System-Building in Urban School District

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Located in a western state, Urban School District (USD) is among the largest districts in the nation with over one hundred schools. Among the ongoing improvement initiatives in USD (and the primary focus of this study) is a central office led "STEAM pilot" aimed at improving instruction and outcomes in elementary science, technology, engineering, arts, and mathematics. Central to the STEAM pilot is improving elementary science instruction in ways aligned with the ambitions of the NGSS, as well as in ways that are attentive to equity, students' racial and ethnic identities, and students' agency in continuing their science learning and in contributing to the development of their communities. The STEAM pilot involves the voluntary participation of roughly 40 percent of elementary schools in the district.

Working toward ambitions for NGSS-aligned, equity-centered elementary science instruction is no small feat. STEAM team members reported that many elementary teachers in USD lack confidence in teaching science and previous efforts to improve elementary science focused chiefly on the adoption of commercial curriculum absent complementary professional learning opportunities. Learning from this, the STEAM team works far beyond the sorting, resourcing, and delegating that has long characterized the organization, management, and improvement of instruction by central offices both in the US broadly and in USD specifically. Instead, the STEAM team is engaging in work central to instructionally focused education systems, with a particular focus on building an educational infrastructure, supporting its use in practice, and developing and distributing instructional leadership.

Context

USD is located in a science-rich economy that includes strong participation from the information technology, bio-medical, and military sectors. The region features natural diversity and, thus, authentic opportunities to connect science education to students' lived experiences. Per

district level documents and the web site, K-12 science education—and the improvement of K-12 science education—are integral to the work of USD. Moreover, USD has drawn directly on the NGSS consortium in communicating to families its ambitions for science education in grades K-5.

USD has a multi-division central office characteristic of large, urban districts, including one division focused on leadership and learning for all content areas and levels of schooling. USD is sub-divided into "Areas" that cross geographic/neighborhood boundaries to ensure socio-economic diversity. The leadership structure includes a superintendent and area superintendents. At the time of our study, the long-serving superintendent had left the district under positive circumstances and USD was searching for a new superintendent. Operating as a sub-unit of USD's leadership-and-learning unit, the STEAM pilot team includes four central-office staff including a STEAM program director and three STEAM program developers.[1] This team works in collaboration with central office units responsible for the arts, English language learning, and ethnic studies (among others).

As the STEAM pilot launched, schools across the district were given the opportunity to join the pilot group. Though this required approval from area superintendents, the choice to participate was ultimately that of teachers and their principal; site governance teams and teachers had to agree to join the pilot thereby agreeing to the additional professional development and minimum expectations for STEAM instruction that would entail.

Developing and Distributing Leadership

The district's STEAM pilot team is tight-knit and collaborative with a commitment to their vision. All have professional roots in the community and team members share a belief in the potential for their work to make a difference for the students in USD. Amidst the unique

pressures of the pandemic and the more common place forces of intuitional inertia, they express an impressive readiness to put in the effort to make the STEAM vision a reality. The STEAM team's strategies are distinct from how the district central office writ large and are facilitated by a shared experience among the three project designers of having previously taught in a project-based charter network in the area. Those experiences helped develop a shared language and culture in the team for how they approach their work and collaboration.

An important feature of the STEAM pilot is that it is wholly created in-house by the STEAM team. To achieve this, the team collaborates with any other unit in USD that is interested, responsive, and available. So far, the team has built the most lasting collaborative relationships with the district's Performing and Visual Arts department and the Teaching & Learning Technologies teams. The success of these collaborations is supported by the commitment and passion of those involved and has developed absent a well-established infrastructure to support this type of work district wide.

The STEAM team also supports the development of instructional leadership capabilities beyond the central office design team. To date these efforts have focused primarily on supporting building principals though the team has started to think about ways of developing and supporting site-based science content-area specialists. For other educational initiatives in the district, instructional leadership has historically been the responsibility of school principals. For example, during a recent textbook-curriculum adoption, the district central office provided teachers with one, 45-minute professional development session; principals were expected to provide subsequent support. The STEAM initiative is thus unusual in that it draws some of the responsibilities for ongoing instructional leadership into the central office—most notably through

the provision of regular and in-depth trainings on each new unit and the STEAM program's underlying vision for instruction.

The team has also worked with the area superintendents to coordinate professional learning opportunities for principals. In the first years of the pilot, principals attended professional learning sessions and supported by one of the area superintendents. One Area Superintendent described:

> We didn't require that leaders attend every session, but it was strongly suggested. Then after each session I would bring the leaders away for a leadership component. During that leadership time, Nicholas and I or members of the team and I would have a safe space for leaders to get clear [on] 'If this was the experience that our teachers just had, what might you do back at your site between now and the next time we come together that will help your teachers implement this new learning?'. It was really amazing.

Efforts like those described above were motivated by an understanding that school-based leadership would be necessary for the ongoing success of the program. Coordinating the kinds of learning opportunities for principals described above proved unsustainable amidst the pressures of the pandemic.

More recently, the STEAM team has started to consider how to best train school-based science content-area specialists beyond the principal's office. Part of the motivation for this has been to expand the capacity of what is currently a small team relative to the number of schools, teachers, and students in the STEAM program. One program developer explained that, "Because we are such a small team, I think we need to build our collective capacity and help teachers be leaders of their own school sites. That needs to be supported". Developing teacher leadership in

schools is also seen as a way of supporting the improvement and expansion of the program while enabling teachers to be leaders in the program. Another program developer explained:

> There's been a lot of conversations about 'how do we build site capacity', 'how do we tap into teachers as resources to inform the curriculum', 'develop new resources', 'help with revisions', and help my team be more facilitators of that type of thing.

With more schools joining the pilot each year—and the ultimate objective of having the STEAM program adopted district-wide—the development of school-level leaders with capabilities to support use is responsive to ambitions to increase both the quality of instruction the number of schools in the STEAM pilot without expanding the central office STEAM team.

Building Infrastructure

Toward advancing the STEAM pilot's aims for NGSS-aligned, equity-centered elementary science instruction, the work of the STEAM team has focused most centrally on building the educational infrastructure needed to support daily science instruction in grades T/K-5. Rather than purchasing commercially available curriculum, the STEAM team has undertaken to develop a STEAM curriculum in-house. The STEAM curriculum coordinates the Three-Dimensional Learning of NGSS with the 5E Model of Instruction (Engage, Explore, Explain, Elaborate, and Evaluate; Bybee, 2009); embeds this instructional design in a comprehensive, web-based, T/K-5 instructional program; and complements the preceding with efforts to develop a culture of possibility and responsibility for ambitious science learning among diverse elementary school students. The team anchors their work in a shared vision of learning for students in USD. As described by the program director:

> We've been trying to show in the elementary space how science can be something that ties the day together. We understand the importance of a literacy and numeracy block, but

> how can we bring those two things together in meaningful ways? Our mission statement is that we want kids to be curious, creative change-makers. They're not just absorbing information. They're taking that information and doing something with it to make change in their communities.

In addition to providing high-quality science experiences for learners in USD, the STEAM pilot objective includes a desire to ignite curiosity and to empower students and future generations to enact change in their local and global communities. In service of this mission, the STEAM curriculum supports project- and inquiry-based learning that places students at the center and reorients teachers to be facilitators of the learning experience. This, in turn, has the team incorporating conceptions of equity in ways that are responsive to the specific local context rather than relying on (or supplementing) the concepts of equity written into commercial curriculum.

The formal structure and scope of the curriculum being developed to support this vision is expansive. At a minimum, teachers in the STEAM pilot agree to lead STEAM lessons for an hour every day. To support this, the curriculum includes 5-7 units for each grade level with each unit comprised of 6 to 20 multi-day lessons which together provide daily instructional material for the entire school year. Curricular materials are hosted online so that they are accessible and so that updates can be made as needed; the physical materials required for the units are provided to teachers by the district. The team is working to translate the entire program into Spanish and when the district transitioned to remote learning, the entire curriculum was adapted for that context. According to one developer, enough material has been included in the supplemental expansions for each unit that a classroom teacher could built their entire school year around the STEAM materials. Though teachers may use these materials directly, the STEAM team is

supportive of teachers adapting the units to their specific circumstances (e.g., to meet the needs of a large ELL population, to partner with a local natural resource or community resource, to align with a school-wide theme).

The STEAM team has incorporated into their designs multiple strategies for developing a social infrastructure that connects teachers, students, and school-communities to the vision and objectives of STEAM. From the start, the requirement that whole schools opt-in to the pilot is intended to establish as base level of buy-in among teachers and administrators in the STEAM schools and helps support a social infrastructure with a common commitment to the importance of science. Then, by launching the STEAM curriculum one grade at a time, the pilot facilitates the socialization of students into their roles and responsibilities as learners beginning in transitional-kindergarten and kindergarten. As a result, teachers using the fourth-grade materials for the first time are doing so with classrooms of students who have mostly already experienced the STEAM curriculum and ways of learning. Finally, in pursuit if supporting ambitious science learning for all students, attention to equity is threaded through the units and intended to specifically reflect the USD community. This work is complemented by the work of a district-level equity office charged with operationalizing the district's commitments to equity.

Managing Environmental Relationships

By deciding to build their educational infrastructure in-house, the USD STEAM pilot has been able to largely side-step the curriculum market that shapes efforts around elementary science for many districts. Nonetheless, the work of the STEAM team remains attentive and sensitive to several loci of influence in its environment. A first order matter is aligning their curriculum materials with the NGSS and the state's adaptation of the *Framework*. In doing so, the district also bridges course content to the communities in which students live.

Another matter has been finding funding for the program. The director of the STEAM pilot is the primary actor when it comes to managing relationships between the pilot program and sources of financial support. His efforts have secured for the project both external financial support and assistance from private and public universities across the state.

Through one university partnership, the STEAM team received support in developing high-quality assessments while another university partnership helped the team integrate computer science and robotics into the STEAM units. The local environment—in particular a project-based charter school in the area—has also been important to the training and development of the pilot team members themselves all three of whom spent some part of their prior careers as teachers at that charter.

Like many districts, USD is in competition with other schooling options in the area. Around the time of the publication of the NGSS and with support from the U.S. Department of Education Magnet Schools Assistance Program, a few STEM magnet programs were introduced in the district as an approach to desegregate enrollment. It is unclear the degree to which the desegregation goals have carried over the current STEAM pilot, but some district staff have talked about the pilot as part of an effort to retain students and families.

Supporting Infrastructure in Practice

Central to the design of the STEAM pilot is the ambition that teachers both use the material and adapt them as needed. But the team knows that though this goal may sound straightforward, achieving it requires some thoughtful design. One program director explained:

> My stance has always been if I want to see something happen, then I need to make it as easy as possible for principals and teachers to do it, and then just support them along the

way. They're much more likely to do the things that are made easy for them than they are to just try figure everything out on their own.

With this orientation, the STEAM team works to develop units that have a minimum barrier to entry with room for flexibility, adaptation, extension, and alteration. The result is materials that are useable off-the-shelf with comprehensive lesson plans, embedded assessments, district-provided materials, sample calendars, pacing guides, overview documents, and videos of exemplar classrooms using these lessons within USD with all of the preceding available on-demand, online.

The STEAM team also recognizes that usable, ready-to-go curriculum materials are not enough; teachers need to be supported both as they are introduced to new curriculum and while they are working to employ those materials in their own classrooms. From those with whom we have spoken in the district, this does not appear to be the typical approach to launching new curriculum or initiatives in the district. As described by a former union leader:

> We just adopted a new comprehensive English Language Arts program. Teachers were given one or two 45-minute trainings at the beginning of this year and then are expected to take on the new program. ... That's something that was different from the STEAM pilot versus other initiatives...the pilot was set up in a way where you had the time you needed to figure this out and the supports you needed to figure it out. I don't think all of the other programs in the district are done that way, at no fault to any person, but it takes time, it takes money, and there's not a lot of extra of that around these days.

In contrast to the single, 90-minute training for a year-long curriculum, the STEAM team provides a number of synchronous and asynchronous learning opportunities for teachers in pilot schools. The first of these opportunities each year is a kick-off PD that, for each grade-level,

goes into deep detail about the ambitions of the NGSS, how STEAM pilot incorporates those ambitions into its design, and the structure of units and lessons in the curriculum. Throughout the year, the STEAM team offers additional PD, particularly as new units are launched or in-line with when teachers are likely moving on to the next unit in their grade level. These PDs give teachers opportunities to experience the materials from a learners' perspective and reflect on the materials. Many of these PD sessions are also recorded and, along with their slide decks, are available on the STEAM program website for teachers to review or return to as desired.

At the moment, the STEAM team does not provide in-school coaching. Though the team members are available to answer teacher questions and provide support in ways they can, there are no instructional coaches in schools supporting the STEAM pilot. This seems primarily due to the small size of the team—again, there have been three to four team members supporting 50 schools across the entire district—though interviews suggest that this kind of role is generally not common in the district. Any ambitions to begin this kind of work were further hamstrung by the pandemic and concerns about individuals moving between schools.

Managing Performance

As detailed above, USD and the STEAM team is engaged in work characteristic of instructionally focused education systems. They have developed a lean, deeply committed and value-driven team working in collaboration with other departments and with district leaders to support principals, with an eye toward developing school-level STEAM leaders. They are doing all of the proceeding from scratch and in-house while drawing in and coordinating support from the environment and supporting teachers along the way.

While taking this all on, the district has yet to develop a commensurate focus on managing performance. The STEAM team has established a partnership with a university to help

develop richer assessments of student learning, but mechanisms for monitoring classroom-level implementation and leveraging classroom-level adaptations are still in the early stages of development. The STEAM pilot team recognizes this issue, but it has not been a place where they have focused their efforts. However, there are parts of the program that seem like they lend themselves to this work in the future.

The STEAM curriculum units contain assessments that teachers across pilot sites can use. This is not typical of the district more broadly where, some years back, the district opted to move away from a district-led comprehensive assessment system in the elementary schools and instead allowed schools to develop their own assessment plans. However, at present, the STEAM team does not collect data from classroom-level assessments.

Both the small team size and the challenges of developing this program during a pandemic have also created challenges in terms of observing how teachers are using these materials in their classrooms. One program director explained:

> It's also hard for us, honestly, to know the scope in which our teachers [are using the material], because we have so many and we can't get into everyone's classroom. We haven't, even before [the pandemic], we haven't been able to get into everybody's classrooms, so to know the level at which they are taking our curriculum and facilitating it with fidelity is still unknown as a whole.

While they may not have data to understand how teachers are using the materials, the team does collect feedback through their website from teachers. The feedback form, which is online along with the lesson materials, offers teachers the chance to give feedback unit by unit and lesson by lesson about what is working well and suggestions for improvement. In interviews with the STEAM team, it is unclear how widely this form is used but they do earnestly work to make

revisions based on critical feedback both that is collected here and that is sent to them through other channels. Overall, however, the STEAM team has not created mechanisms to document, mine, or test teachers' adaptations of the curriculum. As such, though valuing and encouraging teacher adaptions, it is lacking key mechanisms for leveraging that work as a resource for pilot-wide improvement.

Implications for School-Level Designs

The preceding findings from the district-level work in USD and, more specifically, in the STEAM pilot show the features of an instructionally focused education system being built to support science. With the central office engaged across many domains of work, the question remains about how these efforts are playing out in schools. If the STEAM team in USD is developing as an instructionally focused education system, there are a set of complementary efforts we hypothesize would be observed at the school-level.

Given the centralized responsibility for *building the educational infrastructure*, we would posit that schools in the pilot are relying on those designs as the foundation for their STEAM programs. This would include teachers using the STEAM units in their classrooms and school-level visions for science instruction that reflects the pilot's objectives. We would also anticipate observing teachers leveraging the professional development provided by the district as a key source of *support in using the educational infrastructure*.

There are also domains of work that are delegated (in whole or in part) to schools in the pilot. Some responsibilities shared between schools and the STEAM team are: a) the adaptation, revision, and improvement of the curriculum-as-written by teachers; b) the instructional leadership of principals, and c) bridging materials to individual school communities. Given this, we may see teachers reshaping the STEAM curriculum to best fit the need of their students,

principals supporting teachers in their STEAM instruction in ways that extend the supports provided by the STEAM team, and/or school-level work to coordinate and *manage relationships with their environments* by drawing in beneficial partners.

Given its design, the central office delegates *managing performance* to the school-level. As a result, we may anticipate seeing things like school-level ownership of student performance and strategies for continuous improvement of STEAM instructional practices and mechanisms for teacher accountability (e.g., ensuring teachers are teaching the STEAM units regularly). Further, we might also see school-level mechanisms for formative and summative reflections on student learning and designs for how to learn from those data. Finally, and in support of these efforts, we might also see school-level designs for *developing and distributing instructional leadership*. Examples of this might include leadership roles for teachers particularly interested in STEAM or teams of teachers responsible for coordinating reviews of student work samples, etc.

References

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