Coding to Connect: Centering Joy and Community in Elementary Computer Science Education

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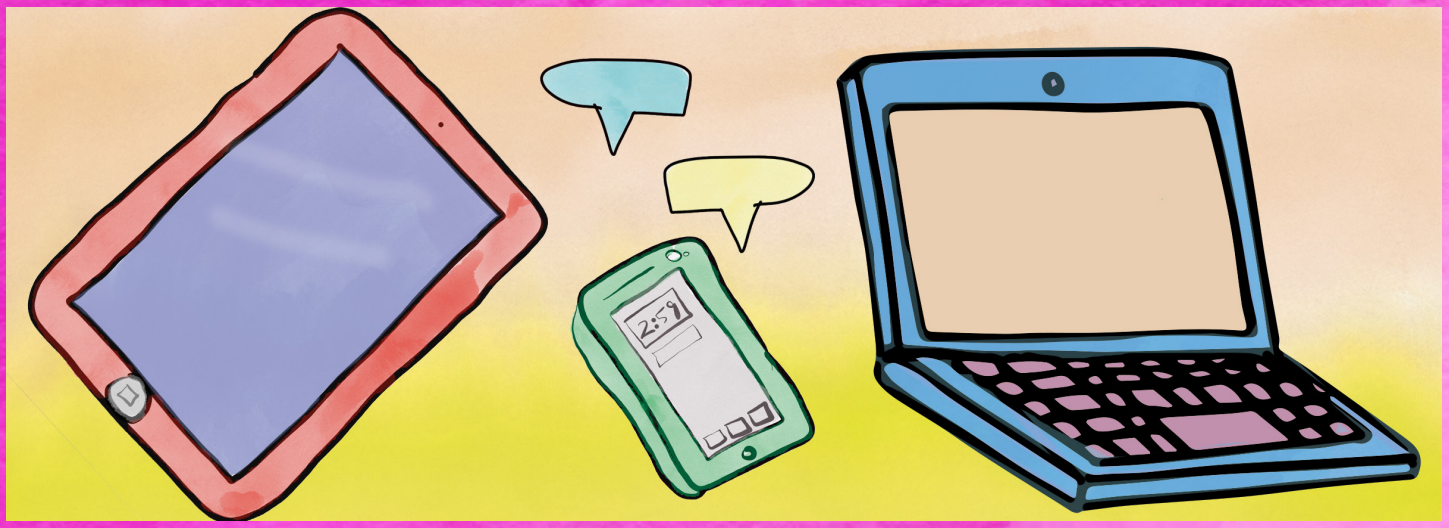


Abstract

In this "how-to" piece, we weave together personal experiences and reflections to explore the design and implementation of an unplugged, elementary computer science (CS) event, and examine the underlying pedagogical principles guiding this work. Critical CS scholars have increasingly called for centering joy and connection within CS, while simultaneously decentering the neoliberal focus on workforce development. We aimed to forefront these ideas with a CS event supported and led by a multi-stakeholder partnership between pre-service teachers, staff, and faculty within California State University, Dominguez Hills' College of Education, and the students, in-service teachers, and administration at 186th St. Elementary School. Historically, CS has been an inequitable and inaccessible field that has not always prioritized diversity or inclusion. By bringing together numerous stakeholders from across the community for a CS event centering joy, we hoped to shift perceptions and experiences of CS and find better ways of supporting and inspiring *all* our students and teachers. *(All images used with permission)*

Keywords:

Broadening Participation in Computing, Professional Development, Elementary Education, Teacher Education, Unplugged Computer Science

In 2013, the Obama White House released a statement entitled "Computer Science is forEveryone!" (The White House, 2013). This statement emphasized the importance of CS education (CSed) in our K-12 systems and encouraged participation in CS throughout US classrooms. In the time since, major efforts at the local, state, and national level have worked to shift funding and focus on K-12 CSed (e.g., Code.org, CSTA, & ECEP, 2021). However, the primary drivers for these efforts have largely centered around neoliberal ideas of preparing students for the workforce and future jobs (Jones & Melo, 2020; Vakil, 2018).

Critical scholars have voiced concerns over this emphasis on jobs and careers, and instead argue for CSed curricula that focus on joy, community, and connection (e.g., Bers, 2022; Jones & Melo, 2020; Ryoo, 2019). Recent research emphasizing the importance of collaboration, relevancy, relationships, and community-centered curricula in CSed have suggested that these types of pedagogical approaches can help shift perceptions of CS and support learning experiences for *all* K-12 students, not just those typically represented (i.e., white, male, abled, suburban, etc.) (e.g., Jones & Melo 2020; Karlin et al., 2022; Ryoo, 2019)

In addition to helping shift perceptions of CS, CSed experiences that center joy and community can support the development of a variety of skills and community can support the development of a variety of skills and dispositions. For example, Dr. Marina Bers' work (2022) on incorporating CS in elementary settings in joyful, engaging ways suggests that these types of learning experiences can help students develop new modes of thinking, connecting, and relating with themselves and others, while also building critical thinking, problem solving, and social-emotional skills. Research also suggests that joy and a love for learning can be sparked by solving the types of complex problems often present in CSed (e.g., Papert, 1993; 2020). Seymour Papert's seminal works in CSed (e.g., 1993; 2020) explore these ideas and examine how engaging in scaffolded complex problem solving through CS, even at an early age, can ignite curiosity and wonder, and provide new opportunities for connecting with content and ideas.

Finally, as a result of the COVID-19 pandemic, students (and teachers) are experiencing isolation, loss, trauma, and a lack of connection at significant and continuous levels (Huck & Zhang, 2021). As schools begin to "return to normal", it is important to use this time to challenge past, inequitable ways of schooling that failed to serve many of our students. K-12 CSed has a long history of being implemented in exclusionary, inequitable ways (e.g., Ryoo, 2019). By centering community, connection, and joy, we can challenge those past ways of doing CS and better serve *all* our our students, particularly during this time of deep loss and grief.

Author Positioning

As educators with a wide range of experiences across diverse contexts, all three authors came to this experience (and to this piece) with different backgrounds, perspectives, and values. These experiences and values informed the design and implementation of this event, but central to all our planning was the core belief of the importance of creating a joyful, connected, community-centered event for students, pre-service teachers, and in-service teachers.

It is also important to note that this work is not meant to be strictly empirical in nature, but rather more holistic and reflective. Here, we weave together our personal experiences and reflections around the design and implementation of one particular event, where our core focus was to create something joyful and community-centered for students and teachers. We are grateful to have this space and opportunity to share, reflect, and discuss how this event was planned and built, and the reasoning behind our design and implementation decisions.

Background and Context

This event was supported and led by a multi-stakeholder partnership between pre-service teachers, staff, and faculty within California State University, Dominguez Hills' College of Education (CSUDH COE), and the students, in-service teachers, and administration at nearby 186th St. Elementary School. More specifically, the three authors: Marcia Reed (Multiple Subject Clinical Coordinator and former 186th St. Principal); Dr. Cristina Stephany (Coordinator of School Partnerships and Clinical Practice); and Dr. Mike Karlin (Assistant Professor of Liberal Studies and STEM) worked directly with Antonio Aguilar (current principal at 186th St. Elementary School) to serve as the planning team and organize the event with support from students, teachers, staff, and administration at both organizations.

The impetus for this event was multifaceted:

1) The CSUDH COE was in the pro cess of expanding and reinforcing partnerships with local K-12 schools.

2) The Snap Inc. Institute for Technology & Education (SITE) was in the process of organizing an inaugural partnership event as a newly formed institute.

3) Local schools had emphasized a need (and interest) in better supporting CSed for their students.

To meet these various, intersecting needs, an initial call was set up with the planning team (Marcia Reed, Cristina Stephany, Mike Karlin and Principal

Aguilar) to discuss the possibility of organizing a CSed event at 186th St. Elementary. Principal Aguilar agreed to the event, provided it would benefit *all* students within a particular grade level, including students with special needs who would join their classmates. A time, date, space within the school, and grade level (4th) were agreed on, and the design of the event began.

Event Design

The central, paramount goal for this CSed event was that 4th grade teachers and students at 186th St. Elementary, and undergraduate student volunteers (pre-service teachers) from the CSUDH COE, would have a joyful, beneficial educational experience. Secondary goals included providing CSed professional development for both pre-service strengthening the existing partnership between 186th St. Elementary and the CSUDH COE, and framing CS as a ubiquitous, interdisciplinary, accessible subject for *all* students and teachers.

Logistically, the event was to be held outside (as a COVID-19 safety measure), for approximately 120 4th grade students across five classrooms, for a one-hour period, on a Friday afternoon in April. To meet these needs, the planning team created a series of three, 20-minute CSed stations (further explored below), each facilitated by one or two pre-service teacher volunteers from the CSUDH COE, as shown below in Figure 1:

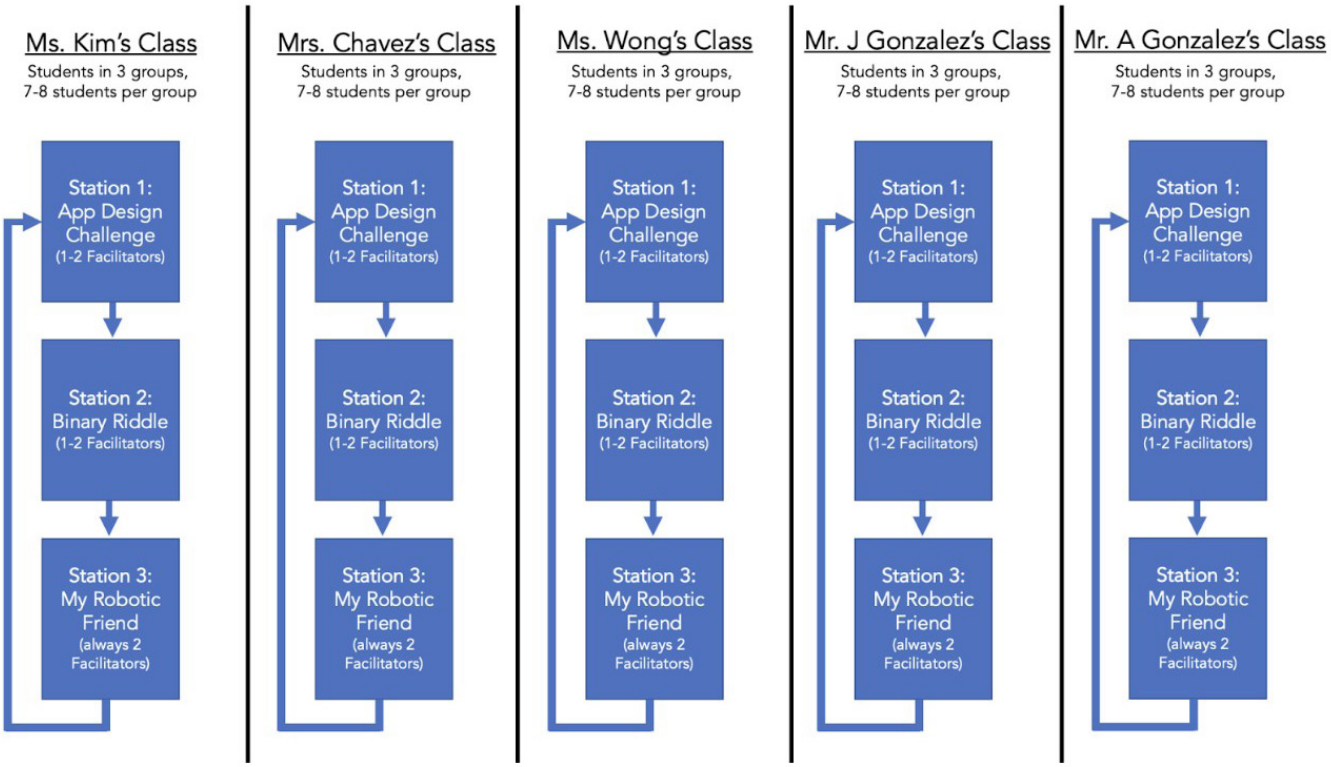


Figure 1
Logistical organization of classes, stations, and volunteers for the CSed event

The planning team also suggested unplugged activities for each of the stations (CS without computers or technology) to work within existing technology limitations as well as to avoid potentially time-consuming troubleshooting issues. These unplugged activities were also designed to demonstrate to in-service and pre-service teachers how to integrate CS in accessible, no-cost/low-cost ways within existing curricula. Finally, given 186th St. Elementary's classification as a STEM school, the school asked that alignment could also be provided to state CS standards and the 21st century skills framework (Partnership for 21st Century Skills, 2009)

To meet these various needs and requirements, three stations were created, two original stations and one remixed from Code.org's curriculum. Across the design of these three stations, a focus was placed on connection, collaboration, and joy (more below, in the description of each station). Additionally, they were designed to be facilitated (and enjoyed) by those at all levels of CSed experience. Finally, alignment with the aforementioned standards and skills frameworks were also provided. The three stations were:

(1) *App Design Challenge:* Students brainstormed a problem they faced in their daily life and drew (wireframed) an app that could help solve that problem (see Figure 2). After they completed sketches of the different pages / components of their apps, each student shared with the group, and the group provided constructive feedback on future iterations. This station was intentionally centered around exploring problems that were specific to students, the school, and the local community. During brainstorming, facilitators helped prompt students to think of problems that were relevant to themselves, their peers, and/or others in their community that they could help address through technology. These relevant, real-world problems also led to rich closing discussions when students provided feedback on each other's apps and shared connections to their own experiences and ideas. By focusing on collaboration and communication, we found students felt valued, appreciated, heard, and willing to take risks to have their ideas acknowledged and accepted in the group discussions.

Station 1: App Design Challenge Template

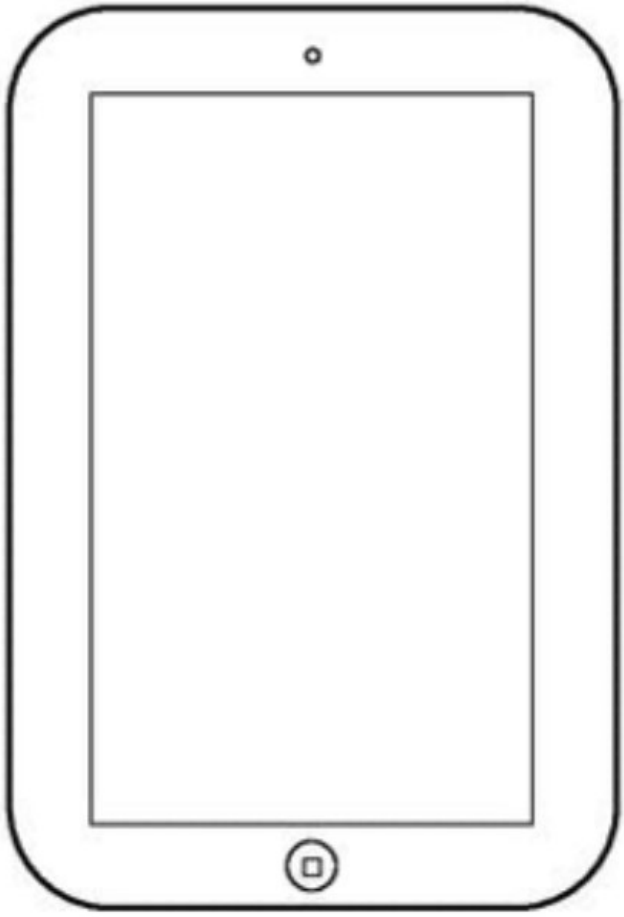
Name: _____

What problem will your app help solve?

How will your app help solve that problem?

Show us your app!

Describe and label what each button / link would do on the right side of each picture



Page Name: Home screen of your app

Figure 2

Template Example for Page 1 of the App Design Challenge Station

(2) *Binary Riddle:* Students were introduced to binary language (how computers store information) by the facilitator and provided with a "key" representing the English alphabet as stored in binary (see Figure 3). Students then solved a riddle by decoding the letters represented in binary. After, students wrote messages, secret codes, or jokes to share with group members, who then decoded each other's message. Some students also added new binary codes to the key to incorporate Spanish letters (e.g., ñ). This station was intentionally designed to center joy through the incorporation of jokes and humor as well as through the follow-up activity where students wrote additional messages and notes to each other in binary. Students also built critical thinking skills by exploring language and communication in new ways, which helped promote problem solving, creativity, and teamwork.

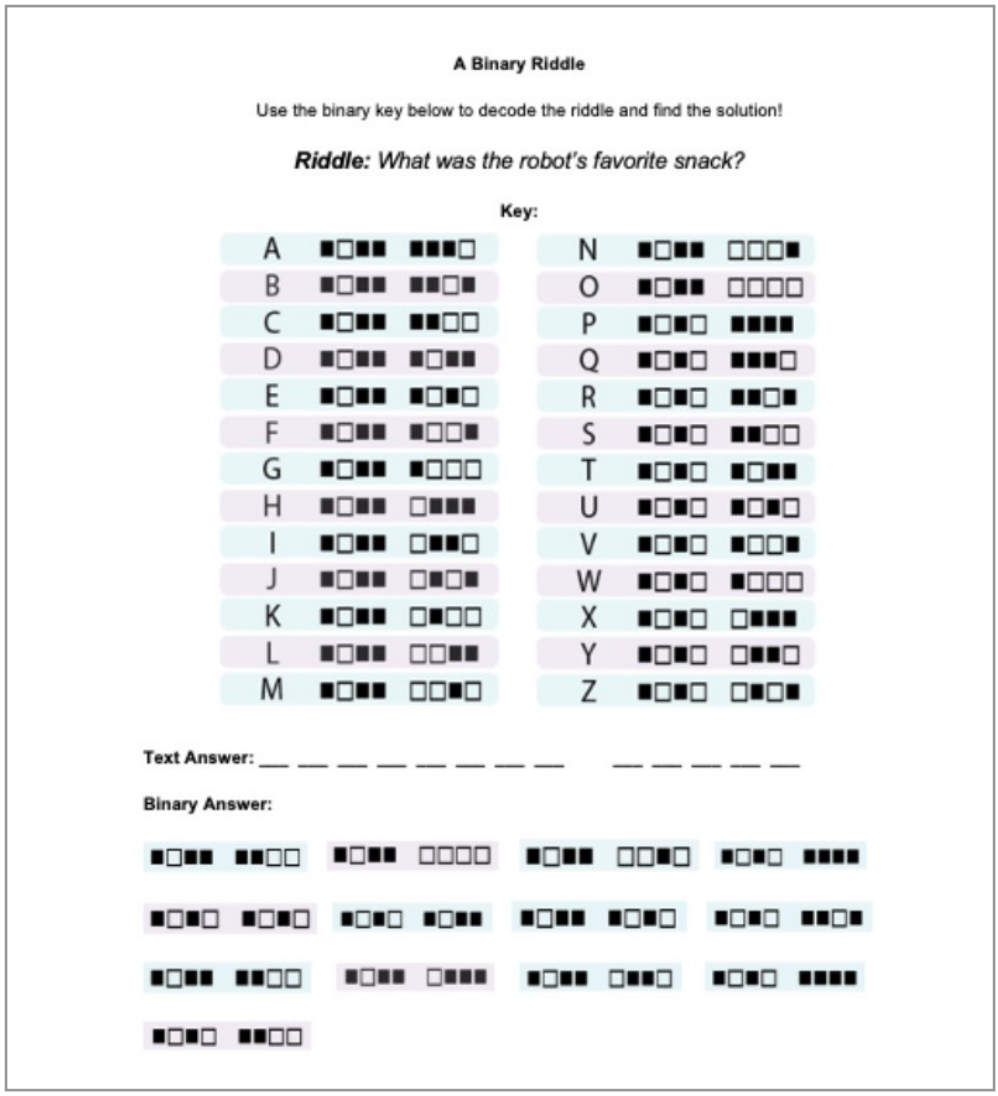


Figure 3
Key and Riddle for Binary Riddle Station

(3) *My Robotic Friends:* Modified from Code.org's curriculum (see: https://youtu.be/xaW3PAzHxCU), this activity asked students to write simple programs or algorithms so their group members could successfully build a stack of cups in the correct pattern. One group member wrote the program, while the other(s) enacted the program using their arms and hands to act as a robot and build the cup structure. Upon completion, students designed their own cup structures and wrote programs to have their group members solve self-designed challenges. Like station two, this station was also meant to center joy and collaboration. Specifically, we saw that students (and teachers) enjoyed the process of programming their peers and watching each other navigate the unique cup-structure challenges they had created.

Additional event design and setup included the recruitment of CSUDH pre-service teachers from LBS405 (Engineering and the Arts in the Elementary Classroom), a junior/senior level course for undergraduate pre-service elementary teachers in the COE. An overview video was also created and shared with 186th St. administration and teachers providing an introduction to the event for teachers to show in class the week prior, so participants would know what to expect and how to connect the activities to various standards (see: https://youtu.be/SY58uuF08EE). Additionally, gift-bags were created for all participants as a way to build community and connection through gift-giving. Lastly, the team created certificates to mark and celebrate students' shared achievements in learning computer science (see Figure 4). When taken home, the certificate was also intended to engage parents/caretakers/community members in dialogue with students about their experience at the event.

Figure 4
Example certificate of participation for 4th grade students at 186th St. Elementary

Event Implementation

The day of the event, 28 pre-service volunteers arrived at 186th St. Elementary School 90-minutes early for training and setup. Nearly all pre-service teachers had no previous experience with CSed, and none had facilitated a similar event prior. They had all received a training overview video the week before the event (see: https://youtu.be/5aoKidFgZ0Y). We spent 60-minutes providing training on the stations with the goal being that all facilitators gain a foundational comfort with the content and activities of their specific station (see Figure 5). Our facilitator training was organized as follows:

(1) *Overview of station (10-min):*
A brief explanation (and recap of above video) was provided for each station while volunteers were asked to think about their top two choices for station facilitation.

(2) *Selection of stations (10-min):*
Volunteers were divided into facilitation roles based on their first and second choices. Nearly all stations had two volunteers, however, two stations were facilitated by a single volunteer.

(3) *First Run-Through (20 min):*
Volunteers first ran through their selected station as students. In other words, they pretended to be 4th grade students, and participated in the station activity as students would during the event.

(4) *Second Run-Through (20 min):*
Finally, volunteers ran through their selected station taking turns as facilitators. One volunteer practiced facilitating for 10-minutes while the other role-played as a student, then they switched for the final 10-minutes.

Figure 5
Training for volunteer pre-service teachers prior to the event

Following the 60-minute training, our planning team and the volunteer pre-service teachers had 30-minutes to set up for the event, which was to be held in the outdoor cafeteria area. During this time, tables were set up with supplies, signage was posted letting elementary students and teachers know where to go, and materials were organized so the stations could begin quickly once students arrived.

Once in-service teachers and students arrived, school administrators and the planning team directed them to their assigned stations, and the facilitators, students, and teachers introduced themselves, and began the stations. After 20-minutes, groups rotated so that each group of students was able to complete each station (see Figure 6).

Figure 6
A teacher-created collage of students participating in the CSed event.

During the event, in-service teachers were also provided information, resources, and training on the various stations, and co-participated alongside students. As the event was also meant to serve as professional development for in-service teachers, time was spent discussing the activities, their alignment with standards and skills frameworks, their potential for classroom integration, and follow-up possibilities that teachers could integrate within existing curricula. At the conclusion of the event, students received their certificates of participation and gift bags, and volunteers and the planning team assisted with clean up.

Discussion, Implications, and Future Directions

Current calls for supporting and increasing CSed in K-12 schools often prioritize the development of workforce-ready students (e.g., Code.org, CSTA, & ECEP Alliance 2021; The White House, 2016). This problem is not unique to CSed, and too often our education systems fail to center joy, connection, and community in the process of learning. Radical calls for re-envisioning and reimagining our education systems consistently ask us to prioritize the importance of joy, happiness, hope, and love (e.g., Freire, 2007; Freire, 2021; hooks, 2014), rather than see these ideals as one potential byproduct of schooling.

This is not to say that a focus on these ideals precludes all other needs; our U.S. K-12 schools still exist within accountability systems that necessitate alignment with standards and other measurements. The activities designed above all aligned with the statewide California CS standards, the 21st Century Skills framework, and various Next Generation Science Standards and Common Core Standards. However, teaching to these standards and frameworks was not the central goal of this work, and neither was preparing elementary students to meet future workforce demand for CS jobs (e.g., Bers, 2022). Instead, we worked to center joy and community consistently throughout these activities.

Other CS curricula have worked to meet this balance as well. For example, the Exploring Computer Science curriculum (see exploringcs.org) centers collaboration and equity, with a focus on justice-oriented CS work for both CS teachers and students (e.g., Goode et al., 2020; Madkins et al., 2020). Similarly, the Beauty and Joy of Computing curriculum focuses on helping students make personal connections to the social implications of computing while centering joy and creativity (e.g., Goldenberg et al, 2020). Specific to elementary CSed, the work of Marina Bers (e.g., 2022) provides numerous examples of integrating CS and robotics with young learners with a focus on developing values and supporting joyful play.

Despite these examples, the consistent, dominant narrative surrounding CSed is the prioritization of workforce ready students. More work is needed to shift this conversation and instead prioritize student voices, interests, and visions for their own futures, rather than what the workforce demands of them. Particularly for CSed at the elementary level, where research and insight are significantly lacking (e.g., Code.org, CSTA, & ECEP Alliance 2021), more needs to be done to ensure students are able to engage in CS experiences in joyful, connected ways.

For our specific event, while we believe we were able to center joy and community, it was also a one-time event. To make a sustainable impact, CSed integration should occur across curricula and grade levels, and should center student voices, experiences, perspectives, and communities (Ryoo, 2019). For our team, this event acted as a starting point, and future work will involve the co-design of additional, integrated CSed activities that teachers can draw on throughout the school year.

Additionally, we were limited on implementation time, and believe that engaging in further professional development and training with pre-service and in-service teachers prior would be beneficial. Research suggests that when technology professional development is sustained and continuous over time (rather than a one-time workshop) it is

more impactful on teacher practices (Liao et al., 2017). Additionally, supporting the development of communities of practice and professional learning communities for CSed professional development can further benefit the development of equity-oriented CS pedagogies (Ryoo et al., 2015). For example, future work could focus on building professional learning communities between pre-service and in-service teachers to co-design and develop community centered CSed learning opportunities that draw on student perspectives and needs. Overall, while we believe this event served as a beneficial starting point, significant work is still needed to further the integration of joyful, community centered CSed in local schools and districts.

Conclusion

We are grateful for the space and opportunity to share this work and acknowledge that it would not have been possible without significant effort and support from students, staff, colleagues, parents, and community members from both the CSUDH COE and 186th St. Elementary School. We attempted to collaboratively create an experience that provided elementary students with a joyful welcome to CSed, and that brought together numerous stakeholders from across the community. As others have noted (e.g., Jones and Melo, 2020), these ideals are too often missing from our work in the CSed community and centering them can help shift the field in support of *all* our students. Particularly in a time of immense collective grief, trauma, and loss, relying on joy as a foundational pedagogical principle is more important than ever. Focusing on activities that encourage children's happiness, curiosity, and engagement builds relationships, promotes positive interactions, and paves the way for sustainable student joy.

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