BUILDING COMPUTER SCIENCE EDUCATION CAPACITY IN MIDDLE SCHOOLS: A UNIVERSITY-DISTRICT PARTNERSHIP

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Abstract

We describe the process used to establish and maintain a sustained university-district partnership within a broader, regional consortium of districts, to improve access to middle school computer science education (CSE). With funding from the U.S. Department of Education, this partnership brings together educators, researchers, faculty, and private and public sector CS experts to (a) examine and assess the current state of CSE in participating schools, (b) identify opportunities to integrate CSE within each school's goals, resources, and infrastructure, (c) implement educational initiatives and innovations, making data-informed decisions at each stage, and (d) assess the short- and long-term impacts of reform efforts, retracing steps when needed, and building on successes when possible. We report findings from the ongoing evaluation of the partnership's performance and impact, including perspectives from an array of stakeholders alongside programmatic considerations that drive the partnership's progress, including those made in response to continued disruptions caused by the COVID-19 pandemic and the insights gained from this experience.

Keywords: computer science education, research partnerships, evidence-based practice, broadening participation in computing, building school capacity.

1 INTRODUCTION

Computer science education (CSE) is becoming increasingly important in the 21st century as it equips students with essential skills that are necessary for success in their future careers [1]. These skills include problem-solving, critical thinking, and creativity, which are transferable across various fields. CSE empowers students to develop innovative solutions to the challenges facing their communities and the world at large [2]. As a result, educational systems worldwide are prioritizing the expansion of students' access to CSE [3].

In the United States, there is a particular emphasis on broadening the participation of historically underrepresented groups, such as students from economically and socially marginalized backgrounds. Although efforts are primarily focused on high school students, research indicates that improving access to CSE in middle school can increase students' interest, participation, and retention in CSE in high school and beyond. However, there are significant variations in the capacity of middle schools to deliver intentional, consistent, and meaningful CSE due to institutional considerations, available resources, teacher training, and characteristics of the communities they serve [4].

Transportation and scheduling constraints, as well as curricular demands, can present significant barriers to implementing CSE programs in middle schools [5]. Furthermore, established curricular and pedagogical norms for engaging students in CSE do not exist at the middle school level, making it challenging to expand access to CSE at an earlier age. As a result, schools require responsive supports as they develop, implement, and refine CSE programs that address their unique circumstances.

Collaborative structures, such as research-practice partnerships [6], research alliances [7], and professional learning communities [8], are powerful mechanisms for connecting educators with evidence-based practices. These collaborative structures can support the building of capacity in schools to deliver high-quality CSE programs. Research-practice partnerships, for instance, bring together researchers and practitioners to co-design and co-implement interventions and to share knowledge, thereby promoting the development of CSE programs that are more effective and equitable. Research alliances, on the other hand, connect researchers with school districts to build research capacity and support the use of research to improve educational practices. Professional learning communities provide a forum for educators to share knowledge and experiences, identify best practices, and work collaboratively to improve CSE instruction.

Expanding access to CSE education, particularly for historically underrepresented groups, is a priority for educational systems worldwide [2, 9]. However, significant variations in the capacity of middle

schools to deliver intentional, consistent, and meaningful CSE exist. Collaborative structures, such as research-practice partnerships, research alliances, and professional learning communities, can support schools in developing and implementing effective and equitable CSE programs.

2 METHODS & PROCESSES

The Consortium for Extending the Computer Science Pipeline (hereafter, the Consortium) was established with funding from the United States Department of Education with the intent to connect middle schools within New Jersey with targeted technical assistance aimed at improving CSE teaching, curricula, and infrastructure within the school, ultimately to provide equitable access to high-quality instruction in computer science (CS) to *all* students. By connecting educators with practitioner and researcher expertise, vetted and curated resources, and tailored supports that follow schools through the process of implementing educational change, the Consortium builds the capacity of these schools to intentionally implement, assess, and refine educational change both within and beyond CSE. Being a large-scale partnership across school districts, partner LEAs are able to tap into the well-understood benefits of researcher-practitioner exchanges at the school-school and school-university levels. Within the Consortium, there are no restrictions on school's existing CS programs; rather, schools at a variety of stages in their CSE initiatives and in the student populations that they serve add to the quality of the partnerships and bring depth to what the Consortium can offer.

2.1 Partnership establishment and composition

The broader Consortium initially grew from long-standing relationships among university faculty in education and computer science. Building on the successes of their previous partnerships (the Rutgers University Teaching & Learning Collaboratory; CS-TLC, and the Regional Educational Laboratory Mid-Atlantic; REL-MA), experts in the development, implementation, and evaluation of technical assistance worked alongside content and pedagogical practitioners from the field to develop preliminary materials and processes for work within schools prior to inviting external LEAs to the Consortium. This work included curating instructional resources in CS from the wealth of online materials; culling best-practices in the effective recruitment and retention of students from demographic groups historically underrepresented in CSE; and developing original workshops and case examples to provide educators with the knowledge and skills to grow as educational leaders, understand the breadth of CSE, and leverage data and research evidence to effectively drive change. Following this groundwork, a small group of middle schools were invited to join the pilot cohort of this initiative. In response to the lingering challenges facing schools from the COVID-19 pandemic, a variety of strategies were used to recruit schools to this project (discussed later in Effects of the pandemic).

Schools' first key decision in joining the Consortium was the composition of a small team of educators and administrators to participate in the project. Our previous work has highlighted the benefits of administrators working alongside teachers when improving CS instruction; however, the current state of CSE within a school is a considerable consideration in this process. For schools that have existing infrastructure in CSE (such as dedicated courses or instruction integrated across disciplines), teams may be more teacher-heavy, as their work will likely focus on enhancing existing curricula and instruction. Conversely, for schools without this infrastructure, work will likely focus on launching CS-related learning opportunities and embedding them into existing systems within the school (e.g., schedules, departments, standards, curricula, etc.); administrators' roles are more suited to this work, and they will likely comprise the majority of teams.

During the initial phases of school-university partnerships, activities focused on developing rapport among team members with external partners as group cohesion is an important contributor to successful educational change. In this type of in-school work, it is counterproductive for university members to be seen as descending from an "ivory tower," especially in this project where researchers and practitioners come together to identify problems and develop solutions, and responsibility and leadership is gradually shifted to lie solely with practitioners. Further, it is often the case that the partners from the school have not worked directly together, as they may represent different departments, work in different buildings, or otherwise; it is likewise important to introduce these members to one another and set aside hierarchical barriers for the purposes of this work.

2.2 Partnership processes and operation

Once the core team of each school-university partnership is established, a comprehensive inventory assessment of existing CS infrastructure and opportunities is conducted. Unlike other inventories or

audits, this computer science inventory (CSI) is a collaborative process and does not pass any value-judgements on findings; on the contrary, the CSI serves to provide a baseline understanding that the team can use to intentionally plan changes and gauge progress. Individual interviews and group discussions generate and confirm an accurate picture of computer science instruction that exists across subject areas, extra-curricular opportunities available to students, and any participation of achievement gaps of across student groups. Administrators share institution-level policy and practice considerations, such as scheduling limitations, transportation concerns, upcoming changes that could impact the team's work, and the type of data that is at the team's disposal. The CSI ensures that when decisions are made about potential improvements, it is sensitive to the unique situation of the school and experiences of their students. Additionally, teachers and administrators are surveyed on key constructs of interest on the consortium-level, including their beliefs about and understanding of CS content, their confidence in implementing or delivering CS instruction, their educational and professional backgrounds, and their perceptions of the team's collective capacity and leadership roles; this information is not shared directly with team members during this process, but is vital for understanding the impact of the Consortium.

The CSI marks the beginning of the partnership's work and formally kicks off team working sessions (TWSs) – the *team* including individuals from the school and the university; full team meetings that take place at the school (initially) every 6 weeks. At the first TWS, all members have the opportunity to clarify their understanding of the purpose of the project and their roles within the smaller team and the broader Consortium. The team jointly reviews findings from the CSI, reviews the content and pedagogical concepts that are essential to make CSE-related decisions, and establishes group norms for meetings and synchronous and asynchronous communications. Generally, TWSs are run by beginning with a shared space for the group to process, reflect, share news, and set the expectations for the day's work. Sessions include a learning opportunity or capacity building experience, such as an unplugged activity and debrief discussion, creating a collective response to relevant news (AI in education, standards-related policies, news in computing or computing education, etc.), or practicing data-use strategies using sample schools and data. The remainder of the session is dedicated to collaborative planning, sharing out progress and providing joint feedback, and (when applicable) structured collaboration/working time, potentially in breakout groups.

Early in the project, the content of TWS discussions are generally focused on larger-picture planning: identifying policies that may help or hinder the creation of CS learning spaces (scheduling, transportation, etc.), defining broad CSE goals that serve as touchstones for the team's work (broadening participation in computing, meeting state learning standards), and carefully articulating educational initiatives (hereafter, *interventions*) that the team will work to design and implement. In planning to implement an intervention, teams think through (a) a series of clearly defined steps necessary to execute the intervention, (b) resources or tools that will be useful in implementing the intervention effectively, regardless of whether the team currently has access to them, (c) a data collection plan to gather information that will determine both the progress of implementation as well as the impact of the intervention, and (d), a resource allocation plan that considers the expertise of team members and their availabilities. With this information (as well as guiding results from the CSI and available school data), the team defines smaller working groups, sub-groups, to each intervention the team decides to pursue. Note that individuals may serve in multiple sub-groups, and sub-groups will form, dissolve, and change through the course of the project depending on current foci, availability, and external forces (school-wide priorities, policy changes, staffing changes, etc.).

For example, if a CSI revealed that there is student interest in computer science, but no courses are offered yet, interventions could include the long-term development of a computer science course, then potentially a course sequence; or, a school may choose to integrate CS instruction across subject areas, which would require broader efforts to bring staff across subject areas into the fold and embed CS and computational thinking concepts into instruction without disruption to existing curricula.

At this point, the logistic operations of the school-university partnership shift to match the cadence of the work. TWSs become less frequent and evolve into opportunities for sub-groups to share progress and receive feedback and for the team to address issues that requite the full team's attention as they arise. Smaller, more frequent meetings begin for each sub-group as they carry out the focused work of planning and implementing their intervention. Communication between working sessions become more frequent and substantive and more work is completed between meetings.

Given that this is a period of change for each school, it is likely that the information obtained from the CSI becomes outdated. Although the CSI is not re-conducted during the project, smaller reflections may take place within the team in informal ways. It is also likely that the composition of the school team may change one or more times as the work progresses (e.g., if a school implements a computer science

course, that teacher may join the team and a curriculum developer might step away). Fig. 1 illustrates the flow of individual school-university partnerships within the project.

Following the above example, a sub-group might be created to lead the development of a new computer science course. School administrators would be the key players in this subgroup, and the Consortium can provide them with resources to select a curriculum provider (should they choose to use an existing curriculum) based on their needs. Should a school choose to write their own curricula, subject area experts, such as university faculty or industry representatives, will join the sub-group to jointly draft and review course materials. In either case, the Consortium can provide schools with connections to practitioners in other districts who have had success in broadly rolling out new curricula.

In tandem with these efforts, the broader Consortium works to facilitate knowledge transfer among practitioners across school teams, researchers, university professors, and industry experts to ensure that implementations of CSE interventions can draw on experience and expertise. In practice, this involves coordinating conversations, both synchronous and asynchronous, between school teams and stakeholders that can offer insights into their work (e.g., other educators within or beyond the Consortium, representatives or trainers from various curricular, undergraduate CS faculty, career representatives, etc.). Unlike discussion, these conversations are targeted, specific, and structured in a way that allows for the connections and relationship-building afforded by more informal communications alongside the effective knowledge transfer that comes from more formal ones.

The Consortium is committed to ongoing resource curation efforts; there is an abundance of professional learning, curricular, and instructional resources in the CSE-space, and educators often encounter information overload in combing through individual resources to find ones that are relevant, valid, and translatable into practice. For example, lists of links can be intimidating and require practitioners to obtain and explore each one before making decisions about implications for practice. By generating research briefs from new publications in computing education and examining curricular resources and their applicability to a variety of scenarios, the Consortium shifts the workload away from practitioners, so they can access vetted and curated resources (that include annotations and explicit links to practice) and focus on resource *use*, not resource *gathering*.

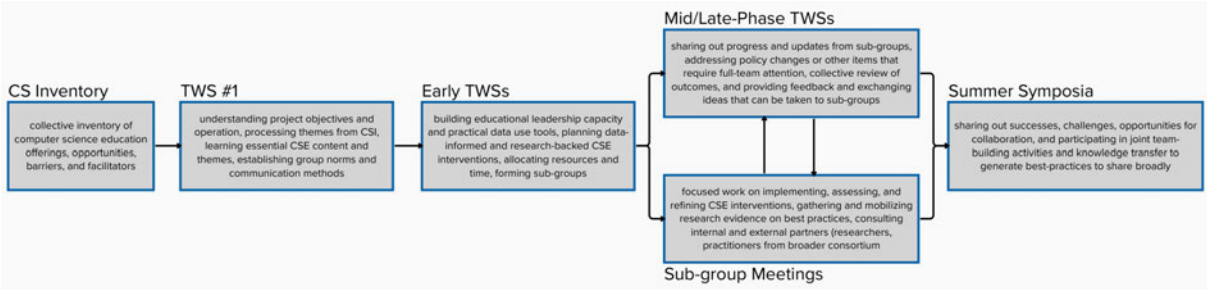


Fig. 1. Workflow of a School-University Partnership within the Consortium for Extending the CS Pipeline

2.3 Ongoing research and iteration

On a larger level still, the Consortium's research team works to examine the work of school teams and the supports they receive through the Consortium to elucidate generalizable takeaways that contribute to the current literature and understanding of computing education, educational support structures, team and implementation sciences, and beyond.

As individual partnerships move forward in their work, they generate a wealth of data that enables them to understand and respond to the progress and impact of their work. This same data, when collected and aggregated at the Consortium level, enables researchers to make connections and draw conclusions on the efficacy of certain strategies or approaches, understanding what conditions are necessary for particular work to be effective, key predictors of success, and early warning signs of work that is not likely to bear fruit (e.g., examining conditions present in schools that implement similar interventions that achieve different results, changes in CS enrollment data in similar schools that implement different interventions, the impact of sub-group compositions on intervention success, etc.).

Practitioners within the Consortium are able to tap this knowledge as it is generated a be active participants in this community-engaged research. These insights can then be shared with broader communities through peer-reviewed publications, presentations at researcher- and practitioner-facing conferences, and through academic magazines, blogs, and social media that are likely to reach broadly

in educational communities. Notably, as more and more schools join the Consortium, we are able to provide more and more guidance based on first-hand experience. In this way, the Consortium is not only a sustainable endeavor, but one that scales and improves over time.

Embedded into the project operations are structural frameworks that enable continuous improvement, such as (a) the cycles of feedback and refinement of intervention planning and implementation, (b) the use of collected metrics to assess the progress and impact of work, informing change when necessary, (c) the routine infusion of the latest research evidence and well-understood tools and processes into the work of partnerships, and (d) the open and authentic channels of communication among school teams, external stakeholders, and the Consortium to inform ongoing improvement of the project itself.

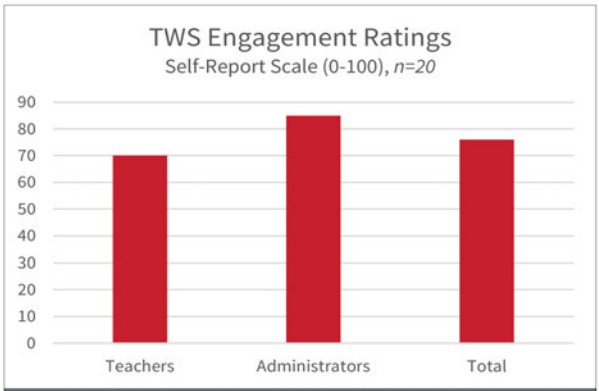
These types of data not only inform the direction of the project, but further allow us to look critically at the efficacy of this tiered-partnership strategy for supporting and driving educational change within CS (and presumably more broadly as well, given this strategy can be readily adapted across disciplines). Over time, we will be able to understand if and how this structure is effective and identify conditions and characteristics that contribute to outcomes. The data routinely generated through the projects work is complemented with more formal periodic data collection and research efforts, such as surveys about larger constructs of interest (i.e., group cohesion, self-efficacy beliefs regarding teaching CS, self-perceptions of educational leadership capabilities, and confidence in mobilizing data and research evidence) and targeted, semi-structured interviews to provide qualitative context to results.

Finally, an external evaluation works to distill and understand the summative impacts of the Consortium, including how many additional students join the computer science pipeline as a result of work done across partnerships (paying specific attention to students from demographic groups historically underrepresented in these spaces), whether students impacted by this work remain in computer science pathways, up to and including undergraduate education, and the collective capacity change within members schools that can be applied beyond this project and beyond CSE.

3 CONSORTIUM OUTCOMES

The Consortium for Extending the Computer Science Pipeline is currently working with a small group of schools from different geographic regions and different demographic compositions in its pilot testing phase. Initial results are promising and show that the Consortium's tiered partnership approach is effective in building the capacity of schools to carry out work in CSE, and that individual schools are having success in developing, implementing, and assessing educational interventions.

Preliminary results, shared in Fig. 2, suggest that the model for TWSs and subsequent sub-groups has been an effective strategy in coordinating and implementing team-oriented work. Further, data shows that both teachers and administrators have found TWSs to be effective time together, more productive than typical work meetings, and neither aim to accomplish too much nor too little during shared time. On a scale from -50 ("we tried to accomplish too much") to +50 ("we could've gotten a lot more done"), administrators and teachers both suggested that TWSs were generally on target, though could perhaps be more ambitious (teachers' mean = +15, administrators' mean = +13, n=20).



	Teachers	Administrators	Total
Mean	70	85	76
Median	71.5	88	81
Std. Dev	17	16	18

Fig. 2. Teachers' and Administrators' Reported Engagement During TWSs

Additionally, evidence from surveys show that following the third TWS, individual school teams feel a sense of community and report mid-high to high levels of group cohesion, as captured by the Group Climate Measure [10]. These results are important, given that group cohesion is a proven predictor of successful collective efforts; note that the survey specified that respondents should consider all members of the team (including members from the broader Consortium not from their school), and the fact that prior to assembling this partnership, many individuals on the team have not previously met, and even fewer have previously worked together.

Although a clear understanding of the nuances of this project has not yet emerged, an early (though unsurprising) trend is the necessity of strong and open relationships among partnership members to conduct impactful work. In many schools, administrators from the school level, administrators from the district level, and teachers have differing (and potentially conflicting) visions for CSE within the school and the steps needed to realize them. Difference in opinion is a strength of partnerships, and although all schools have made progress in developing and implementing interventions, the type of work conducted by schools where teams feel comfortable in communicating their differences of opinion openly (such as reconsidering a course, or tackling deeply ingrained school cultures around CS) is often deeper than the work of schools where this is not the case, where work is more likely to take the shape of isolated efforts.

Qualitative evidence gathered from TWS observations and individual semi-structured interviews with team members support these findings. In these conversations, many teachers have shared that they enjoy feeling included in educational decision-making at a more involved level than usual. On the same vein, administrators have found it useful to hear the opinions of teachers and receive feedback on initiatives before they happen and during their development, rather than at the time of implementation. Administrators and teachers have both shared that above all else, joining the partnership represents a commitment to CSE; it is on their minds, they have dedicated time for it, and they have access to a robust network of support (and one that they actually use).

3.1 Early implementations

During the project, school teams and sub-groups have implemented a variety of interventions, ranging from smaller events, educational and outreach campaigns, developing a school-wide CS recruitment strategy alongside school counselors, redesigning elective selection processes, or (re)designing entire courses. Here, we share two brief vignettes of interventions of completed interventions: the first is a family-focused computer science night implemented by a school without any existing CS courses or instruction in a high-needs area, and the second is a school-wide professional development event to raise educators' awareness of CS and take initial steps towards systemic integration of CS concepts across subject areas. Within each, we pay particular attention to the ways that data are used and gathered and the allocation of resources and time.

3.1.1 Family computer science night

Sunrise Middle School (a pseudonym to preserve anonymity) serves 704 students in grades 6-8. Roughly 40% of these students are White, 25% are Black, and 30% are Latinx, with other racial and ethnic groups comprising remaining 5%. Half of the student population is classified as economically disadvantaged, and 70% of students received reduced-price or free lunch. Students with disabilities comprise 30% of the population. At the time of this intervention, Sunrise did not have any CS courses or electives; a STEM class is offered in a rotation, though not all students are guaranteed to take it before high school.

At this stage in their work, the team aimed to build community awareness and support for CS, so that as larger efforts (establishing a course and building a program) unfolded, the broader community would understand the importance of CS and take advantage of new learning opportunities. To this end, a sub-group was formed to design and implement a family computer science night. The group consisted of the school's STEM teacher, an administrator that oversees extra-curricular activities, and a representative from the parent-teacher organization. The sub-group met bi-weekly in the two months before the event, and ultimately prepared an agenda using CS unplugged resources, Code.org activities, and short video samples that showcased "hot topics" from several curriculum providers.

Nearly 50 individuals registered to attend the event, and around 30 attended. Some families walked to the school, others drove, and some met their students at the building who stayed after the school day. A total of ten families completed the event post-survey developed by the sub-group. Of these, 70% of families agreed that attending the event helped them understand why computer science was important,

with 30% strongly agreeing, and 70% of families agreed that they will encourage their students to be more involved with computer science, with 30% strongly agreeing. Additionally, 5 families expressed interest in learning more about computer science and educational opportunities planned for Sunrise students, and 6 expressed interest in attending similar events in the future.

This event represented an early success for Sunrise's partnership. In implementing this intervention, the team was able to garner support from families and begin the work of setting the school community's expectations as CS education is rolled out. Based on feedback from attendees, this sub-group was able to share informational materials that were effective with their school community in particular and suggest continuing to implement similar outreach events given parents' interest in learning more and participating in these events. On it's own, the event invited many students into the computer science pipeline and gave them exciting information to share with their friends.

3.1.2 School-wide professional development session

Nightfall Middle School (also, a pseudonym) serves just over 1,000 middle school students in grades 6-8. Roughly 50% of students are White, 30% are Latinx, and different or multiple racial/ethnic groups comprise the remaining 20%. Very few (less than 10%) of Nightfall students are classified as economically disadvantaged, and around 20% of the population are students with disabilities. Nightfall offers multiple computer science elective courses, and students are required to take one of two introductory courses before they finish 8th grade (introduction to computer science or robotics I). These courses, less than 9 weeks each, both meet all of the state standards in CS.

Nightfall's ambitious curricular goals for a relatively short course, combined with the fact that a defined goal was to increase the retention of students from the required courses into subsequent optional courses (especially the retention of females and underrepresented minorities), the team looked to integrated and embedded instruction as a solution. Integrating CS and computational thinking concepts across subject areas will alleviate the heavy curricular burden on the introductory courses, allowing time for more engaging and inviting pedagogical practices to tackle persistent retention challenges.

For integration to be successful, teachers across disciplines must have the content and pedagogical knowledge to deliver robust and accurate CS instruction. Thus, a sub-group was formed within Nightfall's partnership to develop and deliver a school-wide professional learning experience to all teachers in grades 6-8. The sub-group consisted of both CS teachers, the department administrator, and the district's professional learning coordinator. The sub-group was able to engage several other educators within the Consortium that have CS integrated instruction for sample lessons and the process of securing school-wide buy-in. Computer science faculty at the university specializing in K-12 outreach trained session facilitators to lead several unplugged activities and conduct debrief discussions, and the team was able to successfully assemble slides, resources, and other materials to conduct the session.

Nightfall's professional learning session is an important step in what is rapidly emerging as a pattern across Consortium schools. A key step in initiating any systemic change is a shared understanding of the breadth and importance of CS and computational thinking, as has been demonstrated in our previous work [11]. Many schools choose to develop and implement a wide-reaching educational event like this one, and the Consortium is working to determine the relative efficacy of these sessions, which have taken the form of traditional professional development events, interactive learning experiences, and synchronous and asynchronous virtual learning opportunities.

3.2 Lessons and implications for practice

Even from this early stage in the project, many key lessons have emerged that will shape the way we continue with the consortium and are more broadly applicable to other providers who work with practitioners in education and other fields of practice. First, despite the authentic composition of the partnership and the strength of the relationships among collaborators, a distributed leadership model may not be optimal for enabling high level of functioning and mobilizing knowledge into actions. Indeed, we have witnessed the formation of hierarchical leadership structures among team members, some of which map onto existing hierarchies (e.g., administrators relative to teachers) while others are based on level of involvement with group activities and/or expertise. In particular, a partnership leadership model that is structured such that planning is centralized and tasks are distributed appears to be optimal for robust and sustained performance over time. Second, clear and consistent communication regarding all aspects of the partnership (roles and responsibilities, expectations and norms, accountability, etc.) is essential for a well-functioning partnership and for the effective coordination of work. Lastly, the work done by the partnership ought to be sufficiently flexible to 'meet schools where they are' in terms of their

readiness to initiate and/or implement change: a partnership is most effective in promoting CSE when it produces tailored educational solutions and supports.

3.3 Effects of the pandemic

The COVID-19 pandemic was a shock to educational systems worldwide, and educators and schools are still grappling with both identifying and understanding its sustained effects; at the same time, they are working to create solutions to address learning loss and social development. From the pandemic, we saw the additional burdens on administrators' and teachers' time. As a result, computer science instruction and many institutional changes became lower priorities as educational systems shifted their focus to addressing the pressing issues posed by the global crisis.

Although schools are becoming more open to taking on additional work or participating in grant projects or initiatives, educators are understandably cognizant of the time commitment that comes with enacting educational change at any level. Our approach to working with schools grew in response to this concern; we wanted to create a model that is flexible and responsive while still moving this important initiative forward. In the Consortium, schools are the key decision-makers and set parameters on the time and resources dedicated to the project. Although researchers, broader stakeholders, and other schools in the Consortium are available, individual schools access this network as they need.

This shift from a more prescriptive model (one where our work with schools assumes a near-identical workflow or the implementation of a standard curriculum or approach), we believe, has markedly eased the process of recruiting schools to the Consortium. Based on qualitative feedback, we also believe that this guidance-first approach increases the overall efficacy of members, as we promote time on task and progress while building educators into leaders, tapping into both intrinsic and extrinsic motivators. We are careful to present our project as it is: working *together* to address a common problem of practice.

4 CONCLUSIONS

Our experience demonstrates that carefully co-designed CSE partnerships can be a powerful tool for building CSE capacity across a diverse range of programs and schools. A partnership model is particularly conducive for the effective exchange and synthesis of research-based and practitioner knowledge, producing effective solutions for problems of practice, and an agile action and support infrastructure that ensures adaptive and sustainable implementation of evidence-based CSE practices and is capable of pivoting to address emerging challenges in times of crisis.

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