Engaging 4th and 5th Grade Students with Cultural Pedagogy in Introductory Programming

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***Abstract*—The computing education community has explored multiple strategies to address the problem of underrepresentation of African American and Latino students. Recently, the community has started to explore culturally relevant pedagogy (CRP) to increase the effectiveness of curricula and programs designed to increase participation in underrepresented groups. CRP suggests that the use of culture can benefit students by providing them with opportunities to bring their culture into learning. In this poster paper, we explore the use of CRP to introduce 4th and 5th grade African American students to computer science in an 8-week summer camp through the context of social justice.**

Keywords—computer science education, culturally relevant pedagogy, broadening participation in computing

I. INTRODUCTION

Although the enrollment numbers of African American and Latino students are low, 5.1% and 11.1%, respectively, they continue to grow in undergraduate CS courses [1]. To further increase the effectiveness of curricula and programs designed to increase the participation of these groups, the Broadening Participation in Computing (BPC) community has explored using Culturally Relevant Pedagogy (CRP) over the past 8 years. In this poster paper, we explore the use of CRP to introduce 4th and 5th grade African American students to computing in an 8-week summer camp through the context of social justice. We also reflect on our experiences implementing this CRP curriculum.

We adopted Gloria Ladson-Billings' culturally relevant pedagogy (CRP) to guide our incorporation of social justice into the computing curriculum and pedagogy [2]. Culturally relevant pedagogy is a pedagogy that addresses student achievement and helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities in society [2]. CRP uses three criteria: academic achievement, cultural competence, and sociopolitical consciousness to guide teachers into providing more culturally rich and engaging student learning.

However, K-12 computing curricula often prioritize the inclusion of students' interests and culture, but not many consider the sociopolitical consciousness criteria. For example, Ron Eglash's curricula on Cornrow Curves and the Virtual Bead Loom focused on the academic achievement and cultural competence criteria of CRP by using math and computing to simulate cornrow braid patterns and Native American bead loom art [3][4]. However, neither tool is used to bring awareness to issues in students' own communities.

II. CURRICULUM DESIGN

Using CRP in our summer camp, we aimed to provide opportunities for 4th and 5th grade African American students to learn computer science concepts (academic achievement), share their own cultural knowledge in lessons and activities (cultural competence), learn from the varying cultural knowledge shared by their peers and instructors (cultural competence), and develop a coding project that brings awareness to a social justice issue that matters to them (sociopolitical consciousness).

Students spent the first 5 weeks learning sequences, loops, conditionals, variables, operators, and how to plan, code, test, and debug their code in Scratch (see Table 1). The last 3 weeks were spent creating an animation on a social justice issue of their choice in their communities.

TABLE I. SUMMER CAMP CURRICULUM

Weeks	Lessons	Cultural Example(s)
1	Intro to Scratch + What is CS?	About Me Slide, Robotics, Black Panther movie
2	Problem Solving and Sequences	*Problem Solving*: Restaurants for a friend with gluten allergies. Sequences: Morning routine
3	Loops & Conditionals	*Loops*: Drill, laundromat dryer, blender, repetition in music. *Conditionals*: Logic playing Uno
4	Coding Process: Plan, Code, Test, & Debug	N/A
5	Variable and Operators	*Variable*: Values in a video game (score, points, health, time, etc.) *Operators*: Comparing money (US bills and coins)
6	Reviews Lessons	N/A
7	Social Justice Project	Immigration, gun violence, bullying, discrimination
8	Social Justice Project	N/A

III. PARTICIPANT DEMOGRAPHICS

All participants in the summer camp identified as African American. They were recruited by the summer camp, which typically targets people of color communities. We taught 49 students, but only 26 students' parents signed the IRB consent forms to participate in the study (Table 2).

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TABLE II. SUMMER CAMP DEMOGRAPHICS

Demographic	**Statistics**
Gender	16 females and 10 males
Ethnicity	26 African Americans
Grade	12 (4th Grade) and 14 (5th Grade)
Prior Programming Experience	11 (No), 10 (yes), 5 (No response)

IV. SOCIAL JUSTICE FINAL PROJECTS

The social justice final project operationalized everything taught in the camp. To help guide this process, resources (worksheets, information handouts, etc.) were provided for the following steps: (1) identifying the social justice issue, (2) brainstorming an animation story, (3) programming planning, (4) coding, (5) testing & debugging code, and (6) presenting and demonstrating the project to the class. The instructors provided scaffolding and one-on-one assistance for students throughout the process.

The students selected social justice topics that were near to their hearts and concerns for their communities. The social justice topics students chose focused on: racism (n=7), gun violence (n=6), littering (n=3), women's rights (n=2), equal pay (n=2), gangs (n=1), theft (n=1), and bullying (n=1). Fig. 1 shows a gun violence protest animation created by a 5th grade student.

Fig. 1. Gun Violence Social Justice Project Example

V. TEACHING EXPERIENCE & LESSONS LEARNED

A. *Male African American Teacher Perspectives*

As an African American male, I anticipated being able to connect with students because I came from a similar culture as them and I understood many of the cultural references the students used during our class sessions. These references included rappers, singers, athletes, movie references, video games, dance trends, and slang. In addition, I intentionally tried to make connections to students by dressing in casual clothing similar to them. Many of them noticed the sneakers I wore, knew the brands (e.g., Nike, Jordan, Adidas, and Vans), and complimented me on my sneakers throughout the summer. However, our cultural similarities alone were not enough to have an instant rapport with students, and it did not prevent behavioral issues. Thus, I had to take a personal interest in students and their work to build rapport. Overall, I found implementing culturally relevant pedagogy (CRP) into a computer science curriculum for the first time both challenging and rewarding. I acknowledged the *importance of leveraging existing cultural competence while intentionally building connections with students.*

B. *Female Latina Teacher Perspectives*

As a Latina woman, I have always had an easy time connecting with underrepresented minorities, especially female students. However, in implementing CRP, I learned that cultural competence requires that teachers understand their own cultural backgrounds and actively learn about those of their students.

During Week 3, a male student calmly asked me, "Miss Jimenez, where are you from?" I replied back "I am from a Caribbean island, do you know the Dominican Republic?", the student responded, "Oh you are going to get deported". At the moment, I was in shock because at 9 to 11 years old, I was not politically or socially aware of events that were happening around me. Instead of getting upset by his comment, I replied back, "No, I cannot get deported. Naturalized American citizens cannot get deported." I continued to explain to the class that naturalization is a legal process that immigrants do to become US citizens. After this discussion, students felt more comfortable and open to talking to me about incidents that were happening around them and expressed their thoughts aloud. Such examples included school shootings, gun violence, and racism. Having a medium for students to express their thoughts and worries is crucial at this point in time.

Overall, we found that integrating elements of sociopolitical consciousness and cultural competence with technology mediums such as Scratch helped students not only understand difficult topics, but also use the computer science concepts learned in class to build their own social justice animations that they were passionate about. Thus, having CRP in our implementation of the curriculum provided invaluable experiences to help us shape future curricula and our approach to teaching diverse students.

REFERENCES

[1] S. Zweben and B. Bizot, "2017 CRA Taulbee Survey," Comput. Res. News, vol. 30, no. 5, pp. 1–47, 2018.

[2] G. Ladson-Billings, "Toward a Theory of Culturally Relevant Pedagogy," Am. Educ. Res. J., vol. 32, no. 3, pp. 465–491, 1995.

[3] R. Eglash and A. Bennett, "Teaching with Hidden Capital: Agency in Children's Computational Explorations of Cornrow Hairstyles," Child. Youth Environ., vol. 19, no. 1, pp. 58–73, 2009.

[4] A. Boyce, K. Doran, A. Campbell, S. Pickford, D. Culler, and T. Barnes, "BeadLoom Game," Proc. 6th Int. Conf. Found. Digit. Games - FDG '11, no. March, pp. 139–146, 2011.