System-Building in Charter School District

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Charter School District (CSD) is evolving as an instructionally-focused education system with emergent infrastructure, supports for use, distribution of instructional leadership, and designs for managing performance and environment. Pushing beyond the status quo where central offices delegate the organization and management of elementary science education to schools and classrooms, CSD begins to buck these conventional arrangements by distributing the responsibility for organizing and managing instruction among central offices, schools, and classrooms. In this case, we explore how CSD's developing emphasis on NGSS-aligned and equity-focused elementary science instruction in concert with centrally-established routines and resources for building capabilities for high-quality science instruction supports elementary science education across the district. In turn, this case illustrates how one central office shares responsibility for elementary science education by building capabilities within and across the five system-building domains.

While CSD's system-building efforts were not exhaustive and were partial in relation to the full demands of the NGSS, they reflect an advancement in central office efforts at organizing, managing, and supporting the day-to-day work of teaching and learning in elementary science classrooms. CSD's theory of action for improving elementary science education presumes that consistent use of an NGSS-aligned curriculum and supplemental resources paired with frequent support for teachers' use of these materials will improve the instructional quality and reduce disparities in students' learning opportunities district-wide. Integral to this theory of action is a distributed central office leadership team that works closely with teachers to use instructional resources, manage environmental pressures, and improve its instructional design. In the following sections, we present CSD's approach to system-building in elementary science by

describing the district's design in each of the five domains of system-building. We begin by providing context about the district and state to situate our analysis.

Context

CSD has nine charter schools located in a large urban area in the southern U.S. The district serves over 5,000 students in grades Pre-K through 12, a vast majority of whom are students of color and economically disadvantaged. Since its founding in the early 2000s, CSD's mission has been to provide high-quality educational experiences to historically underserved communities with a specific focus on college-access. More recently, CSD expressed a commitment to anti-racism and centers this work in its instructional design across the district, including in elementary science.

CSD operates in an active and competitive charter environment where the district competes with other local schools for student enrollment. This competition has CSD keenly focused on demonstrating student achievement on state assessments as it seeks to differentiate itself from other schools and vie for student enrollment. Student enrollment in the city has steadily declined in recent years which has further increased competition among schools for student enrollment and the associated funding. Central office leaders contribute this decline to the rapidly gentrifying neighborhoods across the city that has displaced many families of color and lower income families to surrounding communities.

Since its founding more than 15 years ago, the organization of CSD's central office has evolved to meet the needs of its expanding district. CSD steadily scaled-up in the number of schools and students served over its tenure and the central office responded by building out its capacity to support instruction across its network of schools. In so doing, CSD's central office developed from a relatively flat organization to a larger, more hierarchical organization.

Currently, a network president and chief academic officer leads the organization. The central office has an academics team and a student support team at both the elementary and secondary levels. At the elementary level, this team includes a Director of Primary Schools, Achievement Managers in English language arts (ELA), mathematics, science, and social studies, and a Director of Primary School Student Support.

In 2017, the state revised its science standards to align with the NGSS and *Framework*, but did not formally adopt the NGSS. As described by central office leaders, in order to implement the new, more rigorous science standards, CSD made its first major investment in elementary science by purchasing a new high-quality curriculum and allocating more instructional time for science at the elementary level. CSD is currently focused on continuing to support teachers in implementing this curriculum and increasing student achievement in elementary science.

Building Educational Infrastructure

Like USD, CSD's system-building efforts are anchored by its centrally-established educational infrastructure. Whereas USD's infrastructure-building is primarily done in-house, CSD draws on a combination of commercial and centrally-developed resources. This infrastructure includes a vision of instruction for elementary science that is rooted in the NGSS and *Framework* and the district-wide commitment to equity and social justice, as well as a series of formal and social resources to support teachers in actualizing this vision.

CSD's vision of elementary science education reflects two dual commitments; a commitment to high-quality, standards-aligned science instruction and the advancement of equity and social justice through science education. Following the adoption of new state science, CSD established a set of guiding principles for elementary science instruction that were anchored

squarely in some (but not all) of the key learning goals of the NGSS and *Framework.* These principles include:

- Science is always relevant
- Children are born investigators
- Scientists read, write, draw, and speak with confidence and rigor
- Science requires both knowledge and skill
- Science is a social enterprise

As described by central office leaders, these principles established a set of core values for elementary science education in the district as driven by the standards. One central office leader explained:

> [These principles] are what we value in a classroom, and it's all based on the *Framework*. Some of the language is exactly—is just stolen from the research framework. Others are tweaked or broken apart just to elevate and make it really sticky.

When describing these principles, central office leaders often used language from the NGSS and *Framework*, such as phenomenon-based learning and literacy integration, which suggests the standards feature prominently in their vision of high-quality elementary science instruction.

While CSD's vision for elementary science instruction aligned with some key features of the NGSS and *Framework*, this vision departs from the standards in important ways. One key distinction is that CSD does not teach science in grades K-2 because, as central office leaders described, the focus in those grades is on ELA and mathematics instruction. This departs from NGSS and *Framework* goals for coherent learning progression in science that extends throughout the elementary grades and beyond. One central office leader explained that, "our bottom line is everything is geared towards test scores. It's all about the state test, which is why third and fourth grade is separated in our region from Pre-K-2 because third grade is when state testing

starts." CSD also showed little evidence of attention to the integration of science and engineering in elementary science instruction which is another key feature of the NGSS and *Framework*.

CSD also roots its vision for elementary science in the district-wide commitment to educational equity and social justice. CSD's vision positions elementary science education as essential to addressing broader systemic and societal disparities. Part of this vision reads:

> Science holds the key to meeting many of humanity's most pressing current and future challenges like environmental racism, disparities in health care, the ethics of genetic modification and climate change. Science education ensures our students have a seat at the table and use their voice to solve the world's toughest problems and equitable access to careers in the fastest growing and highest paid fields. In [CSD] science classrooms, students explore problems and develop ideas with a joyful sense of curiosity. Instead of seeing science as an inaccessible body of facts, it is an avenue for exploration and agency. Students will express their knowledge in a variety of ways to fight for social justice.

The vision for elementary science expressed here reflects the district's broader goals of educational equity that permeates all subject areas and reflects the district's deep-seeded values for social justice. For instance, the central office has a set of expressed commitments to anti-racism that guides their work in all subject areas across the district, including in elementary science. These expressed commitments include:

1. We are fighting lack of access to resources and opportunities.
2. We commit to teaching in ways that fight oppression - building deep and authentic relationships, allowing students to work together as a community, increase in student voice in classrooms, holding a high bar for rigor and a focus on exploration, honor the skills and capital students bring to class, etc.
3. We commit to advocating for more narratives from scientists of color and will support teachers in developing these and make them come alive in their classrooms.
4. We will infuse social justice into the curriculum by creating lessons on global warming, activism, environmental racism, sex/gender and other topics that expose students to social justice.

Similar to the guiding principles for elementary science developed from the NGSS and *Framework*, these commitments aimed to establish a set of norms, values, and beliefs for social justice that, in part, serve to drive system-building efforts in CSD.

CSD's ambitious vision for elementary science education that is rooted in key features of the NGSS and *Framework*, educational equity, and social justice establishes a high bar for teaching and learning in the district. To support teachers in developing the knowledge and capabilities to actualize these aims, CSD leverages a range of formal and social resources for instruction, including (a) a commercial and centrally-developed set of curricular resources to guide instruction and (b) routines aimed at cultivating a set of norms, values, and beliefs about elementary science education.

Following the release of the new state science standards, CSD established a collection of formal resources for instruction to support teachers in carrying out vision-aligned elementary science instruction. CSD began by adopting a commercial curriculum, Amplify, to serve as the backbone of their science program. Designed by experts at the University of California, Berkeley's Lawrence Hall of Science, this NGSS-aligned curriculum emphasizes science and literacy integration and provides full phenomena-based lessons and units. The curriculum includes, among other things, student texts, assessments, and embedded educative curriculum features to support teachers in developing scientific knowledge. Central office leaders described the adoption of this curriculum as the first major investment in elementary science in the district.

In addition to adopting the new curriculum, CSD established a series of additional central office-developed resources to support teachers in using Amplify curriculum in practice. One such resource was centrally-developed guidance that recommended schools allocate 45-minutes daily for science instruction. The district also recommended that science specialists teach science

(instead of self-contained classroom teachers). While CSD developed this guidance for schools, schools made instructional time and staffing decisions.

The central office also developed a series of supplemental curricular materials as a way to "chunk" the curriculum to support teachers in their day-to-day use. These materials included pacing guides, daily semi-scripted lessons developed from the Amplify materials, and interim assessments. One central office leader described the importance of the supplemental resources for teachers:

> My summer was pulling the units and putting them into actual lessons for teachers to use because it's just hours of prep, especially in elementary school where teachers have multiple jobs as teachers. That was just a huge barrier that we could get in front of. […] We focused on making the existing Amplify—not adding or taking away too much, but making existing curriculum accessible so that a teacher could just open up a document that's just a couple of pages because if you print from Amplify, it's 11 to 15 pages. Just simplifying the existing curriculum.

For CSD, the central office was sensitive to the amount of time needed for teachers to prepare the instructional materials and sought to manage this challenge by abridging the instructional materials in a way that minimized the time teachers need to plan and prepare for instruction. In addition to abridging the curriculum materials for teachers, the central office also elaborated these materials to support elementary science education by organizing the lessons using the research-based 5E Model for instruction (Bybee, 2009). As described by a central office leader, the district used the 5E model in elementary science previously and, in addition to aligning with the key shifts embedded in the new standards, including the 5E model in these adapted lesson "maintained a consistent feel" and "routine" for teachers.

While the central office expected that teachers use the commercial and district-developed instructional resources in their daily instruction, teachers were encouraged to further adapt these resources in ways that supported their students. As described by one central office leader, this

curriculum is the "floor" and teachers are able to make modifications to address the needs of their students. She explained:

> I always say that our curriculum is the floor, and it's your job to make it better. I think the base expectation is we all want to be rowing in the same direction and be doing the same things, but if you see an opportunity—if the planned activity is, one, something you're not going to—if you need to change the activity or if you're like, "My kids struggled with this in the last lesson. I need to spend more time on X, Y, or Z," those are adjustments that you should be making.

With this discretion, however, it is unclear if and how the central office or schools supported teachers in understanding how and why to adapt instructional materials in ways that were responsive to student needs and learning.

At the time of this study, the central office was also in the process of establishing formal resources to support teachers in addressing equity and social justice through the analysis of CSD's curricular resources. Prior to the onset of COVID, CSD was working with a consultant to develop a curriculum audit rubric to identify issues of equity within their curricula in each content area, including in elementary science. The central office was piloting this rubric to assess the science curriculum; however, this work was stalled due to the pandemic.

In addition to CSD's vision for elementary science education and set of formal resources for instruction, the central office established a set of routines aimed at cultivating CSD's commitment to NGSS-aligned instruction, equity, and social justice across the district. The central office cultivated these values mostly through central office-led professional development (PD) that included designed opportunities for teachers to engage with the district's vision. For example, in one PD session the facilitator sought to build teachers' understanding of high-quality, standards-aligned elementary science instruction by analyzing videos of vision-aligned instructional practice and leading conversations about how the lesson exemplified the district's guiding principles for elementary science instruction. In another session, central office leaders

engaged teachers with social justice issues by presenting statistics about inequities in STEM educational experiences and facilitating dialog on systemic racism and disparities in STEM opportunities. One central office leader explained how she uses central office-led PD to cultivate the district's values and beliefs around equity and social justice:

> The way that it's lived in science PD is we always start with that, either a video observation, and talking about, what tenants of anti-racist teaching is this living up to and how is this fulfilling our vision for that.

Whereas CSD's vision established what the district values in elementary science, central office-led PD provided the opportunities to cultivate and norm teachers on the key commitments and principles driving elementary science instruction in the district.

In sum, CSD established a vision for elementary science education that was rooted in the district's commitment to standards-aligned science instruction, equity, and social justice. In establishing this high bar for teaching and learning in the district, CSD sought to support teachers in developing the knowledge and capabilities to actualize these aims using a set of commercial and centrally-developed materials and routines for cultivating norms, values, and beliefs about elementary science education. While these efforts for building an educational infrastructure suggest advancement in system-building efforts for elementary science at the district level, questions remain about how these system-building efforts extend to schools. In particular, these efforts raise questions about the ways in which schools leverage central-office developed guidance for instruction and how schools support teachers in adapting this infrastructure to meet the particular learning needs of their students.

Supporting the Use of Educational Infrastructure Practice

In contrast to USD's focus on central office-provided supports for use, CSD supports the use of its educational infrastructure in practice through a combination of ongoing district-based

professional development (PD) complemented with frequent on-site coaching. In addition to supporting teachers in building a set of norms, values, and beliefs for elementary science, district-led PD and coaching focused on supporting teachers in using the commercial and centrally-developed materials to establish a consistent floor for instruction district-wide.

CSD provides central office-led regional PD approximately every six weeks to support teachers in preparing to teach upcoming science units. These day-long PD sessions provide opportunities for (a) aligning teachers with the instructional vision for elementary science (as discussed in the previous section) and (b) collective sensemaking and collaboration around the use of the district's curricular resources. In one session, for instance, a central office leader worked with teachers to understand the purpose of the 5E model of instruction used in the centrally-developed lesson plans. She described, "Lessons not unique or snowflakes. There are routines based upon the 5E model, which includes engage, explore, explain, elaborate, and evaluate. Explore and elaborate are considered the highest leverage parts of the lesson." This leader also engaged teachers in what she described as "internalization" where teachers made sense of the curricular materials in preparation to teach a lesson by identifying the objective, purpose, and main activities of a lesson. Teachers then worked with their colleagues to internalize the rest of the unit's materials in preparation for instruction.

CSD's central office also provides weekly on-site coaching to schools. The Primary Science Achievement Manager, which is a formal central office role with responsibility for students' science achievement at the elementary level, visits each school once a week and works either with the school's instructional coach for science or with classroom teachers on improving science instruction. When coaching teachers, the Primary Science Achievement Manager typically helps teachers develop science content knowledge, plan and prepare for using the

curricular resources, or provides feedback on instruction. When coaching school-based instructional coaches, the Primary Science Achievement Manager typically conducts a co-observation of a teacher with the instructional coach or helps the coach to prepare for an observation or coaching meeting.

In sum, CSD does not just delegate the work of using the district's educational resources in practice to schools, but rather the central office works with teachers and school leaders both to understand the district-level infrastructure and to begin putting it to use. The demands for using CSD's educational infrastructure in practice, however, are high. These demands include using the commercial and centrally-developed resources at a base-level, diagnosing and adapting these resources in response to student learning, and adapting in light of ambitions for equity and social justice. Again, this begs the question of how schools are supporting teachers in using the district's educational infrastructure to ensure high-quality science education is happening in each classroom.

Developing and Distributing Instructional Leadership

These approaches to supporting educational infrastructure use in practice, in turn, have CSD developing and distributing instructional leadership capabilities within and beyond the central office, with a particular focus on instructional coaches supporting teachers in elementary science. Despite a lean staff for elementary science at the central office, the district's design for instructional leadership is coordinated across the central office and schools and suggests CSD is evolving as an educational system.

The design for central office leadership for elementary science includes two key roles: the Primary Science Achievement Manager and the Director of Primary Academics. The Primary Science Achievement Manager has primary responsibility for elementary science in the district

with her core responsibilities including; (a) choosing and managing the elementary science curriculum, including developing supplemental instructional materials for schools; (b) designing and leading district-run PD; (c) coaching school-based instructional coaches and teachers in elementary science; and (d) monitoring science achievement across the district on both standards- and curriculum-aligned assessments. The Director of Primary Academics supports the Primary Science Achievement Manager in these responsibilities through weekly PD and coaching. The Director of Primary Academics also works directly with school principals on overall student achievement and school management across all content areas.

CSD has a design for school-level leadership to complement (and to work in coordination with) the design for central office leadership. This design includes school-based instructional coaches who are responsible for, among other things, providing weekly coaching to science teachers. Using centrally-developed resources, such as planning protocols and vision documents, instructional coaches complement central office support by providing more frequent, onsite coaching on the use of the district's instructional resources and supporting teachers in adapting these resources in response to classroom needs. The central office and school-based instructional coaches coordinate their work through weekly school visits and regular PD for coaches.

While the district has a lean central office staff for elementary science, CSD's design for developing and distributing instructional leadership goes beyond delegating support to the school-level to developing school-level capability to work collaboratively with central office staff to support ambitions for science instruction. This coordination, in turn, can be interpreted as CSD evolving as an educational system where the central office collaborates with schools around the day-to-day work of elementary science instruction.

Managing Performance

As described above, CSD's design goes beyond delegating the work of elementary science instruction to schools and teachers to supporting use of its educational infrastructure in practice in coordination with school-based leadership. This design, however, goes even further by actively monitoring student performance and refining its design in response. CSD's design for managing performance is, in part, a response to environmental pressure to improve student achievement.

CSD closely monitors student performance on both state standardized measures of achievement and centrally-developed curriculum-aligned assessments. These assessments, in turn, inform and drive learning and improvement processes in the central office aimed at improving the quality and use of its educational infrastructure and supports. As described by central office leaders, improving student achievement scores is a central priority for CSD in order to remain competitive in the active local charter environment. For instance, the Director of Primary Academics explained that, "My top priority is driving school-based results and classroom results through the coaches that I coach. Our bottom line is everything is geared towards test scores."

In response to this priority, CSD established a set of tools, routines, and norms for monitoring and analyzing state test results and curriculum-aligned classroom-level assessment data. For example, the Primary Science Achievement Manager explained that following the release of state standardized test results the central office does a "deep analysis" of the data. Using a district-developed state test analysis document, central office leaders compare state results to previous scores and to the state average and use this data to develop quantitative and qualitative goals for the following school year.

To understand student learning and variation in student learning at the school- and classroom-level, CSD uses curriculum-aligned assessments given twice a unit in all elementary science classrooms. The Primary Science Achievement Manager described:

> […] we call it a checkpoint midway through the unit and then a unit test, basically. Those were both shared datapoints. They happened on the same day, and they were a way to, again—I also mentioned this—identify, are we all achieving at the same level, or is one teacher spiking?

For her, the curriculum-aligned assessments help to identify trends across schools and classrooms within instructional units and, as we describe below, inform the continuous improvement of the district's educational infrastructure.

These standards- and curriculum- aligned assessments, in turn, inform and drive learning and improvement in the central office aimed at improving the quality and use of its educational infrastructure and supports. For instance, the Primary Science Achievement Manager described how she uses curriculum-aligned assessment data to modify the types of supports she provides to schools. She described:

> Let's go in and figure out what's happening there. Is one teacher far behind? Let's pour some more resources into them. […] Also, to identify, yeah, if something's a trend across five schools—if all the kids across five schools are getting the same question wrong, then I think that's—I use that data to be like, "Okay, so the next flex day, let's do X, Y, or Z to fill this gap," and I can use it as a planning forward. "Next year, when we teach this lesson, let's do a better job on this lesson or that lesson.

While CSD monitors state standardized tests closely, the Primary Science Achievement Manager explained that there are limits in how the district can leverage this data for continuous improvement given the lack of classroom- and student-level data they provide. As a result, she finds the curriculum-aligned assessments to be helpful in understanding student progress.

CSD's design for managing performance for elementary science goes beyond the modal delegation of performance management to schools and teachers. Instead, the central office co-

owns responsibility for student outcomes and learns from students to inform their own improvement. In establishing goals for student learning as expressed in curriculum-aligned assessments, CSD has taken a stand on quality and are holding themselves responsible to those goals.

Managing Environmental Relationships

CSD is evolving as an instructionally-focused education system with emergent infrastructure, supports for use, development and distribution of instructional leadership, and designs for managing performance. The district goes further yet to actively manage all of the preceding in interaction with environments in at least three ways: 1) acquiring resources; 2) engaging state standards and accountability; and 3) managing market competition. We have addressed how CSD acquired resources and managed state standards in previous sections. We expand on those dynamics in this section and then turn to the new dynamic of market competition.

As described previously, CSD leveraged the commercial market to acquire a standards-aligned curriculum as it worked towards building an educational infrastructure for elementary science instruction in response to changes in the state science standards. As described by central office leaders, state adoption of the new science standards and the eventual realignment of the state science test to the new standards was one of the biggest drivers of elementary science improvement in CSD. One central office leader described, “The test changed, and I hate to make it sound like we are just a test-driven organization, but it really is from a place of that’s just how we stay open. We just don’t have a choice.” For CSD, the increased rigor of the new standards and the realignment of the state test to these standards puts pressure on the district to make changes to their elementary science program in response to the state-level shifts. This had the

central office leveraging an ever-growing market of NGSS-aligned instructional materials to establish a high-quality, standards-aligned curriculum. The Primary Science Achievement Manager described:

> Part of my job, X number of years ago, was to go through curriculum vetting. At that time, there wasn't a ton of curriculums out there, especially that aligned to the rigors and needs of the new standards. We looked at a couple. Also, on the table was creating our own. When we went through this curriculum vetting and all that, the focus group that was with us also chose the Amplify curriculum was something that would align the best with state standards.

The pressure of the new state standards also had CSD (a) building a vision for elementary science instruction that centered, among other things, on key features of the NGSS/*Framework*, (b) supporting teachers in using the centrally-developed educational infrastructure in practice, (c) developing and distributing leadership capabilities to support use across the central office and schools, and (d) managing student performance in ways that advanced the refinement of the design for all of the preceding.

We can understand CSD's design for elementary science, in part, as a function of the particular educational environment in which it is located. Located in a competitive charter market where the district competes for student enrollment, CSD understands the critical role of student performance on state tests in the district's efforts to remain authorized and competitive in the local educational market. Central office leaders explained that the district needs to demonstrate student achievement as measured by state standardized tests in order to (a) meet the requirements of charter authorizers to keep their schools open and (b) remain competitive for student enrollment. The Director of Primary Academics explained:

> I don't love standardized testing. I don't really know anyone who actually is in education for the long haul who loves it and also recognize the reality of that's what keeps our school building open. We just have a very fast—it's very easy for us to get closed down here, so we have to just pay attention to it really closely.

Nearly every central office leader interviewed identified the need to demonstrate student achievement on state measures as a central concern for the district.

The need to demonstrate student achievement, however, went beyond keeping schools' doors open - although that was a central concern. CSD also needed to demonstrate student achievement to differentiate itself from other districts and schools in the competitive charter environment. One central office leader said, "We are much more competitive [with other charters] than collaborative because we not only compete in terms of test scores. We compete for seats." For CSD, outperforming other local schools with regards to student test scores helped to distinguish the district as a desirable educational choice among a wide range of educational alternatives in the city.

Again, CSD is evolving as an instructionally-focused education system with emergent infrastructure, supports for use, distribution of instructional learning, and designs for managing performance. Yet, its design goes beyond the preceding as the district actively manages CSD's sensitivity to the state policy context and the local charter environment. In particular, CSD manages its environment by responding to state policy and differentiating itself among educational alternatives in the competitive charter environment in which it is located.

Implications for school-level designs

The preceding analysis gives us perspective on how CSD's central office is evolving in ways consistent with that of an instructionally-focused education system. We observed emergent action in all five domains of work as CSD established an educational infrastructure, supported the use of that infrastructure in practice, developed and distributed instructional leadership, managed performance, and managed environments. That said, this work was not exhaustive, and was partial in relation to the full demands of the NGSS.

The preceding opens up questions about complementary work in schools. If CSD is evolving as an instructionally-focused education system, we hypothesize that we would observe a set of system-building activities also happening in schools. In particular, we might observe teachers using the commercial and district-developed instructional resources, heeding district guidance for instructional time in science, and maintaining school-level commitment to the district's vision for elementary science as rooted in standards-based science instruction, equity, and social justice. We might also observe schools engaging in school-based PD and coaching using district-established resources and instructional coaches supporting teachers in adapting the instructional resources to meet classroom needs. Finally, we might also observe school-based attention to performance management and ongoing collaboration between the school and central office to refine CSD's design for elementary science in response.

References

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