System-Building in Suburban School District

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Suburban School District (SSD) has a student body of 12,500 students in a conservative state in the Southern U.S. and is partially located within the neighboring urban city. The central office in SSD works with schools, teachers, community members, and external partners to continuously improve their educational programming across grade levels and subject areas, including in elementary science. That elementary science is centrally included as a distinct part of the improvement work in the district places SSD in sharp contrast with many districts across the U.S. One way that SSD appears to accomplish this work is that the subject areas are not siloed according to different curriculum coordinators in the central office; instead, the teaching and learning department staff manages instruction across all disciplines. Rather than having the effect of sidelining elementary science, an outcome of this design appears to be improvement processes that are inclusive of elementary science. Unlike USD and CSD, SSD has had this focus on elementary science for over two decades, pre-dating the release of the NGSS (NGSS Lead States, 2013) and the state's adaptation of the standards; so, while SSD has been responsive to the NGSS, their release did not signal a dramatic shift in instructional priorities for the district. Thus, SSD was already beyond conventional approaches to organizing, managing, and improving instruction when the NGSS were released.

Context

When SSD was first founded in the beginning of the 1900s, it was a rural community made up of settlers, forcibly displacing the Indigenous peoples who lived there. It is now a small town with a range of income levels. About 13% of students in SSD are recent immigrants of Asian descent, signaling a noticeable shift in demographics. SSD's handful of pre-K-4 elementary schools are large: anywhere from 1000 to 2000 students in each.

The central office in SSD is able to support instructional improvement across these large elementary schools in part due to its design. An Executive Director and a Director of Teaching and Learning oversee curriculum, instruction, and assessment across all subject areas, pre-K-12. As part of this department, Teaching and Learning Specialists in each school report to the Executive Director and Director and work in collaboration with school leadership teams. A Director of Student Support and Accountability, who is also responsible for the English Language Development program, works alongside the Executive Director and Director of Teaching and Learning, as well as a Director of Special Education and a Director of Professional Development. At the school level, due to the large size of the elementary schools, each campus has a site principal in addition to two or more building principals who serve as assistant principals for each campus building. Each campus also has a STEM Lab Facilitator, and each grade level team has a Science Chair, both of whom work with the school's Teaching and Learning Specialists to coordinate and support science learning opportunities for students.

Suburban School District has three areas of focus as part of their strategic planning: (1) supporting and celebrating their diverse community of learners, (2) fostering innovation and collaboration, and (3) focusing on continuous improvement. SSD's first focal area includes delivering learning opportunities "across the Five A's – Academics, Activities, the Arts, Athletics, and Attitude," providing "pathways for student engagement," and enhancing safety for students and employees to thrive. SSD also encourages innovation and collaboration in classrooms, schools, and departments in addition to strengthening access to services that support the needs of students, teachers, and families. Lastly, as described throughout this case, SSD stands out from USD and CSD with their emphasis on continuous improvement which they pursue by utilizing stakeholder feedback, supporting professional development, and seeking out

funding sources in support of school improvements. SSD's Executive Director describes their focus on continuous improvement as follows:

> You're constantly trying to do a process better, have an improvement, meet a need more effectively, communicate more effectively with families, engage families more effectively, engage learners more effectively, provide opportunities that allow students to really grow toward their lives beyond K-12.

The Associate Superintendent described four areas where elementary science fits into the district agenda.

1. Science is part of the focus on academics (one of the 5 A's) in the first focal area.
2. Science builds "opportunities for more student engagement," another objective of the first focal area.
3. Science fits two objectives in the second focal area of fostering innovation and collaboration: creating a culture of innovation in classrooms and spreading effective instructional practices.
4. Science is included in professional learning programs for teachers in SSD; professional learning is one objective in the continuous improvement focal area.

Though described here as how elementary science currently fits into the district agenda, as noted in the introduction, this work has been ongoing for decades, long before this current version of SSD's strategic planning. For example, SSD has had a kit-based curriculum for elementary science since the early 2000s, and in 2014 they began a district-wide STEM initiative that put into place STEM Learning Labs in every elementary school.

In Suburban School District, the theory of action for improving elementary science instruction appears to be that the consistent, expert use of a high quality, NGSS-aligned

commercial curriculum will offer opportunities for all students to engage in authentic science learning. Integral to this theory of action is a distributed central office leadership team that constantly evaluates feedback on the use of this curriculum and adapts both the infrastructure and teachers' professional learning opportunities in ways responsive to evidence of challenges.

Building Educational Infrastructure

Suburban School District is engaged in the work of building educational infrastructure to support elementary science. As described in the introduction, SSD has a history of elementary science improvement dating back over two decades—with kit-based curriculum since the early 2000s and the STEM Initiative that began in 2014. As a result, science is integral to the district's identity and work. At the time of our study in 2019-2022, SSD was engaged in building and adapting educational infrastructure to support elementary science as part of a cyclical resource adoption process. At that stage in its development, key components of formal infrastructure included: a) a vision statement; b) kit-based curriculum materials; c) science notebooks; and d) a STEM initiative. Key components of social infrastructure included: a) a shared philosophy of instruction and b) a culture of continuous improvement. This final piece of infrastructure–a culture of continuous improvement–differentiates this district from USD and CSD.

SSD has aim statements that express an instructional vision for each subject area. These aim statements are revised routinely during the cyclical resource adoption process by a committee of stakeholders, informed by current research on best practices. In science, "The aim of the Suburban School District pre-kindergarten-twelfth grade science curriculum is to promote curiosity and critical thinking by engaging all students in inquiry-based exploration of real-world phenomena, using collaboration, the science and engineering practices, and evidence-based analysis." Phenomenon-based learning and engagement with science and engineering practices

are both central aspects of reforms promoted by the *Framework for K-12 Science Education* and the NGSS (National Research Council, 2012; NGSS Lead States, 2013). Additionally, crosscutting concepts, though not included in the aim statement, have been used by the central office as a key lever for organizing standards and student learning experiences.

A second feature of the formal infrastructure for science is SSD's kit-based curriculum materials. Provisioned since the early 2000s, the rationale for their use is that they provide hands-on, inquiry-based science experiences for students. According to the Executive Director of Teaching and Learning, "It's good for students. It sparks interest. It creates curiosity."

In 2020-2021, the resource adoption committee (known as the Science Committee) selected Twig Science Next Gen, from Twig Education, as the new kit-based curriculum, relying on the external market for curricular materials similarly to CSD. As a program, Twig is more than a collection of science kits, but rather is a comprehensive, coordinated, multi-component suite of resources, the development of which by SSD committee members or administrators would have been impossible given their capacity and capabilities. Twig is aligned to the NGSS, designed around phenomena, and incorporates high quality multimedia components (e.g., student- and teacher-facing videos, simulations, and virtual labs). Though still new in SSD at the time of this writing, some of the features of Twig that SSD leaders and committee members are enthusiastic about include easier investigation setup for teachers (previously, they had the FOSS curriculum which could be more complicated for teachers), significant supports for emergent multilinguals, teacher training videos, user-friendly website design and distance learning resources, student-facing simulations, the integration of literacy materials for use in the ELA block, and instructional materials in Spanish for the district's dual language program.

The Executive Director of Teaching and Learning, along with Teaching and Learning Specialists at each elementary school, created guiding documents for each grade level, K-4, that help teachers consider their pacing through the units along with expectations for how often to be teaching (e.g., in fourth grade, four 30-minute lessons per week), what to do with the embedded assessments, and more. Central office administrators expect teachers to use the Twig resources consistently, as designed by Twig Education and modified by SSD, within and across schools.

A third piece of SSD's formal educational infrastructure is science notebooking. Science notebooking is a practice where students record their questions and observations, data and interpretations, and other aspects of their science learning as desired by the teacher and students, like how scientists record notes in lab books. The district purchases science notebooks for every elementary student in the district and provides support in how to integrate science notebooks into teachers' instruction. That said, SSD leaders recognize a need for more and ongoing training to help teachers grow their confidence and skill for using science notebooks.

Finally, as noted previously, SSD launched a district-wide STEM initiative in 2014. Its goal is to integrate STEM throughout all class activities with hands-on, problem-solving experiences; to raise college and career awareness; and to install and use STEM Learning Labs in every elementary school. The STEM Learning Lab classes are not associated with Twig but rather are enrichment to classroom instruction. The SSD Foundation raised funds to pay for the STEM labs. The River Valley STEM Ecosystem (described later in Managing Environmental Relationships) helped develop some lessons to be taught in the STEM Labs.

Two distinctive norms have surfaced in the data that together represent a social infrastructure for instruction in the district. The first is the "District[1] Way," and the second is a culture of continuous improvement. The District Way is a philosophy of instruction that is shared

across teachers Pre-K-12 and explicitly taught to new teachers. This philosophy includes a commitment to constructivist teaching practices in the face of recent demographic changes due to a wave of Asian immigrants. The Associate Superintendent of Educational Services shared:

> Honestly, I see in other districts that as demographics change that maybe some of the constructivist teaching practices particularly are what goes by the wayside. It gets to be more of the drill and kill kinds of practices. That has not happened here. It's important to us that it doesn't, that we are really providing those high-quality learning experiences for students.

This philosophy aligns with SSD's focus on supporting all students, and it is one way that SSD addresses equity—that is, through on-going high-quality, constructivist teaching as other districts shift their teaching philosophies in response to increasing representations of minoritized groups.

Furthermore, from our school-level data collection, the District Way was described by a school leader as "We will guide you in what to teach, but the art of teaching is yours." Thus, SSD promotes values that include constructivism and the importance of teacher discretion. This shared set of values, along with the work described above to institutionalize instructional visions and curricular resources, represent key social resources for instruction in SSD. In other words, SSD's central office both expects teachers to teach Twig consistently, in line with district values and guidelines, and SSD gives space to teachers to adapt the materials to make them their own—both of these ideas are important components of continuous improvement.

Indeed, SSD has a culture of continuous improvement, a design feature that distinguishes it from USD and CSD—and a topic we describe in more detail later, in Managing Performance. Throughout this case write-up, we highlight ways that SSD engages in continuous improvement as it builds systems to support elementary science instructional improvements.

Supporting the Use of Educational Infrastructure in Practice

To support the use of SSD's elementary science educational infrastructure in practice, the central office engages in a three-year roll-out plan after adopting a new resource—or rather, after incorporating a new resource into its educational infrastructure—that encompasses professional learning for teachers in the form of at least one practice-based workshop to introduce the new materials as well as infrastructuring in the form of developing supplemental resources as needs arise. We think of the process of 'infrastructuring' (Penuel, 2019) as blurring the lines analytically between our framework domains of Building Educational Infrastructure and Supporting its Use in Practice. Here, we include it in the Supporting Use domain as the resources are developed *in support of* existing educational infrastructure; however, the resources themselves also constitute educational infrastructure, hence the blurred line. Ongoing support after the three-year roll-out, with an emphasis on supporting new teachers, is provided in two forms: (1) training in the curriculum materials at the start of each school year, and (2) support from instructional coaches. All district-led support is intended to serve two purposes—supporting teachers' consistent use of the Twig across classrooms and schools while also supporting their ability to adapt the materials in response to their own students and classrooms.

We are writing this case study in the middle of SSD's first year of using Twig. In the first year of use, the central office typically provides professional development for teachers, often making use of trainers from the curriculum company. In the 2-hour Twig PD we observed for this study, the Twig trainer primarily focused on the use of the teacher-facing instructional materials, including the online platform. Additional professional development was offered early in the school year on the Twig online platform and on science notebooking in addition to onsite

instructional coaching. The Executive Director of Teaching and Learning also worked with her team during this year to update guidelines for teacher use of the new instructional materials.

Within its structured first-year roll-out, the central office worked directly with schools to address three unanticipated needs and exigencies. The first was that the materials were delayed in transit by several weeks given global supply chain issues caused by the pandemic. This required the central office to adjust pacing guides in order to meet the standards in less time. The second issue was that the Twig trade books played a more central role in the lessons than expected, but SSD did not purchase them. The media specialists have been working with the central office to identify alternative titles in their school libraries and seeking informational text to supplement and amend the Twig resources. Thirdly, the central office needed to identify alternative materials to some suggested in Twig due to allergies (e.g., eggs). The Teaching and Learning Specialists brought these concerns to the attention of the central office.

In the second and third years of using new instructional resources, members of the Teaching and Learning department continue building out additional supportive infrastructure as needed. According to the Director of Teaching and Learning, they make an assessment:

> After a year of use of the tool, where are the gaps? Where do we need to build in additional pieces of either training, additional resources? Maybe it's curating a collection of articles for a particular content or skill that isn't, maybe, addressed in the same level of depth that we would want for that particular concept or skill. Maybe it's just, perhaps, that teachers are saying our students are still not getting this based on the experience alone. That's when we would, maybe, pull in our media specialist, where we would do tech sets from there. That's part of the—when we think about the professional development, I

know that's not necessarily training, but that's very much a part of the continued work that we would do.

This kind of infrastructuring occurs in coordination with the district's Teaching and Learning Specialists who are also providing ongoing onsite coaching to teachers, especially new teachers, in the elementary schools. It is also a key example of the district's approach to continuous improvement, wherein processes are in place that serve to monitor the use of educational infrastructure and identify areas where teachers may need additional support.

Managing Performance

In line with other aspects of Suburban School District's approach to teaching and learning, and in contrast to USD and CSD, SSD's strategies for Managing Performance are also driven not only by a culture of continuous improvement, but also by systems and processes supporting continuous improvement. In many districts, continuous improvement adheres to a formal process of iterative analysis, design, enactment, and evaluation that leverages practical measures and other sources of evidence. In SSD, the process is more social than formal and is highly dependent on Teaching and Learning Specialists who are positioned in schools and who serve as a wealth of observational and anecdotal data about work in schools and classrooms. The 'managing performance' processes are largely used to develop and refine common science assessment tools to support classroom teachers, as well as to develop and refine additional supports that are needed to enact science instruction (see the Supporting Use section of this case study). As summarized by the Associate Superintendent for Educational Services:

Okay, we're here now, but we know we want to be better tomorrow than we are today, so how are we going to get there? What's going to be that next piece? How are we going to

grow our practices? How are we going to grow our capacity for really doing great things in the classroom? That's something that is really a part of our culture.

The SSD central office also includes a Continuous Improvement Learning Team, on which several of the central office staff that we interviewed for this study participate. This team is primarily responsible for establishing and reviewing the district's processes related to curriculum and instruction. As such, SSD's approach to managing performance operates on double-loop learning wherein the district is interested not only in how to support teacher learning and growth to work towards improving classroom instruction, but also in making improvements to their own processes and the growth of district leaders.

With regard to SSD's use of outcome assessments to manage performance, the results from the state's fifth-grade science assessments are often released too late to be used for instructional improvement purposes. Instead, the assessments are used as a tool for the planning and alignment of standards and instructional sequences. In lieu of useful state-level assessment data, the central office has designed and used for many years a common assessment to evaluate student progress on their science notebooks. Additionally, the central office plans to modify and adapt some of the assessment tools in Twig, finding a balance between assessments that will look and feel more like the state assessments and those that look and feel more like performance assessments that are more authentic. This will be part of the ongoing infrastructuring work described previously in the Supporting Use section—in other words, these assessment tools will become part of the educational infrastructure as they are designed in response to teachers' needs. Though these tools are and will be available to teachers, the central office does not have routines or guidance to support teachers in analyzing and using student data in science (though these structures are in place for English language arts and mathematics).

Examples of how SSD manages performance for continuous improvement have been referred to in previous domains. For example, the central office has a design in place for incorporating new instructional resources each year into its educational infrastructure on a rotating cycle of subject areas – the central office also monitors and refines this design from year to year. Additionally, the central office has a process for monitoring the early use of new curricular resources in order to further develop infrastructure or other supports for teachers' use of the curricula. According to the Director of Teaching and Learning, much of the data for their continuous improvement efforts comes from the Teaching and Learning Specialists:

> I think part of it is just having those conversations with our teaching and learning specialists and learning more about what's working, what's maybe a little bit harder to implement….It could be, perhaps, that we would meet around the table with examples. Like student notebooks and actually sit down with them and do some calibration of our rubric. Making sure that we're consistent in how we're using the rubric and making refinements to the rubric if necessary. Thinking about, okay, how can we coach teachers to maybe get a little closer to what we want to see here?....I think the evidence collected there is more qualitative versus quantitative. It's more of a discussion. It's more of a conversation.

Thus, in SSD, both the processes for affecting change for elementary science, as well as the mechanisms of change (i.e., infrastructure and infrastructure supports), are monitored and improved on through regular meetings and conversations across teams of instructional leaders.

Developing and Distributing Instructional Leadership

As mentioned previously, and unlike USD and CSD, no central office staff member specializes in science education for Suburban School District. Rather, an Executive Director

(ED) of Teaching and Learning and a Director of Teaching and Learning are responsible for all subject areas, pre-K through grade 12. The ED and Director, along with SSD's Teaching and Learning Specialists, build educational infrastructure, develop supports for teachers to use the infrastructure, and manage its performance. The ED and Director of Teaching and Learning, seem to be principally responsible for managing environmental relationships with regards to elementary science. Finally, the Associate Superintendent of Educational Services seems principally responsible for developing the capabilities of school leaders, including in elementary science. By design, these leadership positions are not siloed, and we conjecture that this allows understandings about how to improve instruction to move more flexibly across content areas—in other words, that knowledge is not isolated to one or another content area.

The **Executive Director of Teaching and Learning** is in charge of developing and supporting the use of infrastructure in practice, as well as monitoring its performance, in pre-K-12 for all subject areas, in addition to overseeing the media specialists and the gifted and talented program, among other ancillary responsibilities. She has been in this position since 2000 and shared that "it's more manageable than it sounds." She described rotating her focus from year to year on different subject areas "in terms of where we are, what we're doing" with the resource adoption process and early years of use. The ED largely finds her own opportunities to learn, through reading books and practitioner-oriented materials (e.g., from NSTA) and attending webinars (e.g., one on crosscutting concepts). She selects what to bring to her colleagues based on ideas and approaches that align with SSD's vision of science teaching and learning.

The **Director of Teaching and Learning** has similar responsibilities to the ED and is responsible to all students and teachers, pre-K-12.

> I work on curriculum documents. I work on leading teachers in adopting new practices, implementing new practices district wide, work on a variety of programs, a number of initiatives. Really, we want to leverage experiences for students that are high interest, but then also address the standards as well.

One of the initiatives that the Director spearheaded is "building out an entire STEM program in a full articulation," described previously as the STEM initiative. The Director's learning in part comes from her collaboration with the ED, but she also learned from the former state science coordinator ("she has done a phenomenal job of promoting this type of instruction") and from an external partner in the River Valley STEM Ecosystem (described later).

The **Associate Superintendent for Educational Services** is responsible for "everything that has to do with students except for transportation." This includes student services and teaching and learning. On the student services side, the Associate Superintendent works with special education, English language development, Native American education, child nutrition, and continuing education. On the teaching and learning side, she works with the ED and Director of Teaching and Learning, professional development, federal programs, and site principals. The Associate Superintendent's role seems to be the primary mechanism for developing the leadership capabilities of site principals as she does learning walks with them as part of their regular Leadership Team meetings. As mentioned previously, the ED and Director of Teaching and Learning, as well as the Associate Superintendent for Educational Services and other central office staff ancillary to the improvement of elementary science, all sit on a Continuous Improvement Learning Team that reflects on and improves district processes and procedures.

The **Teaching and Learning Specialists** are instructional coaches, distributed across school sites–one or two depending on the size of the school. They are responsible for supporting

the use of infrastructure in practice by working one on one with teachers in their classrooms. However, as noted previously in this case, they also play a role in developing infrastructure as they sit on and facilitate small groups in resource adoption committees each year; they engage in infrastructuring work as they develop resources to support teachers' use of the curriculum; and they also liaison between schools and the central office, aiding the central office in managing the performance of teachers and students. According to the ED of Teaching and Learning:

> Our elementary Teaching and Learning Specialists are generalists, really fabulous educators. They've risen through teaching and learning, teaching in classrooms to that role. They are, in a sense, leading science from what we do at the district level at their sites.

According to one Specialist interviewed for this study, the main job of Teaching and Learning Specialists is to "help our teachers become better teachers." She went on to describe a particular focus on supporting new teachers to the district, sharing that new teachers are more likely to grow into good teachers who will "actually enjoy teaching and have a good, engaging relationship with students" if they have guidance in their first year of teaching.

At each school site, in addition to Teaching and Learning Specialists, there are several other (science) leadership positions. These are **Site Principals**, **Building Principals**, **Science Chairs**, **STEM Learning Lab Facilitators**, and **Science Committee Members**. Given the size of SSD's pre-K-4 elementary schools, each school campus has multiple buildings divided by grade bands. As such, each campus has one site principal who oversees instruction and other administrative duties, in addition to two or more building principals who function as assistant principals and instructional leads for each building. SSD also has one science chair per grade level (note that grade level teams can be upwards of 12 teachers in SSD). This person

coordinates with the Teaching and Learning Specialist in the building to inventory and order science materials, share how science is going, and coordinate special experiences for students, such as real-world connections with community events. Thus, this role has some responsibility for developing educational infrastructure (in the form of learning experiences for students) as well as managing its performance via messaging to the Teaching and Learning Specialists. There is also one STEM Learning Lab Facilitator in each building. This position was created as part of the STEM initiative described previously. The STEM Facilitators teach classes in the STEM Learning Labs that are designed to serve as enrichment to classroom science instruction and do not draw on Twig resources. Finally, for the resource adoption process in 2020-2021, each elementary school sent representatives to serve on the Science Committee.

Managing Environmental Relationships

Similar to USD and CSD, the work of managing environmental relationships cuts through the other domains of system building activity in Suburban School District. For example, in SSD's work of building educational infrastructure, we have evidence of the central office bridging to resources and curriculum materials that align with their instructional vision while buffering from and/or reconciling with those that do not.

The state science standards are a close adaptation of the NGSS. However, rather than creating a direct bridge from the standards to classrooms, the ED instead used the first meeting of the Science Committee to review literature (largely from the National Science Teachers Association, a strong advocate for NGSS-aligned instructional practices) on best practices for science teaching and learning, and to review and propose modifications to SSD's aim (or vision) statement for science. In the second meeting, committee members engaged more deeply with the standards, identifying areas where they have changed (from the state's first NGSS-adapted

standards to the revised set), clustering the standards into units of instruction, and identifying outlier standards that may be better suited in another grade level. The ED designed this intentionally to maintain a vision based on best practices as central to SSD's improvement work, very slightly distancing themselves from the visions articulated in the NGSS[1].

Of course, the science standards are just one part of the political environment that SSD responds to. The state also has a third grade reading law that requires all third graders to read at grade level. This creates pressure for teachers to prioritize English language arts. According to the ED, "If they're not [reading at grade level], we have to do this huge paperwork process and have retention meetings, and we don't believe in retention. That's part of the pressure, to be honest with you." In response to this pressure, the ED did some reconciling and some buffering. She buffered her Science Committee from reading articles about literacy in science.

> I choose carefully the articles for reading for this process that talk about the doing of science because there's so much pressure to spend so much time in reading that not everybody is committed to the power of the doing part of science and then layering on the learning.

Similarly, after reading *Focus*, by Mike Schmoker (2018), the ED decided not to share the chapter on science with her committee despite how much she liked the other chapters because, "He really questions inquiry. I didn't use that article because I don't want to plant that seed."

The ED did some reconciling, however, with the final selection of Twig. The ED agreed to purchase the Twig leveled readers on condition that they are used during the reading block or as research for an investigation, but not to use them during science.

In SSD's work to support the use of infrastructure in practice, the central office also engaged in bridging and buffering work. For example, upon selecting Twig as their new

curriculum, the ED buffered schools and classroom teachers from parts of Twig that were not in line with the district's vision for science teaching and learning (e.g., the use of the Twig workbook that would too narrowly restrict students' sense-making as compared with their science notebooks, the fast-track course that would cover the standards but skip many lessons in the program, and assessments that were perceived as inauthentic measures of student performance). Instead, the ED and others in the central office developed more supports for science notebooking, their own pacing guide for completing each grade level's Twig modules with the full course, and they're working on developing their own assessments.

Here, the relationship between Twig and SSD cannot be understated. Though the ED buffered SSD schools and teachers from some of the Twig resources, on balance, Twig Education offered to SSD a suite of complex resources, the depth of which SSD was not prepared to develop in-house. That SSD was able to outsource that work to Twig was critical to its ability to build and support the use of educational infrastructure for elementary science.

SSD's partnership with the River Valley STEM Ecosystem is another example of how SSD manages environmental relationships. SSD has heavily invested in this partnership for over a decade. One STEM Ecosystem leader described SSD as:

> the easy button, where you can say, 'Hey, we have this idea. Can we try it out?' They will give you good feedback, very grounded feedback….They are always interested in new, innovative ideas as well, so that's always very exciting.

Through this consortium, SSD has access to PD opportunities and grants for teachers, a STEM classroom grant, as well as several other community partnerships. The Director of Teaching and Learning described these community partnerships as follows:

> What's great is that if we find a need, we can usually take it to the consortium…and [brainstorm] okay, who has resources to help support this?.... Then the STEM Ecosystem is the one who's coordinating all of it and providing those supports. It could be that a training is provided or that they're able to send a handful of teachers to professional development, maybe locally.

Educators in SSD take advantage of many of the resources available through the STEM Ecosystem. SSD in turn supports the River Valley STEM Ecosystem in securing grants; for example, by writing letters of support for grants or offering support in other ways.

In addition to bridging community resources with elementary schools in the district, the central office also does some buffering work. The Director of Teaching and Learning believes that initiatives they pursue at the district level must be scalable to all of their elementary schools.

> I think when we think about science instruction, we really try to approach it from the district approach, rather than there's this great program and then there a handful of classrooms that get to be a part of it…. That's why, like I said, we normally rely on larger threads that we can tap into rather than trying to pool a number of resources to address our district. Or to fill that need in our district, knowing that our district is so large.

Implications for School-Level Designs

This account offers insight into how SSD leverages their unique central office leadership structure and district-wide commitment to continuous improvement to affect policies and procedures that are designed to support and improve elementary science instruction that is adjacent to the visions espoused by the NGSS and the *Framework for K-12 Science Education* (National Research Council, 2012; NGSS Lead States, 2013). We have evidence of these policies impacting domains across our analytic framework: building educational infrastructure,

supporting its use in practice, monitoring performance, developing and distributing instructional leadership, and managing environmental relationships. Given this work being done by the central office, we hypothesize that schools are making use of the Twig curriculum with support from the Teaching and Learning Specialists via coaching, infrastructuring, and interfacing with central office leadership. We further hypothesize that this would take place in schools with ample variation, in part because of SSD's District Way that encourages adaptation. That said, for as much as SSD has done to build systemic supports for elementary science, there are elements left undone that warrant investigation at the level of the school. For example, we do not know how attached schools and teachers were to FOSS, and how that may impact their buy-in with Twig.

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