementary alignment and continuity is challenging for reasons stretching from the long history of separate and parallel departments to different policy and funding streams to differing beliefs about high quality instruction.[33] In documenting these four districts' journeys, this report provides evidence that, although difficult, it is possible to strengthen district systems for supporting high-quality mathematics instruction across the pre-K to elementary divide. These districts, then, can provide a model for other districts who are seeking to provide stronger systems of support for instructional improvement across the pre-K to 3 divide, especially while navigating challenging circumstances.

External providers can support districts in building infrastructure for pre-K to 3. The districts in this study made gains with the support of California Education Partners' Pre-K to 3 Coherence Collaboration. California Education Partners viewed their work with this cohort of districts as an opportunity to pilot an approach to supporting districts in fostering pre-K to 3 alignment and continuity. As such, they experimented with different emphases and approaches and worked on developing new tools and strategies throughout the three-year initiative. Yet, even as their approach was emergent and evolving, it assisted districts in making substantial progress in developing systemic support for high-quality mathematics instruction. It is impossible to know which specific facets of the initiative's multi-pronged strategy made the difference for these districts, given the evolution of the approach over time and our study design, which did not permit isolating the impact of individual strategies. However, there were several features of the initiative's approach that are notable:

- **Simultaneous focus on both teaching and learning in classrooms and district systems.** The initiative focused both on teacher learning (providing and helping districts provide professional learning opportunities to teachers to improve their instruction) and at the system level (encouraging districts to develop systems to support this learning). That is, their strategy was simultaneously top-down and bottom-up. They also consistently cued initiative leaders during learning routines (e.g. convenings) and tools (e.g. the workbooks districts used to guide their work) to consider their system of supports with high quality instruction in mind. This strategy appeared to foster both consistency and alignment in the changes dis-

33 Coburn et al., 2018; Stein & Coburn, 2023; Whyte & Coburn, 2022

tricts made to their infrastructures.

• **Broad view of district systems necessary to support instructional improvement.** The initiative took a broad view of the district systems necessary to support instructional improvement, cueing initiative leadership in each district to examine the ways that multiple district elements were consistent with the approach to mathematics they were trying to support, aligned with one another, and whether they included pre-K and TK to 3. In so doing, they encouraged districts to move beyond a typical approach to improving instruction by focusing on teacher learning and/or curriculum and assessment to think through the ways that this work could be guided by a framework for high quality instruction, supported by school leaders, and monitored for the purpose of instructional improvement.

• **Elevating the voices of pre-K leaders and teachers.** From the early days of the initiative, California Education Partners worked with districts to elevate the voices of pre-K leaders and teachers, something that is unusual in district systems where early childhood education is typically separate and marginalized. California Education Partners insisted that early childhood leaders and teachers be part of district improvement teams, created spaces for conversation and mutual learning across pre-K and elementary, and encouraged elementary school leadership to visit pre-K classrooms and learn more about what mathematics instruction could look like for the districts' youngest learners. These actions appeared to chip away at the status differentials between early childhood teachers and leaders and TK-12 ones, enabled joint problem solving, and kept early childhood education on the front burner during discussions about instructional improvement in mathematics.

• **Learning opportunities and support to multiple levels of the system.** The initiative provided professional learning opportunities for multiple levels of the system from teachers to school leaders to district leaders to superintendents. These supports were tailored to each level's specific needs but were focused on common messages about high quality mathematics instruction and the necessity of building district systems of support across the pre-K to elementary divide.

• **Taking the lessons about job-embedded professional development to the system level.** Research on professional learning for teachers has long identified job-embedded professional development—that is, professional development that happens in teachers' classroom—as an effective approach to supporting teacher change.[34] California Education Partners approach to coaching district leads took up this approach, providing guidance and support to district leads in real time as they worked with their teams to engage in continuous improvement, planned district learning activities in mathematics, and made changes in their instructional infrastructure. This regular, on-the-ground support assisted initiative leads in problem

34 Althauser, 2015; Borko, 2004; Darling-Hammond et al., 2017; Putnam & Borko, 2000

solving challenges as they arose and served to help keep the focus on improving mathematics instruction in the face of competing priorities.[35]

Moving toward pre-K to elementary alignment and continuity is a developmental process. We found that district pre-existing capacity—both the presence and development of elements of infrastructure and experience with the specific approaches to mathematics instruction—enabled districts to make changes in their infrastructure that touched more elements, were more substantive, and more aligned. Pre-existing experiences with the specific approaches to mathematics enabled districts to go beyond the addition of specific instructional technique or assessment, to integrate underlying pedagogical principles throughout elements of their infrastructure.

However, this is not simply a story of the rich-getting-richer. Districts in this study that started without all elements of their infrastructure in place were sometimes able to establish them. Those with emergent or incoherent elements were able to strengthen them. Districts without prior experience with the approach to mathematics were able to begin to incorporate these approaches into their infrastructure for instructional improvement, although in a less central way than districts with prior experience. And, most crucially, none of the districts in this study had begun the process of integrating pre-K into their infrastructure for instructional improvement. And yet, if they worked on an element for TK-12 during this initiative, they did so in ways that extended those efforts to pre-K. This suggest that building a district infrastructure to support pre-K alignment and continuity is a developmental process. Districts with more limited capacity can build their infrastructures over time. It may simply take more time for districts with more limited pre-existing capacity than those with greater pre-existing capacity.

District systemic change requires district systemic leadership. Building an infrastructure for instructional improvement in mathematics requires systemic change. It involves bridging the historically separate early childhood and elementary realms. It involves connecting district systems of support that span beyond teaching and learning to include leadership and data systems. As such, leadership with positional authority that spans these realms appears to be crucial for aligned and consistent changes. In this study, pre-K to 3 efforts were led by leaders with such authority in three out of four districts. However, in the fourth, the leader with that positional authority not only did not lead the initiative, the leader was simultaneously leading another initiative in the district that put forth a different vision of mathematics education. This state of affairs not only made it challenging for the initiative to work on developing some aspects of their instructional infrastructure, it also led to the incorporation of inconsistencies into the structure and function of key elements of the infrastructure itself.

Building a district infrastructure for pre-K to elementary mathematics is challenging work. But it is work that has the potential to support teachers in making instructional improvement that creates more seamless pathways in support of student learning across the pre-K to elementary divide.

35 see Coburn & Meyer 1997 and Meyer & Coburn, 1997, for a similar approach

Appendix A: More about the methods

This study employed a multiple, exploratory case-study approach (Yin, 2013), drawing on interview and artifact data to explore how the four districts changed their instructional infrastructure over the course of the three years during which they were active participants with the Pre-K to 3 Coherence Collaboration. We took a longitudinal approach, drawing on 2.75 years of data focused on understanding the supports that California Education Partners provided to four small-to-midsized California districts to foster district systems to support early childhood mathematics, and how these four districts shifted their systems of support in response.

Table A1. Sampling frame for districts

	Small (under 500 kindergarten students)	Mid-size (over 500 kindergarten students)
Prior Experience with California Education Partners	Birchwood	Avalon
New to California Education Partners		Cedarville Diamond

At the start of the study, we theorized that the task of building pre-K to 3 coherence would be different for small districts compared to mid-sized ones. We also theorized that districts with prior experiences with California Education Partners' approach to district improvement would come to the initiative with a more developed capacity to engage in improvement activities than those new to the approach. For that reason, we selected four of the 10 initial pilot districts that varied in size and prior experience with California Education Partners to participate in our study. However, after we selected two small districts that met our criteria, one of them paused their participation in the initiative for a year due to COVID stress. We replaced that district with a third mid-sized district because the remaining small district in the pilot did not run their own pre-K classes (they collaborated with an outside provider). With the four districts in our study, we are able to investigate the role of size by comparing Birchwood (small with prior experience) to Avalon (mid-sized with prior experience) and the role of prior experience with California Education Partners by comparing Avalon (mid-size with prior experience) to Cedarville and Diamond (mid-size with no prior experience). See Appendix Table A1.

Table A2. Number of interviews with improvement team members

District	Year 1	Year 2	Year 3	Total
Avalon	4	6	9	19
Birchwood	3	3	4	10
Cedarville	1	8	7	16
Diamond	1	4	7	12

Note. Year 1 includes January 2021-June 2021; Year 2 includes July 2021-June 2022; Year 3 includes July 2022-June 2023.

We collected data from January 2021-September 2023, during the height of the pandemic. Data collection during the pandemic came with challenges as we worked to be responsive to schools' and districts' changing needs and conditions. We had to repeatedly rethink our research design in response to the windy road of the pandemic and the challenges it posed for public schools. Some pandemic-related changes enabled us to collect data that we would otherwise not have access to. For exam-

ple, initiative-related meetings and professional development shifted online, enabling us to observe them without traveling from Chicago to California. Teachers, school leaders, and district leaders also became more comfortable with interviews over zoom, enabling us to be more flexible in scheduling since we did not need to do all interviews during in-person travel. At the same time, many other research activities became much more difficult, including anything involving teachers. Most pertinent for the analysis we present here, in the first six months of the study (January-June 2021), data collection at the district level was uneven across the four districts. We completed the full round of interviews in two of the four districts but interviewed fewer people in the other two during the first year of the study. Fortunately, we were able to observe district activities and convenings in all four districts and had full access to all the workbooks and other documents for all districts during that first year.

Ultimately, we collected 132 interviews with 41 members of the district improvement teams and their superintendents across the study (see Table A2). Interviews focused on: a) the districts' priorities in mathematics and early childhood instruction that year; b) conceptions of high quality mathematics instruction, pre-K to 3 coherence, and continuous improvement; c) any efforts they were making to improve mathematics (in the context of the pre-K to 3 coherence collaboration or otherwise); d) experiences with learning supports provided by California Education Partners; and, e) other challenges they were facing in the district (e.g. COVID, school consolidation, roll out of universal TK, etc.) that impacted their work.

We also interviewed California Education Partners staff and consultants twice a year for all three years (N=41 interviews with 11 people). Interviews focused on: a) goals and strategies, and how they changed across the initiative; b) how they navigated the COVID pandemic and changes in state policy (e.g. the roll out of universal TK); c) how they worked with specific districts and their perceptions of how districts were responding; d) conceptions of high quality mathematics, pre-K to 3 coherence, and continuous improvement; and e) what they were learning along the way. We used semi-structured interview protocol for all interviews to ensure that comparable data were collected across interviewers and participants, however researchers were also careful to tailor the protocol based on the participant's role in the district. All interviews were audio-recorded, professionally transcribed, and uploaded into NVIVO qualitative analysis software.

To understand the supports that California Education Partners and their partners provided to participating districts, we observed 90 hours of convenings and SLOs across the three years. We also collected 288 artifacts from California Education Partners, including meeting agendas, tools, frameworks, and other documents that California Education Partners developed and shared with participating districts. Finally, to supplement our understanding of changes in districts' infrastructures, we gathered the extensive workbooks that each district developed as part of the initiative, as well as documents outlining districts policies and practices over time (N=563).

Analyzing the California Education Partners' Approach

To understand the supports that California Education Partners provided to districts, we began by analyzing the interviews with California Education Partners staff and consultants, with the goal of identifying the strategies that the initiative employed to encourage and support pilot districts in fostering pre-K to 3 coherence. We iterated between inductive and deductive approaches to coding (Miles et al., 2014) to identify nine distinct strategies that the initiative employed across the three years of the project. We then identified who was involved in each strategy and the frequency at which it occurred. We also analyzed meeting agendas and topics of the convenings, SLOs, and superintendent convenings, calculating the amount of time devoted to each topic. Finally, we analyzed how the different strategies, and their relative emphasis as indicated by the amount of time spent on them, shifted across the three years.

Analyzing changes in district infrastructure

The first task in analyzing the degree to which districts changed their infrastructures for instructional improvement in mathematics across the three years of the initiative was to identify the existing infrastructure prior to the initiative and at the end of Year 3. To identify the elements of the infrastructure before the initiative, we began by reviewing information about each district that California Education Partners collected prior to the start of the initiative as part of what they termed a capacity review. While the district capacity reviews provided valuable information on districts' mathematics infrastructure prior to the start of the initiative, there was missing information about some elements in each district. To fill in this missing information, we asked members of the improvement team in each district retrospective questions in year 1 and 2 interviews to fill in the missing information. Next, we identified each district's infrastructure at the end of the partnership. To do so, we drew on interviews conducted with improvement team members during the 2022-23 school year (the final year of the partnership). We supplemented these interviews with interviews conducted with California Education Partners staff who worked closely with the four districts. We conducted member checks with leaders of three of the four districts to ensure that our information was complete and correct.

We then analyzed changes in the six elements of each district's infrastructure from before the initiative to the end of the initiative, using systematic, deductive coding strategies (Miles et al., 2014). We organized the data into a simple matrix for each district, with rows representing the infrastructure elements and columns representing the year. The content of the cells included summaries of coded data, key themes, and examples of coded data. These matrices allowed us to see each district's infrastructure for mathematics by year and when changes (if any) were made.

After determining which infrastructure elements changed over the course of the partnership in each district, we analyzed four dimensions of the changes: 1) substantiveness of the change; 2) the degree to which the changes were consistent with approaches to

mathematics instruction fostered by California Education Partners, which we called consistency; 3) whether the changes linked together different infrastructure elements in ways that mutually supported approaches to mathematics instruction, which we called alignment; and 4) whether the changes within a given element brought pre-K and TK-3 closer together, which we called continuity.

To analyze the substantiveness of the change, we coded each element in one of three ways: 1) no change; 2) add-on, defined as when the district added a new practice or approach without changing existing ways of doing things; or 3) transform, defined as a change that served to shift existing ways of doing things. We considered a change to transform existing ways of doing things when, for example, they integrated mathematics into an element that was previously content neutral, made an element more systematic, or changed a core strategy for supporting instruction.

To analyze changes for consistency, we analyzed the degree to which any changes in a given element promoted approaches to mathematics instruction in line with those fostered by California Education Partners. If all changes within an element promoted that vision, we determined the changes were consistent. If some changes promoted California Education Partners vision while others were conflicting, we determined the changes were somewhat consistent. If all the changes promoted a vision for mathematics that conflicted with California Education Partners vision, we determined the changes not consistent.

To assess changes for alignment, we analyzed the degree to which changes in one element were linked to changes in other elements in ways that were mutually supportive. In other words, we were interested in whether districts were moving beyond siloed changes to individual elements to changes that intentionally connected elements so that they worked together as a coherent system. For example, if districts made changes to their instructional framework, did they redirect teacher and school leader professional learning to focus on the pedagogical strategies in the new framework? Did they incorporate the framework in their instructional oversight processes?

To analyze changes for continuity, we analyzed the degree to which changes in a given element included both pre-K and the TK-3 system. The criteria by which we determined this was different depending on the element. For example, if there were changes to teacher learning, did the changes create an opportunity for pre-K teachers to learn with teachers in TK and up (or at least focus on similar content or content that built on one another)? If changes were made to student assessments, did the changes create a coherent assessment system from pre-K to the third grade?

Our final analytic task was to understand what enabled and constrained district infrastructure change efforts. To do this, we utilized a multiple cross-district comparison to uncover differences between those districts that were better able to make changes with consistency, alignment, and continuity in their mathematics infrastructure and those that were not. To understand the role of participation in the Pre-K to 3 Coherence Collaboration in the changes that districts made to elements in their infrastructure, we analyzed interview data for information from improvement team members that explicitly attributed

changes to the initiative, we analyzed the relationship between the foci of learning opportunities and the work that districts undertook on their infrastructure, and we analyzed the presence of key practices or approaches (e.g. Counting Collections, Learning from Children Growth Assessment, etc.) encouraged by the initiative in elements of the districts' infrastructures.

To understand the role of districts' pre-existing capacity, we analyzed each element of each district at the start of the initiative and categorized them as: 1) does not exist; 2) emergent and/or incoherent; or 3) established and functional. We defined emergent as when a district had a practice in place, but it was not systemic or routine. We defined it as incoherent if an element was in place, but disorganized and lacking in coherence. We defined an element as established and functional if it was systemic and regularized. In some cases, we considered elements established and function even if it was not focused mathematics at all much less the approach to mathematics encouraged by the pre-K to 3 Coherence Collaborative. We then looked at the relationship between the starting point of each element and the degree of change they made in the element, alignment, and continuity. We used cross case matrixes to analyze the relationship between the district starting capacity and the nature of change along each of these dimensions (Miles et al., 2014). We then interrogated our analysis for any disconfirming evidence.

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