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Negotiating Equity Priorities Within Systems Change: A Case Study of a District-Level Initiative to Implement K12 Computer Science Education

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***Abstract*—This article explores the intersection of two central issues in computer science education (CSed)—what is meant by "equitable computer science education" and how attendant equity goals play out as school districts attempt to implement comprehensive K12 CSed initiatives. Based on analysis of qualitative data gathered over 15 months of one district's efforts in this area, our findings illustrate how varying conceptualizations of equitable CSed are at play during institutional change processes in a school district, and how negotiation and management of differing equity-related goals takes place within CSed systems change efforts. The implications of this work point to the need of district-wide**

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CSed efforts to engage stakeholders from across levels in the system in the process of planning and implementation. Additionally, we see a potential need for deliberative routines where various conceptions and attendant goals around equity—both related and unrelated to CSed—can be understood and negotiated among district actors.

As school districts in the United States embrace computer science education (CSed), they must contend with a range of decisions—how will they build teacher capacity to teach CS? What curriculum should be used? What is the right mix of "stand-alone" versus "integrated" CSed approaches? Perhaps more foundational to these is an underlying question of how to achieve *equitable* computer science education, with equity being an oft-stated goal around the broader "CS for ALL" movement. Ideally, how this question is answered should shape answers to a range of other questions related to professional development, curriculum, and policy design.[1]

Two other issues complicate this story. First, we have observed that equity can mean many things in the context of computer science education. In prior work, we found that district leadership considered varied goals including reaching all students, utilizing culturally relevant pedagogies, and teaching about ethics in CS, among others, as they considered the question of equity.[2] Second is the reality that achieving these equity-related goals around CSed will require strategic and system-wide approaches in school districts, implicating institutional decision-making, planning and implementation that must contend with existing local priorities, infrastructure and norms around instruction.

This article speaks empirically to the intersection of these two issues of how equitable CSed is conceptualized, and how these conceptualizations play out within the context ambitious systems change efforts in school districts. We ask the question: *How are school district actors conceptualizations of equitable computer science mobilized and enacted as part of a school district computer science education planning initiative?* We explore how one school district engaged in planning and implementation activities over the course of 15 months. Data includes 42 district created documents, field notes from 40 h of district planning meetings, and 9 1-h interviews with members of the district's CSed leadership team. Analysis was conducted first through lenses of instructional systems decision-making,[3] and then utilizing a framework for understanding varied conceptions of equitable CSed.[2]

Findings illustrate how varying conceptualizations of equity are manifest and negotiated during district systems change processes around CSed. First, it was evident that multiple conceptions of equitable CSed were at play in the context of district activities. Second, district leaders involved in development of the CSed initiative sometimes diverged when it came to which conception of equity was more important to foreground at various points in their initiative's rollout, with some seeing efforts focused on promoting equity in terms of the rigor of learning goals potentially coming at the expense of other efforts aimed at fostering the institutional conditions necessary to provide comprehensive access to CS learning for all students. Third, district actors attempting to implement activities aimed at furthering their equity-related goals around CSed experienced institutional barriers related to existing equity priorities unrelated to CSed.

We see the implications of these findings as centering on the idea of negotiating tradeoffs among different conceptualizations of equitable CSed, as well as with pre-existing equity goals unrelated to CSed. The findings highlighted the importance of engaging decision makers at multiple levels within districts early on in the CSed planning process. As initiatives unfold, the findings highlight a potential need for approaches to district-level decision-making that support deliberation and problem solving around how to meet multiple equity-related goals in the context of the larger district, its initiatives, and community values. In that, equity goals in schools are more productively seen as requiring ongoing management, negotiation, and problem solving, as opposed to ever reaching a stage of "completion," we see the results of this study pointing to such processes of deliberation and negotiation as a likely central element for those involved in the district-level change around CSed.

VARYING CONCEPTUALIZATIONS OF EQUITY IN K12 COMPUTER SCIENCE EDUCATION

Equity is itself a contested notion within education, with views differing not just on how to achieve equity, but also what equity means in the first place. Within CSed, existing scholarship as well as various policy and practice discourses highlight multiple conceptions of what's meant by "equitable computer science education," with no single, agreed upon definition.

In prior work, we offer one framework for how varied conceptions might be understood through three lenses *equity in who gets taught CS, equity in how CS is taught, and equity in what CS is taught*.[2] We briefly review the attendant literature underlying this framework.

With regards to *equity in who gets taught CS*, two frames are dominant—CS as being "for all," and goals of CSed to "broaden participation" in computing. Notions of "for all" are linked to the broader movement to provide universal access to CS learning.[4] "Broadening participation" has been put forth as the primary equity orientation of the National Science Foundation,[5] focusing on the need to support historically underrepresented groups within computing, including African–American, Latinx, and Native American minority groups, women, rural communities, and those with disabilities. While still foregrounding issues of access, "broadening participation" more actively centers historical and contemporary realities of exclusion of particular groups from participation in computing.

Conceptions of equitable CSed that focus on *how computer science is taught* are linked to concerns around access, but foreground questions of inclusive pedagogies. This conception includes addressing issues of accessibility for students with disabilities,[6] creating gender-inclusive curricula and programs,[7] and utilization of frameworks of culturally and linguistically relevant pedagogy.[8–11] Such approaches acknowledge that issues of equitable access for underrepresented groups and inextricably linked to modes of inclusive pedagogy.

Finally, conceptions of *equity in what computer science is taught* span a range of questions related to what learning goals are centered within curricula and learning experiences. One prominent dimension of this conception of equity focuses on the overall rigor of learning goals within CSed efforts, with documents such as the K12 CS Framework and CSTA's K12 CS Standards aiming to operationalize what "counts" as rigorous learning goals in a way that both advocates for going beyond introductory experiences but also aims to promote alignment and depth across learning opportunities.

A second way that equity in what CS is taught can be understood is through goals focused on addressing challenges of economic inequality through technology-related careers, seeing such professions as ladders of economic mobility.[12] These approaches then focus on ensuring that certain types of learning goals are included in CSed opportunities, such as learning specific programming languages, or about industry-related work processes.

Finally, equity in what CS is taught also speaks to the inclusion of learning goals that have students themselves learn about issues of equity and justice in computer science. These include learning about the social impacts of computing as they relate to areas such as privacy, bias, misinformation, democracy, and civil society, (see the work by Eubanks,[13] and Vakil[14]) as well as how to address and develop inclusive computing cultures,[15] an ongoing challenge in the technology sector.

In sharing these various conceptions of what might constitute "equitable computer science education," we aim to highlight first that there are, indeed, multiple ways of thinking about this construct, and, second, provide a general framework that could be used in the context of analyzing CSed efforts along these varied dimensions of equity.

SCHOOL DISTRICTS, SYSTEMS CHANGE, AND POLICY IMPLEMENTATION IN COMPUTER SCIENCE EDUCATION

These conceptions of equitable CSed may seem abstract, but small differences among them can mean significant, cascading effects when it comes to implementation, especially at the scale of large, complex, and distributed school systems.

Within the policy context of the United States, districts are a critical unit of change. Education

reform has historically been largely decentralized, with both state and local district-level actors playing a large role shaping education systems. Districts play central roles in questions of curriculum, learning pathways, graduation requirements, and professional development, among other things. And while some advocates for universal CSed have noted that understanding policy implementation will be key to achieving that goal,[16] there are few studies that aim to understand the relationship between policy implementation and issues of equity (see the work by Fancsali *et al.*[17] and Proctor *et al.*[18] for emerging work in this area), and none that look at how district actors' views concerning equity play out within implementation around CS instruction.

This study draws on conceptual tools from policy implementation scholarship concerned with how district decisions are made and how they contribute to, or detract from, the development of coherent instructional systems.[3,19] This framework focuses on the importance of looking across many elements of instructional systems—including core values and rationales, learning goals, guiding pedagogies, curriculum, professional development, leadership practices, and organizational routines—in order to establish coherence. For example, professional development opportunities should build capacity to teach in ways that align with guiding pedagogy of a district, selected curricula should align with learning goals, and organizational routines should support the process of aligning elements of an instructional system.

In the context of understanding issues of equity, frameworks related to policy implementation in districts are useful in that they expand the view from solely looking at classroom contexts to the broader organizational systems that classrooms, teachers, and students are situated in. Additionally, the particular framework of instructional systems coherence focuses on understanding linkages between broad goals and values held by system actors and how they manifest in decision-making about aspects of an instructional system that mediate equity. In this article, we aim to explicitly explore how equity-related decision-making about CS instructional systems plays out within districts.

METHODS

Data presented were collected within the context of a research practice partnership (RPP) between a university and nonprofit organization that supports CS education nationally, with RPP focusing on researching and supporting K12 district level computer science initiatives through a system-change approach.[20]

This article focuses on one district from among four that the RPP conducted more intensive, longitudinal data collection on over the course of 15 months, selecting it purposively due to the nature and extent of equity-related decision-making and activities its team members displayed over the course of the study along with demographic make-up of its student body. Based in a small city in the northeast United States and serving surrounding rural communities, Greenwood Central School District (GCSD) serves just over 5000 students across 12 schools, with a mixed student body both racially and socioeconomically. 66% of students are white, with the other 44% including 8% African–American, 6% Latinx, 12% Asian or Pacific Islander, and 8% multiracial. 38% of the student body receives free or reduced price lunch. 5% are english language learners, and 12% are designated students with disabilities.

The make-up of the GCSD CS leadership team, formed in response to their participation in the RPP, is of note. While the superintendent for the district supported participation in the RPP, he did not participate directly in the planning and implementation team. A middle school principal, Stan, was designated to lead the team, and two others were central to leading CS planning and implementation: the district's Chief Information Officer, Jason, and a teacher on special assignment (TOSA), Laura, who led a range of STEM-related professional development and curricular development activities across the district. Other core team members included a technology department head, library and media specialists, technology integration specialists, TOSAs, and assistant principals. Approximately, 8–9 people were involved in this core team. The team also regularly engaged a larger group, between 15–20 faculty, that participated in planning and implementation in varying capacities.

Data included 42 district created documents related to planning and implementation of the

CSed initiative, nine 1-h long interviews with CS team members in the Winter of 2019, one year into their implementation work, and researcher field notes documenting 40 h of district strategic planning activities that took place during RPP-led workshops at three time points between January 2018 and January 2019.

The focal question we address in this article is: *How are school district actors conceptualizations of equitable computer science mobilized and enacted as part of a school district computer science education planning initiative?* To answer this question, the research team first coded qualitative data using a coding scheme based on an existing theoretical framework around district decision-making and instructional systems.[3] One aspect of the codebook focused on what element of the instructional system a decision or activity related to (e.g., professional learning, curriculum and instructional materials, leadership, etc.) and another focused on decision-making processes and enacted activities (e.g., a goal being set, a potential activity proposed, an action being carried out, etc.). Throughout, we also coded for any activities focused on addressing equity concerns. In a second round of analysis, we returned to these data related to equity and further analyzed them using the framework outlined in our prior work[2] on equity in who is taught CS, equity in how CS is taught, and equity in what CS is taught. Our findings highlight both the theories of action that under-girded equity-related decisions and how these decisions played out the context of implementation.

FINDINGS

We organize findings utilizing the framework developed in prior work[2] highlighting three dimensions of equitable CS education: 1) equity in *who* computer science education is for, 2) equity in *how* computer science is taught, and 3) equity in *what* computer science is taught. We focus on how plans and activities related to each of these dimensions of equity played out in the context of implementation in GSCD, highlighting how institutional dynamics impacted decision-making around what kinds of equity-oriented implementation activities would be pursued.

Equity in Who Computer Science Education is for: A "Bottom-Up" Approach to Reaching the "For All" Goal

Central among the ways that district actors within Greenwood CSD conceptualized equity and thus engaged in systems change efforts was a stated value that CSed should be "for all;" accessible to all students. This commitment was evident in the mission and vision developed by the CSed leadership team: *"Every GCSD student across race, class, gender, language, and ability level, will creatively and critically engage in representing and solving problems using computational and systems thinking."* In attempting to make this vision a reality, however, district actors encountered institutional barriers, particularly from district central office administrators, that ultimately shaped an implementation approach that actors variably characterized as "organic," "grassroots," and "building it from the ground up."

One element of the CS leadership team's theory of change was the belief that in order to equitably provide all students with access to CS learning experiences, CS would need to be integrated into existing disciplines across the curriculum, an approach especially important at K-8 grades where they saw fewer opportunities for "stand-alone" CS learning. As such, team members believed that all teachers across the district would have to engage in CS-focused professional development. To them, this not only meant creating opportunities that reached all teachers, but also a clear message from district leadership of the importance of CSed. However, the team was stymied in their attempts to enact these two goals. One effort in this area focused on bringing leadership messaging and professional development to a district-wide faculty convening at the start of the 2018 school year. But as one team member recounted, "that definitely became off the table;" the CS team put in an explicit request to district administrators, and it was rejected. At another point the team proposed a paid, all faculty pull-out professional development day during the Summer of 2018. Again, they were told, in their words, "it is not going to happen." Despite the fact that the CS team had sufficient budgetary resources, there was not willingness on the part of the central office to utilize limited professional development time to focus on CSed.

Jason, a member of a CS leadership team who held a position in the central office—though not one with authority to approve district-wide communications and PD decisions—characterized the result of this lack of top-level buy-in this way.

> *"If it's not articulated and clearly spelled out [by leadership] it's kind of limited. Everyone will say privately, oh yeah we want to do this but if we don't speak it and do it sort of gets lost in the focus. And if you're a teacher who's coming and you're hearing we should do this or we should do that, CS becomes just one of the things that maybe they can do—there's no central incentive structure to buy into that idea."*
> —Jason, Interview, February 7th, 2019

Another member of the team, Laura, echoed these sentiments that without a clear message from leadership, challenges to equitable CSed access to CSed would continue, despite general commitments to such values on the part of teachers.

> *"I think teachers in Greenwood in general have a strong sense of wanting to be equitable. I think they would identify that way and say, "Yes, we want to do our best for all kids." But, in reality, that just doesn't happen because we haven't said, "All teachers do this." It doesn't happen equitably."*
> —Laura, Interview, February 14th, 2019

Jason and Laura both articulated that as a result of not having top-level buy-in to communicate the importance of CS and permission to enact comprehensive PD, the team had to take an alternative approach to reaching all teachers, one that aimed to "grow it organically." Jason shared that "I'm guessing that we have to do really good ground level, organic work for two, three, four, five years with the hope that that will someday grow into a system." Laura echoed these sentiments.

> *"I feel like as this work is proceeding now we're kind of working in a way that's almost, not guerrilla work, but just, if you say no to this, we're gonna go and talk to this other person and see if we can get this lever to move in that way, and if there's a no there, what else can we do to just keep building and building at the lower grade levels or the middle grade levels to try to move the juggernauts that just haven't moved yet."*
> —Laura, Interview, February 14th, 2019

The ensuing approach to reaching all students resulting from this lack of central office support reflected these sentiments to "just keep building," utilizing a "bottom-up" approach. This approach took a range of forms, all oriented at finding intersections between the roles and authority of those involved in the CS team with the existing district initiatives, human capacity and organizational infrastructure.

For example, a long-standing project-based learning (PBL) initiative in the district that Laura had been deeply involved in, was seen as a site of integration of CS.

> *"Right now we've been doing PBL at the elementary level for a couple years. All teachers across the district are being asked to do at least one PBL unit across the year. We identified, as one powerful way to begin adding computational thinking or computer science experience in for all kids, nine exemplar case studies in development right now, K through fifth grade. What we're gonna do is work this Spring as those are being developed to weave a CS aspect into those exemplars."*
> —Laura, Cross-district call, March 15, 2018

The team took a similar approach of integrating with existing instructional assets in a case where it aimed to find not only integration points but also pilot teachers associated with an inquiry-based science curriculum and kits it had recently purchased for its middle schools. The new curriculum focused on data collection, analysis, and visualization, so the team saw an opportunity to bring CS into the schools utilizing those kits, starting with "willing and able teachers who have already started to build their capacity within CS," as one technology coach put it. Again, evidenced in their talk was making choices based not only on where CS might "fit" pedagogically, but where there were existing curricular materials (i.e., recently purchased science kits) and human capacity (i.e., pilot teachers familiar with CS) these efforts could build on.

The CS team, in that Jason oversaw district's instructional technology coaches, also decided to utilize these coaches to bring model lessons around CS into schools coaches worked in, along with more limited PD offerings, including a four part PD on computational thinking within one of the district's middle schools. The team also

included multiple library and media specialists who worked to bring priorities around CS learning into the district-wide librarian team, seeing this team as another element of the district's instructional system that reached, at least in some capacity, all students.

The diverse activities outlined above were not comprehensive of all efforts that the GCSD CS team engaged in as a means to expand access to as many students as possible, but are representative of the overall approach taken in the first two years of its CS initiative. Team members framed these activities—somewhat of a patchwork their roles and authority, existing expertise and interest of faculty, and existing initiatives—as ones that were available to them in order to meet equity-in-access goals. These activities potentially took place in lieu of ones they might have taken had the central office been willing to authorize more comprehensive approaches to communicating a clear priority and associated professional learning around CS. In some respects, this resulting range of somewhat opportunistic activities can be seen as ones that, intentionally or not, ended up prioritizing achieving equity in who had access to CS learning experiences—integrating them wherever it was viable to reach as many students as possible—while goals around promoting equity in what CS was taught in terms of the rigor and overall alignment of experiences were less able to be addressed due to a lack of a comprehensive, district-wide PD program.

EQUITY IN HOW COMPUTER SCIENCE IS TAUGHT: EFFORTS AT BROADENING PARTICIPATION THROUGH CULTURALLY RELEVANT PEDAGOGY

A second conceptualization of equity found in our data related to *how computer science is taught*. This equity-oriented centered not simply on who gets taught CS, but the modes of pedagogy utilized within classrooms. Though this value around equitably teaching CS was intertwined with commitments around equitable access, this conceptualization added an additional dimension of what constituted equitable access to include the ways that different curricula, tools and guiding pedagogies did, or did not, support inclusive learning for underrepresented students. As GCSD team attempted to implement inclusive CS pedagogies, they again encountered similar barriers within the existing district instructional system.

In early planning by GCSD's team, they set a goal to "find curricula that is culturally and linguistically responsive and relevant to the identities of historically underrepresented and marginalized groups," indexing an orientation toward culturally relevant pedagogy, as well as progressive approaches to teaching English-as-second-language learners.

Throughout the project, faculty on the GCSD CS team actively noted gender and racial disparities in participation in their existing CS offerings at the high school level. During an RPP-team led call with another district, Melissa, a technology integration specialist, noted the existence of high school courses in advanced placement CS, non-AP CS, and computer-aided design, stating that: "...we have a lot of strong offerings. But we're not reaching a really broad or diverse population of students. [...] The kids who sign up for these classes are the same kids taking all of those classes."

To address this, the team's curriculum committee began exploring possibilities of working with their high school teachers to develop new interdisciplinary courses that integrated CS practices, setting aside lesson planning days to support course development. The course development process focused on aligning student interests and identities with academic content, a key principle of culturally relevant pedagogy. One course focused on the intersection of mathematics and robotics, leveraging student interest in robotics with a goal of diversifying enrollment. The course description explicitly stated that it was aimed at those with no prior experience in CS. A second focused on integrating Spanish language learning and CS practices, involving students in exploring current events related to Latinx culture through creation of computational artifacts. Members of the CS team shared that the aim of these courses was to not just enroll the same kids that were already taking advantage of existing electives more explicitly framed as being solely about computer science.

Despite enthusiasm from the CS team, one of the challenges to implementing the interdisciplinary courses was working with existing

academic departments represented in the interdisciplinary topics (i.e., mathematics, Spanish language) in order to change course requirements so that underrepresented students would be able to enroll. Specifically, for the integrated mathematics, robotics, and CS course, the team wanted to have students that were currently receiving remedial support, termed "academic intervention support" (AIS), to not have that designation prevent enrollment. However, Laura reported that in conversations with the mathematics department head, the CS team encountered challenges.

> *"We have been trying to get [the course] opened to kids who might typically have AIS math support and meeting a lot of resistance around that because it's a change in that AIS paradigm. I guess he's just not comfortable at this moment moving forward. He's definitely on board with examining what we're doing at AIS and get some data so that we can make it better, but it felt like pushing too much at this moment to have that particular class in that way."*
> —Laura, Interview, March 4th, 2019

In this case, a fairly resource intensive course development effort that the CS team believed would be responsive and engaging for underrepresented groups hit an institutional barrier, with conflicting conceptions from different district actors around what appropriate pedagogical interventions were for students in need of academic support, in particular around a high-stakes subject area like mathematics. While our data did not directly speak to the underlying rationale for this decision, one possible explanation is that the mathematics department head believed that the existing AIS approach, one centered on more traditional remedial math support—pullout tutoring with a certified teacher—was one that he saw as more appropriate to support their academic needs, potentially viewing those needs in terms mathematics achievement. In contrast to this, the CS team saw potential for engaging these students in math through a more experimental, interdisciplinary approach that also incorporated meeting their equity goals around broadening participation in CS through culturally relevant pedagogies.

EQUITY IN WHAT COMPUTER SCIENCE IS TAUGHT: DIVERGENT LEADERSHIP PERSPECTIVES ON THE IMPORTANCE OF DEVELOPING A CS SCOPE AND SEQUENCE

A final conceptualization of equity present in the GCSD team's activities was *equity in what computer science is taught*. CS learning can focus on many different concepts and practices, and choices about what learning goals to address intersect with issues of equity. This dimension of equity includes issues of rigor of learning goals present in and across learning opportunities, whether learning goals are included that explicitly address reducing inequality through promoting economic opportunity, and, finally, how learning goals help students learn about equity issues related to CS including the social impacts of computing and issues of inclusivity of underrepresented groups in computing. Almost all of these conceptions of equitable computer science were present, to varying degrees, within GCSD's work.

We center here on how questions related to the specificity, depth, and rigor of learning goals as one element of equity in what CS is taught, played out in the planning and implementation of CSed during our study. This issue was most present in how the CS leadership team diverged around the relative importance of developing a scope and sequence—a guidance document that articulates a set of learning goals linked to particular grade levels. Of the CS team three leaders, one advocated for putting substantive resources into developing a CS scope and sequence, and two others felt the team should not devote substantial resources to this activity at the time given a number of internal and external factors. In this section, we share first what the team ended up engaging in vis-a-vis a CS scope and sequence, and then outline the divergent positions and respective rationales held by the three team members.

CS Scope and Sequence Development

The GCSD team began considering development of a CS scope and sequence at one of the planning workshops facilitated by the RPP team in July 2018. During this workshop, our research team presented development of a scope and

sequence as one option for how district teams could utilize open work time available to them, and also included a presentation of a sample CS scope and sequence developed by another district. Two sample CS scope and sequences were included among resources district teams received during the workshop. GCSD ended up discussing ideas around developing a scope and sequence during their planning time, and set forthcoming goals to, within three months, "Utilize a wide variety of stakeholders (students, teachers, admins, community members, and community partners) to get a workable scope and sequence", and that "A small group will convene through a release day format in October to research, create, vet Scopes and Sequences." They set as a six month goal "Acquire Board Approval of Scope and Sequence as a living document."

That Fall, the group did follow through on accomplishing at least one goal they set out, convening a broader team, though only of district faculty, over the course of two meetings lasting 5 h total to develop a draft scope and sequence. The group met, reviewed a number of sample scope and sequence documents along with other guidance documents such as the K12 CS Framework, and then used one as a template that they modified to reflect their desires around learning goals for each grade. One library and media specialist involved characterized the process in this way: "We basically looked at other district scope and sequences and decided not to reinvent them, but to merge the things that we liked and add in what we wanted to." Laura, the TOSA, noted that they explicitly added certain elements related to equity that reflected GCSD's values.

> *"[We added] fostering an inclusive and culturally responsive computing culture. Again, that is one of the foundations of this work from the very start and so how we marry all that work that we are doing and saying we are doing as a district to be culturally responsive, marrying that with computing culture is another aspect of this scope and sequence that felt really important to embed."*
> —Laura, Interview, March 4th, 2019

The group also added learning goals around ethics and social impacts of computing, along with language oriented toward inclusivity for students with different linguistic backgrounds and disabilities. Evidenced in their activities were ways that values around equity played into the articulation of learning goals that centered on having equity present both in what would be taught (e.g., CS ethics) and how it would be taught (e.g., culturally responsive computing).

Divergent Perspectives on Scope and Sequence Development

In discussing the decision to develop a CS scope and sequence, the three key team members expressed divergent perspectives, each citing different rationales for and against putting substantial resources into this area, revealing how they viewed the process from an institutional change perspective. These divergent rationales took three forms: 1) the utility of a scope and sequence as a support for instructional coherence, 2) the perceived impacts of forthcoming state standards and having to re-do a scope and sequence following that, and finally, 3) perception that engaging in scope and sequence development was an unwise use of resources due to relative district-readiness at the current stage of implementation.

Scope and Sequence as Perceived Support for Instructional Coherence A key rationale offered by Stan, the middle school principal that led the CS team, was the utility of actively articulating specific learning goals that could guide instructional decisions. Stan shared his perspective in this way.

> *"I think it's important for teachers to have some mapping or some idea of what the goals and concepts are. I think in the absence of that I don't really understand what curriculum we're moving. It's like we don't have a blueprint."*
> —Stan, Interview, February 15th, 2019

In an informal discussion, Stan shared that he saw a broader culture within GCSD that resists these sorts of activities—"a sort of hippy culture"—that he found challenging. He mentioned that he did not think district curricular leaders were able to say why a particular lesson is an "exemplar lesson," as they did not often articulate what counts as "exemplar." Jason, another leader of the CS team, was not unsympathetic to

this view, sharing that had a similar understanding of the purpose of a scope and sequence:

> *"It's the idea that we want to start codifying what are the things we think are worthwhile, what are the ideas we want to teach. It's our first stab at getting onto paper the ideas that we believed to be important to hit on and emphasize at each grade level."*
> —Jason, Interview, February 7th, 2019

As we will explore later, however, Jason had reservations about the utility of using resources to do so given where the district was at in its roll-out. Another team member, Nicole, understood it similarly, as a way to guide teachers around expectations and where they can bring their teaching, though noted that it was most useful for those already interested in teaching CS, sharing that "I think the scope and sequence is meant to serve as a tool for people who are sold on the idea and not sure where to begin." At the same time, even Stan, the most vocal advocate for this work, shared that the realities around this kind of activity do not necessarily match-up with the intentions.

> *"We also have a history as a district of creating giant, like any district, giant guidance documents don't really ever achieve the goal."*
> —Stan, Interview, February 15th, 2019

This general perspective supportive of this work both matches how such documents and the broader principle of having articulated learning goals to guide an instructional initiative are traditionally viewed within scholarship on instructional reform, and was also one the RPP team members expressed both formally and informally when the option to spend time on such a document was given to districts during planning workshops.

Perceived Impacts of Forthcoming State Standards on a Scope and Sequence For both Jason and Laura, however, the development of the scope and sequence was partly perceived as an unwise use of limited resources in part because state-level CS standards were in development at the time, a process that they both were involved in as members of a statewide advisory group. Laura shared that

> *"Jason and I had just started with the state standard work and, to be honest, that was what was kind of making me hesitant to put so much time into this knowing that no one has time to do work a couple times. [...] We needed to make sure that it could be in sync with whatever the state came out with."*
> —Laura, Interview, March 4th, 2019

Jason shared similar sentiments

> *"Stan and I don't really agree. I don't think we should care about a scope and sequence at this point. State standards [are] coming and we should just let stuff grow organically as much as we can. [...] To me it's a waste of time."*
> —Jason, Interview, February 7th, 2019

These dissenting views reflected both concerns about limited resources, with the risk that forthcoming standards would require the team to "do the work a couple of times," as Laura stated, and that it was something that might negatively impact the general flow of work that was unfolding.

Perceived of Lack of District-Readiness Around a CS Scope and Sequence Another concern voiced by those that opposed spending time on a scope and sequence, mainly expressed by Jason, was that it was not the best use of limited resources given the current stage of the district's CS implementation work, regardless of external factors like state standards. This perspective related to a number of issues, including that limited resources should be better spent on more critical needs, mainly fostering buy-in and interest from faculty who did not see the importance of CS, but also that the CS team itself did not yet have the necessary capacity and experience to make informed decisions to develop a scope and sequence.

Jason shared that "My stance is we don't have time to dedicate to [a scope and sequence] 'cause we're pulled in a thousand different directions." He stated that the work that needed to be prioritized was more along the lines of getting model lessons that incorporated CS into classrooms in ways that demonstrated the value of this work to those stakeholders,

something he saw as central to the initiative's success.

> *"To me efforts are better spent getting that one principal, when they see CS activities, [to see] that engagement increases, understanding, reading, all these things increase. That can help us bridge that disconnect [with] other administrators and then classroom teachers."*
> —Jason, Interview, February 7th, 2019

He also did not see CS leadership team having enough expertise to develop a "great" scope and sequence, and that prioritizing other work would actually help them to build that internal capacity.

> *"I don't know if we know enough to be making a great scope and sequence. None of us have taught this stuff because it's all new. There's no way of doing it without a lot of experience. I don't think we can create a truly, helpful, meaningful document at this point.*
> —Jason, Interview, February 7th, 2019

His concerned did not question the utility of having a scope and sequence in and of itself, but rather were framed in relation to perceptions of the institutional change process and what kind of activities were most important at what point in that process, both in terms of internal factors including the need to develop internal capacity of the CS leadership team and buy-in from others, as well as external factors, in this case the development and roll-out of state policy around CS standards.

DISCUSSION

Our findings highlight how various conceptions of what it means to enact equitable CSed played out within the context of district-wide planning and implementation of a K12 CS initiative.

In one case, when attempts at reaching all students through a more centralized approach were rejected, the team engaged in actions available to them given their positions, utilizing existing institutional infrastructure to find "grassroots" points of integration. In a second case, attempts at implementing culturally responsive computing courses integrated with other subject areas faced barriers around access for underrepresented students from actors who were disinclined to allow students receiving remedial math support to enroll in an integrated math and robotics course. Finally, we saw divergent perspectives among the CS team itself as to the relative importance of developing a CS scope and sequence given a number of internal and external factors.

Each of these examples highlights how varied equity goals manifest, and, at times, come into conflict, in the context of district systems change. The divergent views on developing a scope and sequence highlight that within an initiative, different actors can hold different conceptions of which actions, with correspondingly differing underlying conceptions of equity, are most important to pursue at a given moment. Stan's focus on equity in what computer science was taught in terms of rigor—indexed in his desire to develop a scope and sequence—was contrasted with Jason and Laura's priorities around fostering institutional buy-in overall, something that they saw as critical to increasing the political will necessary to fulfill broader equity goals around who would get taught CS. In having the team focus on activities related to equity in what CS was taught, Jason and Laura saw a tradeoff in advancing goals around who gets taught CS.

In both the case of the central office rejection around district-wide communications and PD and the math department head's rejection of remedial math student enrollment in the math and robotics course, we see how broader equity priorities might have played a role in preventing those related to CSed from being achieved. While we are not able to speak directly to the rationale of the district office actors, their rejection of a more top-down approach tracks with what some team members shared about the overall district culture, with one CS team member sharing that in GCSD, "you don't top down anything. You don't tell teachers what to teach or how to teach it," indexing a view of equity that can be interpreted as centering teacher agency and discretion, a broader orientation towards decentralized district policy. While we do not have direct evidence that it was this particular view that undergirded the rejection of the CS team proposals, other actions and ways that team members talked about district culture suggest that it's one possible explanation.

In the case of the secondary course redesign to promote culturally relevant computing, advocates encountered resistance to changing an existing academic support structure, possibly out of concerns by those who ran it that their own equity goals around mathematics outcomes might be short-changed if they opened up the new course to students currently receiving remedial math supports. Whether this is correct can be viewed as an empirical question—it is possible the alternative pedagogical approach would prove productive in terms of math learning for these students. But this dilemma may simply represent another instance of how various equity goals are juggled and negotiated within educational institutions, systems which are regularly managing tensions around achieving a range of equity goals.

That we would see such challenges in the context of district implementation of CS, which represents a new institutional priority in education, is not surprising. In one sense, it acts as an object lesson to the broader community of CSed advocates that the viability of achieving equity, in whatever form, around CSed within schools is one that must engage actors at all levels of the system and not solely focus on questions related to curricular or professional development design, issues that occupy the attention of many in the CSed community. Such activities are situated in broader institutional systems that must be both understood by researchers and contended with by policymakers, content providers, and, most centrally, school-based practitioners from the classroom to the central office engaged in CSed work.

In the cases noted, the hierarchical mechanisms at play around key decisions limited our understanding of the various priorities held by disparate actors in the system. However, it is possible to imagine more deliberative structures that allow differing equity goals to be brought to the surface, and, within those contexts, new possibilities on where goals might overlap could emerge. Ultimately, we do not believe that there is any silver bullet available that would resolve these tensions in perfect harmony. Rather, we see the management of such contradictions as part of the fundamental work of the project of education, and understanding how to navigate them as critical to that project. As advocates of equitable computer science move forward, we believe that it is important for them to keep this reality in mind in order to effectively approach processes of systems change in ways that acknowledge, and aim to incorporate, existing priorities, perspectives, and values.

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