

How a Research-Practice Partnership Refined its Strategy for Integrating CS/CT into K-5 Curricula

An Experience Report

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ABSTRACT

Massachusetts defined K-12 Digital Literacy/Computer Science (DLCS) standards in 2016 and developed a 5-12 teacher licensure process, expecting K-4 teachers to be capable of teaching to the standards under their elementary license. An NSF CSforAll planning grant led to the establishment of an NSF 4-year Research-Practice Partnership (RPP) of district and school administrators, teachers, university researchers, and external evaluators in 2018. The RPP focused on the 33 K-5 serving schools to engage all students in integrated CS/CT teaching and learning and to create a cadre of skilled and confident elementary classroom teachers ready to support their students in learning CS/CT concepts and practices. The pandemic exacerbated barriers and inequities across the district, which serves over 25,000 diverse students (9.7% white/non-Hispanic, 83.7% high needs). Having observed a lack of awareness and expertise among many K-5 teachers for implementing CS/CT content and practices and seeing barriers to equitable CS/CT teaching and learning, the RPP designed an iterative, teacher-led, co-design of curriculum supported by equity-focused and embedded professional learning. This experience report describes how we refined our strategies for curriculum development and diffusion, professional learning, and importantly, our commitment to

addressing diversity, equity, and inclusion beyond just reaching all students. The RPP broadened its focus on understanding race and equity to empower students to understand how technology affects their identities and to equip them to critically participate in the creation and use of technology.

CCS CONCEPTS

• Social and professional topics → Student assessment; K-12 education; Computational thinking

KEYWORDS

computational thinking; K-5 computer science education; teacher preparation; research-practice partnership

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1 Overview

In 2016, the Massachusetts departments of Elementary and Secondary Education (DESE) and Higher Education (DHE) issued K-12 Digital Literacy and Computer Science (DLCS) standards [4], defined a 5–12 DLCS teacher licensure process, modified the MassCORE recommended high-school curriculum to include a computer science option, coordinated professional development, and published curriculum planning tools [10]. The second largest

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Massachusetts district, Springfield MA Public Schools (SPS), committed as part of a 2016 NSF CSforAll planning grant to a six-year plan to make computer science and computational thinking (CS/CT) available to every SPS student. Collaboration under this planning grant led to the formation of the CSforAll SPS research-practice partnership (RPP) of SPS district and school administrators, academic coordinators, and teachers, University of Massachusetts Amherst and Five Colleges Consortium researchers, and SageFox evaluators. CSforAll SPS received funding from a 4-year NSF CSforAll grant in fall 2018.

Springfield offers high and middle school CS-related academic and vocational computing courses, but typically a small percentage of SPS high school students and few females or students of color enroll. The RPP chose to focus on the 33 K-5 serving schools. DESE assumes elementary schools will ensure that students are exposed to and learn the DLCS concepts and practices. When the RPP began, few schools had technology teachers or room in the school day for separate CS courses. CSforAll SPS decided to focus on classroom teachers who could engage all students with CS/CT curricula integrated within other standards-based subjects [1][32]. Preliminary research [16] identified a significant lack of classroom teacher skills and expertise for implementing DLCS standards-based CS/CT content and practices. Additional research under the planning process uncovered community, family, school, administrator, and technological barriers to equitable CS/CT teaching and learning. These two factors, led to a strategy for empowering teachers through an agile and iterative co-design of integrated CS/CT curriculum supported by high-quality, equity-focused professional learning [27].

Each year the RPP recruited 16 “design team teachers” from 2 grade levels one each from the DLCS elementary grade spans – Kindergarten & 3rd grade in Year 1; 1st & 4th grades in Year 2; and 2nd & 5th grades in year 3. The design team teachers were joined by a Special Education and an English as a Second Language specialist as advisors to form two grade-level Professional Learning Communities (PLCs) to co-design, pilot, assess, revise, and document the curriculum (see Figure 1). The teams created 4 quarterly CS/CT Modules with 4-11 lessons integrated within standards-based ELA, Math, Science, or Social Studies.

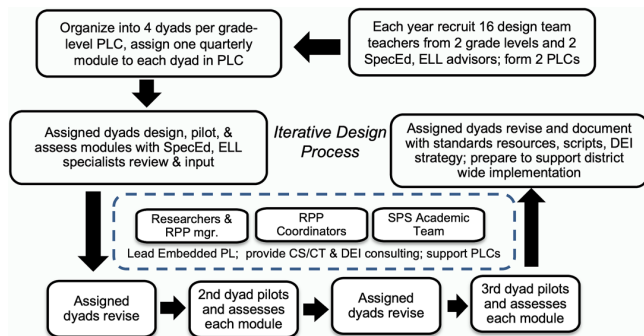


Figure 1. Design Team Process

A few other projects are addressing computer science and computational thinking education at the elementary level, often in diverse districts. Among these are Broward Codes [3], the CSNYC

CSforAll effort [6], the San Francisco Unified CSforAll project [24], the CS Visions RPP Elementary Computing for All curriculum [14], the LTEC-2 STEM+C project [26], the AIR@NE RPP [19], the EDC/MA-DESE project [29], and CELS [13]. CSforAll SPS differs in that the RPP has not partnered with curriculum or professional learning providers. The RPP chose instead to develop the teacher-centric, co-design process shown in Figure 1 to build expertise, efficacy, trust, and community among all SPS elementary teachers and to achieve our goal to deploy an equity-based, integrated CS/CT curriculum across all schools and classrooms. The RPP co-design process differs from others [7][17][22] in that it was led by teachers who created curricula and professional learning activities that are intended to be used by over 600 teachers across the district.

In a majority-minority district with a majority of white teachers and administrators, the partnership quickly moved beyond assuring access for all students to CS/CT curricula and developed programs of diversity training for the teachers and all partners to address implicit bias, deficit thinking, and systemic racism so that the curriculum would be culturally relevant and taught in a way that recognized student identities.

2 Project Goals and Progress through Year 3

CSforAll SPS researchers are committed to addressing real problems of practice in partnership with the teachers, principals, and administrators and use an adaptive, and agile Design-based Implementation Research (DBIR) approach [8]. This allowed progress to continue as research uncovered new challenges and research directions including those arising from the disruption caused by the COVID-19 pandemic. The initial goals included:

1. Enable teacher-led, dyadic design teams to engage in integrated curriculum co-design, focused on the examination, interpretation, and integration of the concepts and practices defined in state CS standards to develop student learning progressions, design instructional approaches, and produce equity-based lesson plans ready for full-scale diffusion.
2. Support the design team teachers who have been trained through high-quality, embedded professional learning (PL) to assist and mentor their colleagues to undertake a full-scale implementation of the integrated CS/CT lessons in most of the 33 elementary schools, reaching up to 12,000 students.
3. Employ tightly coupled research projects jointly chosen by the District using an iterative, adaptive, and agile DBIR approach to guide and assess the piloting and diffusion strategy and identify and address barriers to equitable CS/CT teaching and learning.
4. Establish and sustain a successful RPP.

2.1 Developing Leadership and Community

At the start of the project the RPP hired five district teachers and instructional leaders as consultants who work under the overall project manager and are supported by the PIs, researchers, and district team. Their hiring turned out to be key to the project’s progress and success. These teacher-coordinators (a lead coordinator, a curricular resources and technology coordinator, and one coordinator for each of the three yearly grade level pairs)

facilitated the teacher-led lesson module design, piloting, and refinement, and designed, implemented, and led the ongoing professional learning. Because the coordinators are active classroom teachers or school-based instructional leaders, they have the respect of teachers recruited to the design and early adopter teams, understand the stresses and constraints within the district, and are able to support and mentor the teachers.

As noted, design teams were formed with teachers from one grade from each of the two grade spans (K-2 and 3-5) in the state DLCS standards. The Professional Learning Communities (PLCs) met frequently for embedded professional learning, reflection, collaboration and trust and community building. The five coordinators worked as a team supporting the grade-level design team teachers and advisors in their PLCs. The coordinators benefitted from professional learning activities that focused on collaboration, diffusion of innovation, leadership skills, and equity led by RPP researchers (see 2.4.) To increase connectedness to the researchers, the RPP encouraged RPP coordinators and paid for them to participate in conferences such as SIGCSE TS, ICER, CSTA, ISTE and AERA as attendees and presenters.

2.2 Curriculum Development and Diffusion

The RPP employed an agile cycle of continuous lesson development, piloting, assessment, reflection, and revision in three iterative steps as shown in Figure 1. Four quarterly modules of 5-11 lessons were piloted in Kindergarten and 3rd-grade classrooms in AY18-19. Modules were piloted in 1st-grade and 4th-grade classrooms in AY19-20 and in 2nd-grade classrooms and 5th-grade classrooms in AY20-21. Each dyad made sure to pilot in at least 1 of their two classrooms. In Kindergarten through 4th grade modules were piloted in at least 4 of classrooms, and in at least 3 classrooms for grade 5.

Grade-Level Teams	2018-2019	2019-2020	2020-2021	2021-2022
K & 3	Curriculum Design, Pilot, Reflect, Redesign, Document	“Early Adoption”	Planned-Rollet	Full rollout in 11-school cohort
1 & 4		Curriculum Design, Pilot, Reflect, Redesign, Document	“Early Adoption”	Planned-Rollet Full rollout in 11-school cohort
2 & 5			Curriculum Design, Pilot, Reflect, Redesign, Document	Full rollout in 11-school cohort

Table 1. Revised Timeline

The original plan to undertake full implementation of the curriculum across all classrooms and schools following the design and piloting phases (i.e., all K and 3rd classrooms in AY19-20, all 1st and 4th classrooms in AY20-21, and all 2nd and 5th classrooms in AY 21-22) proved difficult due to teacher loads, the pandemic disruption, and a lack of a full commitment from the district. As a result, the original approach first was modified to have three stages - design/pilot, early adoption, and full implementation across all schools (Table 1). Section 3 discusses the current “whole school, cohort” model. In AY19-20, 57 “early adopter teachers”

volunteered to expand teaching of the K & 3rd grade curriculum in classrooms in 28 of the 33 schools with ongoing PL support to ensure equitable and inclusive instruction. This newer approach was further disrupted by the pandemic and the resulting move to online and hybrid instruction in parts of AY19-20 and AY20-21. The RPP was able to adapt piloting and teaching to remote learning although some teachers had to move to an out-of-school-time delivery due to limited remote class time.

By the time the district went fully remote in March 2020, a reduced number of K and 3rd teachers were able to teach three of the four quarterly modules to around 400 students and the 2nd and 4th design teams completed two (of three) iterations of piloting and documenting. In summer 2020, the RPP recruited 2nd and 5th grade design teachers, a smaller cohort of 1st and 4th grade early adopting teachers and revised the curricula so it could be taught in class, after school, or remotely. Hybrid instruction began April 5, 2021, and full in-class elementary instruction resumed May 3, 2021.

The design team teachers documented their modules and lessons and included references to both CS/CT and core standards, objectives, assessments, vocabulary and definitions, strategies for differentiation, recommended scripts, and links to resources as outcomes of the design phases. During summer 2020, volunteer teachers revised the curricula to incorporate more culturally and historically responsive pedagogy [11] and to focus on developing student identities, enhancing individual skills and intellect, and emphasizing student criticality in viewing curricula and materials [18].

2.3 Professional Learning

High-quality, embedded, and on-going professional learning was essential to the success of the project as the RPP began with few district teachers who had awareness and expertise for implementing CS/CT content and practices standards. The RPP first enrolled the K & 3rd design team teachers, the coordinators, and some of the graduate students in the Launch CS [15] Computational Thinking Integration curriculum but found that the first-year design teachers leaned too heavily on the sample lessons in their lesson designs. The RPP intensive, online Launch CS course, did not include an equity component. The second and later years, the teacher coordinators and the RPP researchers co-designed the professional learning curriculum around a variety of curricula and technologies, e.g., CS Fundamentals, codeSpark, micro:bit, MakeCode, Scratch, Makey-Makey, and Hummingbird Bit (see [10]) and included diversity training.

The RPP coordinators and project researchers provided support, mentoring, and continuous professional learning and collaborated on the design process with the design team teachers’ PLC for the curriculum development task. The grade-level coordinators worked directly to support and mentor the early adopter teachers who were taking the designed curriculum to their classrooms across the district and who were also organized into grade level PLCs. Importantly, the community forming within the RPP drew earlier grade-level design teachers in as mentors for the early adopter PLCs. This first step toward achieving Goal 2 was enhanced by the interventions [30] described in Section 2.4.

The RPP successfully moved professional learning, design, and early adopting teacher meetings, and other RPP meetings online in spring 2020 and designed new and what has proved to be very effective online professional learning [33]. The RPP PL online strategy included extensive use of norms, attention to self-care and reflection, and tools and protocols to support individual, dyad, grade-level team, and whole-group learning. PL included self-reflection and building on teachers' knowledge and skills for equity-driven, integrated CS/CT module development and implementation. PL focused on building a growth mindset that let teachers experience that mistakes are part of learning, and included synchronous and asynchronous activities, plugged and unplugged activities, opportunities for choice about what to learn and how to demonstrate learning, and opportunities for personal expression and creativity.

2.4 Research

The partnership has been most successful when research addresses real problems of practice and when the outcomes influence teacher, school, and district actions and policies. The CSforAll SPS team works together in areas where university researchers collaborate directly with district administrators, principals, teachers, and the RPP teacher-coordinators including: analyzing the curriculum design process; recruiting a diverse group of teacher participants; designing equity-centered professional learning; and addressing issues of race, equity, and inclusion. The initial RPP research projects were jointly chosen by the researchers and the district, and all have a central focus on diversity where the RPP team developed a series of interventions (see 2.5). The interrelated projects include:

- Research on collaboration, particularly how it affects the dyadic professional learning communities, the evolving structure of the RPP, the implementation of integrated CS/CT, and how equity is addressed.
- Assessment of the growth of student knowledge of computational thinking, teacher engagement with classroom issues of equity, and teacher development of CS pedagogical expertise through integration of disciplinary CS practices as mediated by professional learning and the use of CS learning technology; and
- Identification and examination of barriers to successful, equitable and inclusive CSforAll implementation in the district.

The collaboration research team focused on collaboration as a primary vehicle to enable successful curriculum development and achieve the RPP goals. The design team PLCs and teacher coordinators were closely observed, interviewed, and trained in collaboration skills. The collaboration research team employs a variety of methods to analyze PLC communication networks and to support disciplined inquiry and continuous improvement through cycles of dialogue, decision making, action, evaluation, and reflection [31]. This team developed yearly sociograms to track the organization and growth of the RPP. They found that the use of effective protocols: increase equitable participation; surface, address, and resolve disagreements; focus team conversations; increase teacher CS/CT knowledge and skills; and enable RPP

team members to effectively facilitate meetings, PLCs, and the DBIR process.

The RPP used several approaches to measure student engagement and learning including the continuing reflection and feedback from design and early adopting teachers during meetings, classroom observations [27], teacher/student interviews, and student artifact interviews [20] [2]. The plan to work closely with teachers to design and develop checklists for ongoing evaluation of student work related to the CS/CT-based lessons and to carry out clinical interviews as a pre-test of student prior knowledge related to CT and CS were disrupted by the pandemic and by increased teacher loads and stresses. Limited artifact interviews are expected to resume in the coming academic year. Earnest et al. [5] are using a Funds of Knowledge approach to develop classroom assessments that the RPP expects to use as the project moves forward.

The team identifying barriers compiled data from many interviews and focus groups of teachers, school principals, chief school officers, curriculum coordinators, other district administrative staff, and members of the RPP. They also collected data from the state and district on student turnover, teacher turnover, student test scores, and neighborhood poverty. Their focus is on the RPP goal to ensure access (providing curricular materials and technology, time in the school day, and level of facilitation), but importantly going beyond access to define levels of success and deepening the rigor of equity manifest in curriculum design.

2.5 Diversity

The district and the city include a broad set of stakeholders - residents, city leaders, students and families, and district and school administrators, teachers, and staff, which are socially situated in different and intersecting systems of advantage and disadvantage. Many district and school administrators, teachers, and staff reside in communities outside of the city. Springfield teachers and administrators are strongly committed to their students, but in a district with less than 10% non-Hispanic, white students and more than 80% white teachers and administrators RPP researchers have observed instances of privilege, color-blindness, avoidance, deficit mindsets, and unconscious bias during interviews, focus groups, and professional development activities [28]. This impacts the district's teaching and learning environment and has made it critical for the RPP to increase its commitment, modify its approach to diversity, equity, and inclusion, and include the core RPP in reaching a common understanding of equity through facilitated conversations.

The RPP made equity a core principle and began with a commitment to reach and engage all students in teaching and learning that includes equitable and integrated CS/CT curricula. The RPP commitment to equity has evolved over the first three years. Initially, the RPP team lacked a shared definition or understanding of equity. The RPP internal Advisory Committee (PIs, other researchers, sub award leads, district academic team members, teacher-coordinators, evaluators - later joined by principals, chief school officers, and other administrators) set as a goal to develop a working definition of equity for the project and

how to operationalize it. Ryoo, et al [23] discuss how to build equity in research-practice partnerships. The RPP has adapted this into a 3-prong model of how to understand equity: (1) define equity, outcomes, and relational power inequities in project; (2) specify communication and decision-making protocols and resource distribution; and (3) develop mechanisms to manage communication, tensions, reconciliations with periodic check ins.

At the school level, the RPP began to understand that not only do students need access to CS, but also, time is needed for the educators to shift from a deficit mindset to an asset-based mindset for their students [21]. We needed to develop a more comprehensive understanding of equity in the classroom [25] - who computer science is for, how is it taught, and what is taught. The design teams began to look at and document their modules not only for CS/CT content, but also from an equity lens. Following a book study of *Cultivating Genius* [18] and gaining an understanding the HILL (History, Identities, Literacy, and Liberation) model, Muhammad's strategies were incorporated into the professional learning for design and early adopter teachers. Importantly, this approach influenced the module documentation and realization.

The RPP now is leading with equity and taking action by both the leadership team and subgroups focused on PL, equity, and teacher recruitment to bring in guest speakers, encourage the RPP participants to read and attend webinars, maintain the series of equity trainings, include mediation where needed, and address the power structures through restructuring and recruiting to ensure broader participation by teachers and administrators of color.

The RPP external evaluators employed two pre-existing frameworks to understand the partnership and its impacts, an RPP Health Assessment [12] and the CAPE framework [9]. Evaluators observed a dramatic change in the RPP organization over the course of the 2nd year of the project. The evaluators noted that after several difficult conversations, the RPP re-envisioned and restructured the leadership and advisory approach in response to a growing sense that the structure was not aligned with the project's stated commitment to equity. These changes were integral in democratizing leadership and bringing equity into the center of the team, the center of the agendas, and the center of all work that flows in the project, because, from the beginning, it had meaningfully involved a wide range of stakeholders who were representative of the project (including district-level administrators, school level administrators, classroom teachers, researchers, graduate students, and evaluators).

The evaluators agreed that equity work has taken on a new level of "intentionality and seriousness, including the development of a common language and framework for understanding how equity manifests in all aspects of project work." They noted that equity is now explored at all levels of the partnership and its associated activities, including the research agenda, research questions, and research methods, as well as within the team addressing district-level barriers equitable instruction where it was originally housed. In an internal report, the evaluators noted, "... perhaps more impactfully, this RPP has created a context for personal reflection and a deeper connection to and identification

of [RPP team] members' personal biases and prejudices. This project is able to be self-reflective at the individual and partnership levels."

3 Updates

CSforAll SPS continued its curriculum design, piloting, early adoption, and related professional learning over the first three years, through the move to online, then to hybrid, and finally back to in class instruction. Over 145 design team and early adopter teachers taught the curriculum in 32 elementary schools reaching approximately 2,000 of the over 11,000 K-5 students. The pandemic, the concurrent introduction of new math and ELA curricula, and general stress on teachers and administrators prevented the planned full implementation of the curricula across all 33 schools.

The RPP first proposed a flexible option where principals would have a great deal of freedom as to determine the "how, where, when, and who" of implementing the curriculum, but RPP advisory and leadership groups raised concerns about sustainability of this approach. After much discussion, the RPP proposed a "whole-school" model to the district that would be implemented in three cohorts comprising one third of the elementary schools each year. Each elementary school, beginning in one of the three years, will fully implement and sustain the teaching of the integrated CS/CT modules in every K-5 classroom with professional learning and support from the RPP. All 33 schools will be offering integrated CS/CT instruction in every classroom and to every student by 2024 and afterwards.

The district accepted the plan and in May 2021 11 Cohort A schools were selected based on data from the district IT analysts and from the RPP researchers. The project obtained school participation and commitment in early June 2021. The district also committed time in the district professional learning days in August and November 2021 for RPP-based PL. Under the whole-school model, each principal identified a school-based lead, who would be paid a stipend by the RPP and be responsible for coordinating the RPP effort in the school including CS/CT professional learning and working with school-based PLCs.

The district concurrently decided to commit fully to K-12 CS instruction and began the process of hiring 54 "computer CS/Technology Coordinator (CSTC)" teachers who are teaching CS while some providing technical support. With at least one CSTC teacher in each of the 33 elementary schools, the project developed a "roles and responsibilities" guide for the school leads, CSTC teachers, and principals. School leads will work with the principals to coordinate the "when and who."

The quarterly modules must be taught during the quarter for which they were designed, but the principals, leads, and PLCs in each school can determine when in the school day and quarter. At least some integrated CS/CT lessons for each module must be taught by all classroom teachers, some may be taught by the CSTC teachers, and some may be co-taught. Students on Individual Education Plans, involved in English language learning, etc. will be scheduled so as to be present for and participate in the RPP lessons and projects. Modules can be taught as standalone lessons or

embedded in the instructional block of another content area (e.g., the standards-based content associated with a lesson). The CSTC teachers are expected to teach additional, more advanced computer science content.

The RPP convened principals from the 11 Cohort A schools in June 2021 to discuss expectations, the roles of the school leads and CSTC teachers, and planned professional learning and research. The RPP recruited 19 former design team and early adopter teachers to work with the RPP teacher-coordinators to revise, complete, and finalize the documentation for the CS/CT modules, enhance content and learning progressions, improve grammar, formatting, and vocabulary, revise links to DLCS, ELA, Math, Science, and Social Studies standards, and add essential questions, objectives, and assessments.

The RPP scheduled a 2-day "train-the-trainer" professional learning for the identified school leads in August before the initial district PL sessions. Over 600 educators (classroom teachers, paraprofessionals, specialists, CSTC teachers, and administrators) from the 11 schools participated in the August professional learning, led by the district DLCS team with breakouts by school and by grade level facilitated by school leads. About 340 classroom and CSTC teachers attended the November PL session designed and led by the RPP teacher coordinators. In addition to planning PL activities, the RPP teacher coordinators were expected to offer school lead PLC meetings, undertake 1:1 school lead coaching, and hold regular "office hours." In November, the RPP teacher coordinators created "mini-PLCs" with each coordinator working directly with 2-3 school leads to build the relationships and community that proved so important during the design and piloting, and adoption phases. The district DLCS team who oversee the CSTC teachers are offering technology-focused professional learning for the CSTC teachers open to all teachers in the district.

3.1 Observations

As a research-practice partnership employing a Design-Based Implementation Research model, we learned a lot about what it takes to have a successful and sustainable RPP.

3.1.1 Positive Outcomes. While CSforAll SPS and its goals have always been supported by the District, early in the RPP it was too often not a high priority. Increased communication, collaboration, and trust-building coupled with more Massachusetts CSforAll initiatives led to the district committing to hiring CSTC teachers in all schools and to a full-scale, district supported whole-school rollout strategy in K-5. The RPP researchers, by addressing real problems of practice, informed and influenced district policy and practice, particularly around the value of CS/CT teaching and learning in the overall curricula and on issues around diversity, equity, and inclusion. The district and the RPP have concluded that access to CS/CT curricula by all students does not go far enough and are committed to keeping equity at the center of the project. The RPP created a cadre of teachers committed to, confident in, and capable of teaching CS concepts and practices and the capacity to support colleagues to deliver the modules. Almost all of the 145+ participating teachers saw improvement in teacher self-efficacy, leadership skills, pedagogical expertise, and engagement with classroom equity issues. Teachers indicated a high level of

student interest and engagement. For example, most of the 205 teachers participating in a survey following the November District Professional Learning indicated that the students were really engaged in the first modules and that they (the teachers) were excited about beginning the next module. Teachers also noted that while they were initially apprehensive, once they began teaching the modules, they grew more comfortable and that collaboration across the schools with other teachers was a key factor.

3.1.2 Lessons Learned. Hiring teacher coordinators as a bridge between the design team and early adopter teachers and the researchers and district team and providing them with collaboration and facilitation skills, including tools and protocols was essential. The RPP began with a strong focus on teachers to create the curriculum and for those teachers to gain the necessary confidence and expertise to develop the curriculum and to serve as mentors for the larger set of teachers across the district. The RPP realized that it had to broaden its leadership and advisory structures to include central district administrators, principals, and chief school officers. This was a significant contributor to the current district commitment at all levels preK-12. Broadening participation of different stakeholders in the RPP, importantly, of teachers and administrators of color, and conducting equity workshops and research seminars for the expanded advisory team enriched the conversations around equity and led to a stronger commitment to diversity, equity, and inclusion.

3.1.3 Challenges. Under the whole school model, even with clearly stated constraints on implementation, the differing plans in each school impacts outcomes. The RPP is developing strategies to measure success as we scale to 11 and eventually 33 schools. The whole school model will add almost 600 teachers and 4000 students to the project each year. The integrated CS/CT curricula must be made more user friendly, more generic in its integration with other subjects, and continuously revised to address evolving curricula in the other subjects, supporting new teachers, and aligning with district pathways. Research-Practice Partnerships are expected to be long term relationships, which is not always compatible with funding sources and changing district and state leadership and initiatives. The RPP team recognizes that parental and community involvement is crucial, but as noted, the district and the city include a broad set of stakeholders situated in different and intersecting systems of advantage and disadvantage. These and many other issues all need to be addressed if the RPP is to be sustainable.

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