Abstract

Children are motivated by the concepts of fairness and justice and by the idea that they can address problems in their communities and in the world. In this paper, we describe an after-school program that teaches Latino elementary school students how they can use computer science to address social justice issues at their school. The classes are co-run by high school near peers, who introduce both social justice and computer science concepts and guide students to design and program a final project. We describe both the process and outcomes of implementing this approach, including the challenges and opportunities, and the important role of the teacher and school context. The paper concludes with recommendations for efforts to engage elementary school students in computer science by scaffolding their awareness of social justice issues and involving near-peer role models.

Latino/as are the fastest growing ethnic minority population in the United States; they accounted for over half the growth of the U.S. population between 2000 and 2010 (U.S. Census 2010). Despite the growing numbers, Latino/as are vastly underrepresented in computing-related fields: in 2010, they made up only 4.6 percent of computer and information scientists in the labor force (National Science Foundation, 2014). Latinos are 16 percent of AP test takers, but only 1 percent of the AP Computer Science (CS) test takers; those who took it scored far below their peers (College Board 2011). Although Latinos make up 19 percent of all U.S. college students ages 18 to 24 (Lopez and Fry, 2013), the 2013 Tauellbe Survey found they earned just 6 percent of CS bachelor’s degrees, and fewer than 2 percent of students who enrolled or completed a Ph.D. in CS were Latino/a (Zweben and Bizot 2014). There are very few CS education efforts that target elementary school; most focus on high school or middle school students, even though early preparation is key to getting children on the pathway. In this paper, we describe a program that aims to engage children
in CS by having them explore and raise awareness about civic issues at their school.

The approach described in this paper builds on prior research that identified some promising strategies for recruiting students from underrepresented groups into computing fields. These include increasing access, relevance, role models, and experiences of success. For example, implementing a computer science curriculum that is relevant to students’ lives both in and out of school is a strategy that has increased the participation of both girls and boys in CS courses. Students see that computer science is a tool they can use to solve real life problems (Ashcraft et al. 2012). In addition, having role models and near-peer mentors in CS courses can decrease the prevalence of stereotypes around computer science careers and increase interest in pursuing these types of careers (Craig et al. 2011; Lang et al. 2010). Opportunities to experience success are most effective when they focus on learning the material rather than completing a set of requirements in order to get a grade; this allows students with less experience to thrive and not feel disadvantaged compared to their more experienced classmates (Schwartz et al. 2009). Finally, students need access to learning opportunities that go beyond computer literacy (e.g., typing) in order to learn and apply CS concepts (Margolis 2008). A key part of this is teaching underserved youth to create technology, rather than merely using it (Denner and Martinez, in press).

A class that connects social justice to CS is a promising approach for computing education, particularly with Latino/a youth, because it shows the relevance of CS to what students value. For example, Latino/a students are more likely than other groups to say that the message “computing empowers you to do good” is very appealing (Association for Computing Machinery 2009). Doing good is connected to family obligation, and studies suggest that family needs (often financial) can serve as motivators for Latino/a students to pursue higher education and succeed on behalf of their families and communities (Cooper et al. 2005). For example, when asked about their career goal and why they wanted to pursue it, most Latino/a fifth grade students from a low income community described a helping profession (e.g., doctor, police officer), and said they want to help their community (Denner et al. 2005). When cultural value systems are taken into account, it appears that truly engaging Latino/a youth involves building connections to their identity and culture by also addressing the needs of their community, not just those of the individual (Sólorzano et al. 2005). In particular, exposure to role models and activities that show how CS can be used for the social good can increase students’ expectations of success and the value they place on computing, which are directly related to their computing aspirations (Goode et al. 2006; Zarrett et al. 2006).

The program described in this paper was inspired by several movements that are focused on civic engagement. The first, Computing for the Social Good, aims to broaden participation in computing in higher education (Goldweber et al. 2011). For example, a growing number of colleges offer opportunities to apply CS to social causes, including Georgia Tech, Xavier University, SUNY Buffalo, and Rice University (Buckley et al. 2008). We extend this approach to K–12, adding perspectives from Latina/o critical race theory, an analytic tool used to critically examine how power relations shape Latinos’ educational experiences by considering how race, social class, gender, language, and immigration status intersect (Yosso 2006). Using this lens, a class on social justice can help students identify issues they want to address in their lives, as well as the underlying or root causes of them, by learning about other young people who are making positive social change. The goal is for students to develop a belief that they can make a difference, or what some have called civic efficacy. Our application of Latino/a critical race theory to K–12 is informed by the Social Justice Youth Development model, which describes how social change begins with awareness, identity exploration, and a critique of existing structures before it moves to taking action to address social inequity (Ginwright and Cammarota 2002). In this view, critical consciousness is an essential part of social justice: it is not simply an awareness of an issue or problem, but is a critique of that problem that aims to identify the underlying causes, which include power dynamics in social relationships and institutional structures.

Our process for integrating social justice with CS builds on similar efforts in mathematics. Studies have shown the promise of using mathematics as a lens to introduce social justice concepts to Latino/a children, and to use social justice as a hook to teach mathematics (Gutstein 2003; Turner et al. 2009). However, we are aware of only three programs that aim to integrate social justice with computing: CompuGirls, an after-school program that links social justice concepts to the technical aspects of digital media (Scott et al. 2014), Apps for Social Justice, a class where youth learn to create apps that address local community needs (Vakil 2014), and Exploring
Computer Science, a school-based curriculum that uses an equity-based pedagogy such as using data to make digital media artifacts about a social issue in their community (Ryoo et al. 2013). All of these programs were designed for high school students, and little is known about how a social justice approach can be used effectively to engage elementary school students in computing.

Studies do suggest that even young children are able to think about social justice, but pedagogical strategies must take into account developmental differences. For example, in one study of 6-17-year-olds in Argentina, children were asked to talk about something that had to do with justice that had either happened to them or that they had seen or heard about, and why they thought it was just or unjust (Barreiro, 2013). The researcher found that only 6 percent said they did not know what “just” meant. The most common representation of justice across the groups was utilitarian—justice is something that enables everyone to be happy. Only 5 percent of students referred to justice as an equal distribution for all people without privilege or bias, which includes concepts of fairness. Starting at age 10, students connected people’s actions to whether or not they deserve punishment or reward. Similarly, Thorkildsen and White-McNulty (2002) found that children as young as six can consider the greater good when reasoning about fairness. However, that study also showed that children under 10 thought it was fair for people to win a skill-based contest as long as they worked hard, while according to older children, it was only fair for people to win based on skill, not based on hard work or luck.

There is little research on children’s understanding of fairness at their school, which is the community they know best. One study found that 7-12-year-old children thought the most fair teaching practices were those that promote equality of learning (everyone should learn the same material equally well), but the emphasis on rewards for high performance declined with age (Thorkildsen and Schmahl 1997). In a more recent study of a small group of Latino/a fifth graders, the majority viewed random choice as the fairest way to make decisions, because it meant that everyone had the same opportunity and reduced favoritism, which suggests a view of procedural justice (Langhout et al. 2011). They also found that this group of children defined fairness in terms of equal outcomes (or distributive justice) and in terms of minimizing emotional harm (emotional justice). These studies show that elementary school students have opinions and even theories about fairness at their school, but few efforts have been made to help students explore or act on them. These studies also suggest that young children’s ideas about fairness in the concrete examples of school and teaching are more developed than the abstract examples of fairness, and that few are ready to translate the concept of fairness into critical ideas about systems of power and social change. Based on this work, we concluded that the concept of fairness is more developmentally appropriate than “social justice” or “civic issues” when talking to young children.

While the studies described so far clearly show that children can think about fairness and have opinions about it, there is scant research on pedagogical strategies that can be used to build a critical consciousness about fairness in elementary school. In one report, Silva and Langhout (2011) describe how a first grade teacher used an art curriculum to increase her students’ critical consciousness, with the result that many of the children took action to address stereotypes at school. The process included talking explicitly about power and privilege in terms of how group membership affected artists’ lives and their art, and reflecting on emotions. In another example, Kohfeldt and Langhout (2011) describe how they helped a group of fifth grade students to define a social problem, which is the first step before taking action. Their approach included constructing the problem as a group, starting with a discussion of students’ hopes and dreams about their school before moving on to discuss problems, causes, and potential solutions. The researchers used a series of questions to help students identify the underlying causes of the problem. These small studies suggest that teaching social justice principles in elementary school is possible, but despite the large number of educator groups devoted to teaching social justice principles (e.g., Rethinking Schools, Radical Math), there is little research on the challenges of integrating a social justice perspective into an elementary school classroom, or on how to connect social justice to academic content like CS.

The CSteach Program

CSteach is an after-school program based on prior research on how to engage underrepresented students in computing. It uses a culturally responsive approach that includes attention to students’ multiple and intersecting identities, among them the students’ identities in their school community (Scott et al. 2014). Key strategies include a multigenerational approach,
the introduction of CS and social justice concepts, and the application of those concepts through the design and programming of a digital media project.

The multigenerational teaching strategy involves instruction and role modeling by high school aged near peers, students who are slightly older, more knowledgeable about the content area, and have qualities that younger students respect and admire (Murphey 1996). Near peers are not expected to be true experts; their value lies in being slightly more advanced, and also in being familiar with the community. The near peers (high school students) serve as role models and ensure that the program is responsive to the local context and to students’ individual motivations, as well as to the dynamic role that culture plays as students negotiate their goals and obstacles (Brown and Cole 2002; Gutiérrez and Arzubiaga 2012). For example, the near peers understand local challenges (e.g., financial constraints, family responsibilities, etc.) and offer stories and activities that help students navigate competing expectations across their worlds of home, school, and peers (Cooper et al. 2005). The high school students also challenge negative stereotypes about who does CS, and provide examples of how CS can be used for the social good. The near peers in CSteach live in the community; in many cases they attended the same elementary school and/or have relatives who attend that school. They receive a stipend for attending trainings, reviewing the curriculum to practice their role, and for attending class.

A key goal of CSteach is to increase students’ understanding of CS concepts and principles. A series of developmentally appropriate activities are designed to introduce and reinforce four of the College Board’s (2014) seven “big ideas” in the Computer Science Principles: abstraction, algorithms, programming, and networks. These include learning to program in Scratch (a child-friendly drag-and-drop tool), doing unplugged activities where students write algorithms, and participating in online communities. The computer science activities are connected to four social justice “big ideas”: fairness, empowerment, action, and community. For example, students explore how “networks” and “community” share similar properties. They also learn that “action” is part of the word “abstraction,” and both involve moving from the general to the specific.

The CSteach curriculum builds on the Social Justice Youth Development model, where social change begins with awareness, identity exploration, and a critique of existing structures before it moves to taking action that will address social inequity (Ginwright and Cammarota 2002). Developing a critical consciousness is a key part of this effort: CSteach aims to help students go beyond a simple awareness of an issue or problem in their community. The activities in CSteach move students along the pathway from awareness toward action by showing them social justice role models in person and on video, encouraging them to debate what is fair and unfair at their school, introducing them to concepts like “bias,” and helping them design and program an animated movie using the Scratch programming tool, to inform other people about why a particular social justice issue at their school is important.

Research Questions
This study was designed to document not only the outcomes, but also the process of developing and implementing the curriculum. In order to improve educational practice, it is necessary to go beyond a simple description of the implementation process to a description of what Gutiérrez and Peniel (2014) call the social life of interventions, or how they are adapted over time in response to the needs and strengths of students, teachers, and the broader school context. This involves bringing key people together to discuss and debate the primary focus of a research and development project. To this end, we employ a Design Experiment, an iterative cycle of implementation, data collection, and revision that helps us to develop programs that avoid a deficit perspective when promoting learning experiences for marginalized populations (Collins et al. 2004). The goal is to describe how to create a learning environment that utilizes social justice to promote students’ interest in computer science, their capacity to productively engage in and apply social justice and computer science concepts, and the extent to which they see and appreciate the relevance of computer science. In this article, we will address the following questions:

- How did the social justice part of the curriculum evolve over time?
- How are fourth and fifth grade Latino/a students thinking about social justice?
- What are the challenges and opportunities of integrating social justice into an elementary school classroom?
Methods

Participants
CSteach has been implemented three times in a school district that serves mostly low income, rural Latino/a students, most of whom have family members who work in agriculture. Participants were 333 fourth and fifth grade students and 31 high school students who attended as part of an extended learning program at nine elementary schools. The mean age of the elementary students was 10, there were almost equal numbers of girls and boys, 85 percent self-identified as Latino/a, and 71 percent spoke a language other than English at home more than half the time. While there is great variation in the group of students called “Latino/a,” the focus of this study is on students of Mexican origin, who make up 63 percent of the U.S. Latino population and accounted for three quarters of the growth in the U.S. Latino population in the last decade (Ennis et al. 2011). We use the term “Latino,” because it is commonly used in California. The thirty-one high school near-peer teachers (mean age=15.5) were 61 percent female; 84 percent identified as Latino/a. Four adult teachers (all school district employees) were also interviewed (one male, three female).

Procedure
The CSteach course met for two hours/week for 12-13 weeks and was implemented over four semesters. Several sources of data were used to address our research questions. These included students’ Scratch animation projects, classroom observations, interviews with high school students and adult teachers, and a survey administered to students at the beginning and end of the program. Student projects from the Fall 2013, Spring 2014, and Fall 2014 semesters were coded using a 0-3 scale to measure the extent to which students integrated a social justice issue into their Scratch animations. Each coding category was defined as follows:

- **Level 0:** The project does not mention a social justice issue. Example: A cat and dog are on screen and the cat says it wants revenge. The dog says “I have to get out of here,” and the cat says, “You are not going to escape.” The cat then attacks the dog.

- **Level 1:** The project includes a complaint or a conversation about a social justice issue or a personal preference. Example: A bear is standing in the forest and a cat runs up and asks the bear to save him/her from the bully. The cat says, “Help hide me! The bully won’t leave me alone,” and the bear replies that he/she will “help get rid of the bully.”

- **Level 2:** Characters in the project advocate for something to change about a social justice issue or a personal preference, but there is no mention of why it is important. Example: A girl is sitting on a street corner near a man who is smoking. Two girls nearby see this and one says, “Look at that man smoking in front of that girl. Should we tell him to stop smoking?” The other girl replies, “I think we should,” and then they ask the man if he can “please stop smoking” in front of the girl. The man thanks them for telling him to stop.

- **Level 3:** Characters in the project advocate for something to change about a social justice issue and explain why it is important in a way that goes beyond personal like/dislike. Example: A boy in the library says that his “school would be better if there was a bigger library.” Another boy appears and says that he “know[s] it is important because more students would be interested in reading and that would help with education.” Then three more boys appear and reinforce the message by saying that students would “choose interesting books” to read, that “students learn by reading” and that “students would be more interested in going to the library.”

Another source of data included a questionnaire that was administered on the first and last day the class. For example, students’ views about the value of computing were measured with a six item scale from the National Assessment of Educational Progress (NAEP). Students rated their level of agreement with statements such as “Computers are important to my community,” and “Learning about computers will help me in the future” (National Assessment Governing Board 2012). Students’ views of how to address community needs were measured using a four-item scale that includes the following statements rated from Never to Often: “I know how to use
a computer to identify needs in my community,” and “Computer science is a field that makes the world a better place.”

Over the three semesters, 21 high school students participated in either individual interviews or a focus group. Students were asked about their experience in the program and had the opportunity to provide feedback on their role. They were also asked specifically about the social justice component with questions that included: Tell me about a day this semester where the kids made the most progress in learning about social justice issues in their community. Tell me what could be improved in CSteach so that students will learn more about social justice issues in their community. Four adult teachers were also interviewed to gather information about their experience teaching the class, including what worked and what needed improvement.

Results

How Did the Social Justice Part of the Curriculum Evolve over Time?

The curriculum went through a series of iterations that were informed by both internal research and an external evaluation. In this section we describe some of the key stages of implementation, as well as the findings that led to a series of revisions designed to strengthen and increase the relevance and impact of the program and to increase the interest and capacity of the schools to sustain the class.

The first draft of the curriculum was pilot tested in two small classes during the Spring semester of 2013. In this initial version, the focus was primarily on teaching CS concepts, such as abstraction, algorithms, and data; there were only a few social justice-focused activities. An early attempt to integrate CS with social justice was an activity that introduced the connection between networks of computers and networks of people. However, additional follow-up and reinforcement of this idea was needed to help students use the concept of networks to address needs in their community. Another activity involved a role-play about a student-led effort to limit food waste at the school cafeteria. However, no connections were made to CS, and the focus was on food waste rather than the social justice issue of “hunger.” As a result, students learned about the importance of helping others, but did not learn about the underlying causes of hunger. For their final project, students created a PowerPoint presentation based on internet research and data collection from classmates on a problem they want to solve in their community. Students were directed to select an abstract problem (e.g., bullying, animal cruelty) but the connection to the underlying causes or how the students could address them was not made. The students summarized their findings by adding them into a PowerPoint template.

Based on data that included observations, interviews, and an analysis of student projects, the curriculum was revised over the summer to reflect a stronger connection to the national K–12 CS standards (Computer Science Teachers Association 2011). This included teaching students to use the Scratch programming tool to make an animation where characters talk about a problem in their community. In order to help students select a social justice topic, we added a new activity where students learned about the CS concept “abstraction,” and were instructed to apply it to their “problem” topic in order to break it into sub-problems that could be solved. However, the curriculum was not designed to help students think about the causes of the problem, and this limited the students’ ability to break it into a smaller set of problems or to identify solutions. In addition, although the role of the high school near peers was strengthened by having them take the lead on instruction starting earlier in the semester and by training them in how to program in Scratch, they did not receive any training on social justice, and there was not a shared understanding of what the term meant. As a result, the topics in students’ final projects were similar to those in the prior semester (e.g., bullying, pollution) and seemed to reflect adult concerns, rather than issues that were meaningful to the students. The new curriculum was implemented in Fall 2013 in four classes by two school-based teachers.

Based on classroom observations, interviews with near peers, and an assessment of students’ projects, several changes were made before the Spring 2014 implementation. These included strengthening existing activities to make more explicit connections between computer science and social justice. For example, students learned how networks of computers and networks of people can both be powerful sources of social change. In addition, stronger connections were made between the final Scratch project and social justice. This involved showing examples and explaining how their animation would
be created using the tools of computer science and then used to communicate a message about how to take action regarding a social justice issue. Although the high school student near peers were increasingly put in charge of leading large group activities, and received additional training in Scratch, they received no training in how to help students formulate a social justice issue. In addition, the connection to the regular class day was lost as the four classes in Spring 2014 were led by the same adult teacher who did the pilot implementation; a tech support employee of the school district with a CS degree. This change was made because the district was in the middle of contract negotiations which did not allow teachers to work outside the regular school day.

During the summer of 2014, the research team engaged in several activities in order to increase the relevance of the activities to the students and the schools. First, the team analyzed the data from observations, surveys, interviews, and the students' final projects. Next, there was a two-day meeting of multiple stakeholders that included two adult teachers, two high school-aged near peers, two experts in social justice, the project evaluator, and the research team. As a result of that meeting, we clarified the definition of social justice as something that a student believes is unfair and needs to be changed or improved. It should be relevant, and ideally personally meaningful to them. Further, it was agreed that the goals of the social justice component were to help students: (1) learn to identify and understand advocacy needs in their school and/or community, (2) learn how computer science can help address these needs (and how it could hurt), and (3) develop a sense of responsibility and motivation to use computer science to address those needs.

As a result of that meeting, the team identified social justice terms that were appropriate for elementary school students, more tightly integrated the social justice and CS principles, and added scaffolding to help students identify issues in their community that are personally meaningful to them. To this end, four “big ideas” of social justice were identified: fairness, community, empowerment, and action. These “big ideas” were designed to run parallel to the “big ideas” from Computer Science described earlier (College Board, 2014). The following are definitions of the social justice big ideas:

- **Fairness**: something in their community that they believe needs to be changed or improved. It is different from a complaint/dislike because it deals with whether there is inequality in people's opportunities, due to the distribution of wealth or other privileges.
- **Community**: the focus is on their school community, because it is personally meaningful to them and they can realistically expect to have an impact.
- **Empowerment**: the belief that they can make real change, and the motivation to do it; development of an identity as a leader or change agent.
- **Action**: collective action is the most effective way to have an impact; change happens by working with others and leveraging networks.

Several new activities were added to the curriculum for Fall 2014, in order to introduce students to these big ideas. The activities included a focus on student leaders, for example by showing short videos about youth who are taking action in their community, and an enhanced reflection component, a daily wrap-up where key CS and social justice concepts and terms were reviewed by a near peer, and then written down by the fifth grade students in their workbook. In addition, flexibility was built into the curriculum to accommodate students who arrive late or leave early due to other school activities or family commitments. In some cases, students worked with a partner who could catch them up and continue the project work in their absence. Another change was in the procedure for selecting and training the high school near peers, and expectations for their role in the classroom were clarified. Applicants were screened to ensure their commitment to working with children, as well as a positive attitude toward using computers and technology to help their community. As part of these revisions, the assessment process was also revised to improve our measurement of how learning progresses over time.

A final iteration of the curriculum was implemented in Spring 2015. The changes included teaching students the definition of social justice that is used in the Teaching Tolerance website: something that is free of prejudice, inequity, and bias. New activities were added to introduce and reinforce those concepts, using models from the website, such as “What is Fair?” where students debate whether or not an issue (e.g., boys getting more time on the soccer field because they get there more quickly) is a social justice issue. A series of trainings were developed to scaffold the near peers' understanding of social justice, and to help them guide groups of students to narrow the focus of their final project so that it was about...
an issue that is personally meaningful to them at their school, rather than an issue in their broader community. The cultural relevance was increased by including bilingual Spanish/English instruction and worksheets, and videos of non-dominant groups taking action in their school and community. In addition, the CS learning part of the class was changed from large-group to self-paced instruction, as students learned to program in Scratch by watching videos created by the high school students, and then applying what they learned by completing a set of challenges. Finally, the role of the high school students became more diverse to allow them to use their strengths: some led activities with the whole class, while others facilitated small group activities or helped students who needed individual assistance.

How Are Fourth and Fifth Grade Latino/a Students Thinking about Social Justice?

Students who participated in the CSteach program varied in the extent to which they incorporated a social justice issue into their Scratch projects. From semester to semester, however, there was a steady increase in the percentage of students who used their Scratch animation as a tool to advocate for change. The Fall 2013 cohort produced only nine projects (21 percent) that mentioned a social justice issue (above a Level 0), while the Spring 2014 and Fall 2014 cohorts produced 15 (52 percent) and 45 (70 percent) projects, respectively, that scored above Level 0. Very few students (seven total) made projects at Level 3, where there was inclusion of information about why it was important to address the issue. The total number of projects that were scored in each category is summarized in Table 1. The data show an increase in the extent to which students integrated social justice into their Scratch project as the curriculum was revised.

Pre-post survey data were also used to understand how the children were thinking about social justice, including variation across demographic groups. Based on their responses to survey questions, fifth grade students from all semesters showed statistically significant increases in their perceived ability to use a computer or computer science to address community needs. However, this finding was less robust for certain subgroups. For example, students who frequently spoke a second language at home (more than half the time) were significantly less likely to make gains in this measure, and the gains were greatest during the Fall 2013 semester. Nevertheless, students demonstrated growth on that scale in every semester. Additionally, students made steady increases in the perceived value that they placed on computing, especially its importance to their community and daily lives. Table 2 provides a summary of these changes by semester.

Although the survey results show that students moderately increased their perceived ability to use computers to address problems in their communities, they still struggled with connecting social justice issues to computing. Interviews with the adult teachers and the high school near peers provided some insight into how the fifth grade students were thinking. As stated by an adult teacher, Fall 2013: “I think that [tying social justice to computing] was hard for them just developmentally to do. That whole idea of the social justice topic and the community… because it is something that I think is really important for the students to be aware of and I think that the students weren’t generally interested in the topics that they chose but I just think it was hard for them to navigate and research and do all that on their own. They needed more guidance and help.” This view was shared by the high school near peers, as shown in the following quotes:
**Interviewer:** What do you think that they learned about using computers to address problems in their community?

**Near peer:** I’m not sure, because we’ve only done that for the past three weeks and all of them picked bullying and pollution pretty much. I don’t think maybe it’s sunk in yet that we’re talking about the community on the whole. Maybe they’re thinking about just the schools. The fact that we’re getting them to think about that even is, I think, pretty good.

**Interviewer:** Do you think that’s a new idea for many of them? That they could make a difference even at their school?

**Near peer:** I would say so.

Another high school student described it this way: “We ask them: What are problems you see in your community? How are they supposed to know that? They focus on issues that they have at the house, like oh I have to go to bed at a certain time and I wish I didn’t. Oh, I have too much homework at school. They’re not thinking a larger bubble, which I understand. That’s part of life that’s all about them and what they’re going through.”

**What Are the Challenges and Opportunities for Integrating Social Justice into an Elementary School Classroom?**

The results suggest that although the fifth grade students were developmentally ready to identify a social justice issue and to explore the underlying causes, most needed additional scaffolding and support to integrate that understanding into their animation project. Challenges include having adult teachers and high school near peers who were unable to provide that support, and a school context in which some of the adults reinforced obedience to authority and discouraged students from questioning existing rules or procedures. The opportunities included connecting the social justice activities to existing civic education curriculum and leadership programs for students at the school.

A major challenge was in staffing the classes, which included limitations on the availability of both high school students and classroom teachers after school. It was also challenging to find adult and high school-aged teachers who were comfortable with both managing a fifth grade class, could learn and support the learning of others with computers, and were committed to following the curriculum and documenting what was changed and why.

In order to effectively run the classes, a teacher needs expertise in three areas: computer science, social justice, and classroom management. None of the four teachers in this study had all three. To address gaps in teachers’ CS knowledge, we used existing resources that were developed and vetted by others (e.g., Hour of Code) and child-friendly software (Scratch). Given that the CS concepts were at an introductory level, the teachers who lacked the CS background learned along with the students, and relied on some of the high school-aged students who had experience with Scratch and some of the CS concepts. Filling gaps in teachers’ experience with connecting computer science and social justice, or in their classroom management skills was more challenging, since both take years to develop and hone.

Most of the high school students also lacked one or more areas of expertise. Initially, few had the classroom management skills to lead an after-school fifth grade class, and many lacked the confidence or assertiveness to deal with disruptive or off-task behavior. While many were tech savvy, during their first semester they learned the CS concepts and their application in Scratch along with the fifth graders. None of the near peers had already developed the language associated with social justice, nor had they applied that lens to their own schools. However, quotes from their interviews suggested that as a result of their experience in CSTeach, they learned how computers can be used to help the community or to make the world a better place.

When [the adult teacher] was telling the little kids about networks and how a network of people is just like a network of computers, I was watching him give this speech, I felt like one of the students. I also realized that I was unaware about all this and I realized that these things that we usually use for fun can be used to connect to other people that we wouldn’t usually connect to or connect to people that have been really hard to connect to. Kind of to try to change. I don’t have any really specifics, but it was just sort of like a concept that was kind of beautiful.
The interviewer also asked “Did you learn anything about how computers can be used to make the world a better place?” And the student responded: “Yeah. Like make projects and show them out to people.”

The empowerment aspect of social justice, which involved using the tools of computer science to create a product to advocate for change in the community, was a new idea and initially a difficult concept for them. At a training for the high school students in preparation for the Spring 2015 classes, the students were tasked with filling in the worksheets that would also be used with the fifth graders. At first, the students struggled to identify a social justice issue they wanted to address. Then slowly, examples emerged. One student described how the availability of food choices was unfair at her school. Her last class before lunch was across campus from the cafeteria, so she was often too late to get her first choice for lunch. She identified this as an injustice that affected her own and other students’ nutrition. Examples from other students included the need for tutoring programs for students who are not adequately prepared for college; the need to raise money to make the playgrounds safer; the need for ramps and wheelchairs for special needs students; and the inconsistency of teacher enforcement of the school’s policy about being late to class. However, while the high school students were able to identify some examples of unfairness at their schools, they were not clear about the underlying or structural causes for these issues or specific ways that these issues could be addressed.

The ways in which students engaged with social justice concepts must also be interpreted in the context of the schools they attend. In the early stages of the program, students did not differentiate between a complaint about their schools (e.g., recess is too short, video games and candy should be allowed) and a social justice issue (e.g., not enough books in the library that have stories about people who look like them). But by Spring 2015, when the social justice terms were defined and reviewed, students were able to explain why a certain issue was about injustice, prejudice, or bias. For example, they advocated for a swimming pool at school (for exercise and so that they could learn water safety), for pets on campus (for emotional support), for cell phones for students (for safety in the event of a fight), and for more science classes like chemistry (to prepare them for college).

However, despite the improvements in the curriculum and the increased understanding by the near peers of what social justice involved, the school context created other challenges. For example, students often arrived late to class or left early to do sports or drama; school-wide activities sometimes led to last-minute class cancellations; and some parents picked their child up early on their way home. Students who arrived late or left early often missed the important introduction and reflection activities. In addition, since the selection process varied across schools, students brought a range of prior experience and interest or ability to learn, and their level of commitment and attendance varied depending on why they were in the class. At some schools, students chose to take the course, while at other schools, they were assigned to take the course, either based on academic merit, or academic need. Schools also varied in the extent to which they required their students to have consistent attendance at the after-school program. Having to account for so many absences often disrupted the momentum of the class because there were always students who needed additional support to learn both the CS and social justice concepts from previous weeks. In addition, halfway through the Fall 2014 semester, daylight savings time ended. As a result, students at several schools left class half an hour early to walk home before dark. In these cases, students missed the review portion of class, which is when the social justice and CS concepts were reinforced.

There were several opportunities afforded by the school to help create a developmentally appropriate curriculum and pedagogy that was engaging, introduced and reinforced CS principles, and showed students that CS can be used to address needs in their community. For example, the curriculum was particularly effective when the teacher made connections between the social justice concepts introduced in CSteach and the activities and concepts students learned about during the regular school day. For example, during a session in mid-January on becoming a leader, the teacher talked about Martin Luther King Jr., whose birthday was being celebrated that week. The following are notes from that observation: “At the end of the class, for wrap-up, she talks about social justice in terms of MLK Jr. fighting for justice. She tells the class that she hopes they will find something that is as important to them in this class. She explains that we will be talking about social justice and helping them think about what it means here at our school.” In another example, a near peer facilitating a discussion about leadership reminds a group of students that they already have a leadership program at their school where fifth grade students help younger children to solve problems. Connecting the CSteach activities to these familiar examples
of leadership helped students to see the possibilities of using CS for the social good.

In summary, the data suggest that most of the elementary school students in CSteach were at the earliest stage of thinking about social justice issues (awareness). Challenges to integrating a social justice perspective into the class included the need to train the adult teachers and near peers so that they understood the definition and developmentally appropriate terminology associated with teaching children about inequity. Additional challenges to connecting social justice to CS include the limited time in which to introduce, reinforce, and apply the social justice concepts, and to teach children how to program well enough to express their ideas in Scratch.

Discussion

In order to increase diversity in computer science, it is important to help children see the relevance and the value of the field for issues that are meaningful to them. The CSteach program described in this study is part of a larger effort to engage young people by showing them how computing can be used for the social good. In this paper, we describe the evolution of a social justice curriculum, including the challenges and opportunities of integrating it into an elementary school-based after-school class, as well as connecting it to computer science. We report on both the strategies and the results of this program, using data from student projects, classroom observations, interviews, and surveys.

The findings from this study contribute to research on how fifth grade Latino/a students are thinking about social justice. Their Scratch animation projects, as well as interviews with the high school students and adult teachers, suggest that participation in the class led to an increased awareness of the difference between a complaint and social justice issue. This was shown in the ability of most students to identify something at their school that needed improvement, although the topics focused mostly on safety issues, which are a common focus of school assemblies. Only a small number used their project to advocate for change or to explain why the issue was important. While this finding may be explained in part by a lack of programming skills to express that knowledge in their projects, our observations of and interviews with the high school students and adult teachers, as well as our efforts to ask students about their projects, suggested that most did not see themselves as leaders who can make change, did not understand the underlying causes of the problem, and could not identify ways to take action. The finding is consistent with another study of fifth grade students in a mostly Latino/a community, which also found that few students identified the underlying causes of the problems at their school (Kohfeldt and Langhout 2012), and studies outside the U.S. (Barreiro 2013; Thorkildsen and White-McNulty 2002) that find most elementary school children to be at the early stages of the Social Justice Youth Development Model, which begins with awareness and moves to identity exploration (Ginwright and Cammarota 2002).

This paper also describes the challenges and opportunities of integrating social justice into an elementary school classroom. Based on several iterations of implementation and data collection, the final curriculum uses a scaffolding process that starts with increasing the students' awareness about social justice issues and developing their identity as leaders, with support from near peers who live in their community. Like Kohfeldt and Langhout (2012), we found it was important to begin a social justice conversation by talking to the children about how to make their school a better place, rather than asking them to identify problems or concerns. Focusing on improvement was one strategy to prevent students from taking a deficit perspective about their school; instead students were encouraged to focus on how they want their school to be, rather than on the problems. Both feedback and reflection played a critical role in helping children to think about the connection between CS and social justice, which is a strategy that has also been successful with high school students (Scott et al. 2014).

One of the challenges was to help students develop a critical eye toward phenomena they see every day, a challenge that Gutstein (2009) also describes in his social justice mathematics classes. An effective strategy is to start by talking about an issue they identify as “unfair,” and then ask questions that move students from voicing a complaint to an understanding of the structural reasons for that issue. In CSteach, there was not always enough time or enough experienced educators to move the students deeply into an issue. One promising strategy was for students to work in small groups led by trained near peers; the interaction increased the opportunity for students to internalize the information and make it more personally relevant. However, as Scott et al. (2014) explain, culturally responsive teaching requires instructors to reflect on their own identities and cultural backgrounds, and most
of the high school near peers had not yet developed their own language or critical consciousness about issues of inequity and fairness.

An important challenge was finding teachers with the range of knowledge required, who were comfortable teaching computer science concepts, guiding students through a process of identifying a social justice, and managing the behavior of fifth graders in an after-school setting. Gutstein (2009) laments that few teachers have the time or expertise to build among their students a critical consciousness and an identity as change agents, and that some may see it as outside their role. Again, it might be more important to select teachers for this type of orientation than for a CS background. Key elements for success include having classroom teachers who develop strong connections to what students are learning during the school day, and high school near peers who have (or build) a critical consciousness about injustice at their school, as well as an identity as a social change agent.

Children now have access to a growing number of digital media tools, but how and for what purpose they are used varies depending on the interest and expertise of the adults in their lives. In this paper, we describe an effort to leverage children’s interest in “fairness” in order to introduce them to new computing skills and concepts and to build their interest and capacity to use computers to create social change. Rather than just documenting the “success” or “impact” of the CSteach program, we included a description of the steps and the challenges involved in developing, implementing, and studying a curriculum that connects computing with the social good. The findings provide insight into the process through which children develop a social justice orientation and learn computer science concepts, and the conditions under which these can mutually reinforce each other. However, several supports need to be in place to move students beyond awareness and empowerment to a sense of identity as a change agent and to an understanding of the power relations and institutional structures that perpetuate inequity. Key supports include teachers who have training in social justice education with young children, access to computing tools and resources, the involvement of tech-savvy and socially aware near peers who live in the local community, and clear connections between the larger school context and what children are learning about computer science and social justice.

Acknowledgements
This material is based upon work supported by the National Science Foundation under Grant No. CNS-1240756. We are grateful to Ryan Morgan, Sarah Anderson, Shannon Campe, Yethzéll Díaz, Katie Roper, and Thomas Gelder for their insights and contributions to this work.

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### References


How We Engaged Audiences in Informal Science Education through the Inaugural Arkansas Science Festival

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Abstract
Science festivals are gaining popularity as informal science education (ISE) events. With support from the Science Festival Alliance and Arkansas State University (A-State), we launched the inaugural Arkansas Science Festival in October 2014. Few science festivals are held in rural areas such as the upper Mississippi Delta, A-State’s home, so challenges were expected. Our local and campus communities enthusiastically came together to host events over eight consecutive days. Beginning with school groups attending the opening performance of ArcAttack’s singing Tesla coils, through the Science Expo’s dozens of hands-on activities, displays and performances, and events in between, we attracted over 2000 participants to our festival. Here we describe the challenges and successes of the first ever Arkansas Science Festival, and how even with a limited budget in a rural setting, we engaged participants in ISE activities.

ISE through the Arkansas Science Festival
Informal science education (ISE) experiences can spark new interest in STEM (science, technology, engineering, and mathematics) fields (National Research Council [NRC] 2009). As advances in the domains of science and technology impact all areas of life, the importance of developing a scientifically engaged public in the 21st century cannot be overstated. One type of ISE experience, the science festival, has become a popular event across the United States and abroad. Though highly varied, science festivals typically focus on a celebration of STEM by engaging the public with scientific content (Bul titude et al. 2011). Science festivals may be offered in a single day or across multiple days, and in a variety of community, university, and museum settings. Each of the 40 science festivals established over the past five years has its own identity, but all rely on STEM practitioners to bring science to participants in an informal, interactive format (Wiehe 2014).

The authors of this paper, research scientists at Arkansas State University (A-State) with interests in ISE, implemented the state’s and region’s first science festival in Fall 2014. At