Pivoting During a Pandemic: Designing a Virtual Summer Camp to Increase Confidence of Black and Latina girls

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ABSTRACT

Out-of-school time programs like summer camps have shown to be beneficial for exposing students to computer science, particularly in school districts where computing classes are not offered. The COVID-19 pandemic presented challenges for students who were already subject to the digital divide, as in-person camps came to a halt if they weren't prepared to pivot. In response, we created a virtual summer camp that provides informal computer science learning opportunities that were intentionally designed to increase the confidence of Black and Latina girls in computing and to promote positive perceptions of computer science education and career opportunities. Key to our approach is the recognition that representation in the camp's community of attendees, teachers, guest speakers, and in the content can foster confidence for Black and Latina girls in computing. In this paper, we draw on the intersectional computing framework and present the structural, instructional, and curricular design of the virtual program and present initial findings on the impact of the camp on computing confidence, intent to persist, social supports, and computing outcome expectations. Findings of a pre- and post-survey study of 107 camp attendees show that participating in the camp resulted in an increase in computing confidence as well as computing outcome expectations among Black and Latina girls.

CCS CONCEPTS

• **Social and professional topics → K-12 education**.

KEYWORDS

intersectional computing, K-12 instruction, summer camp, girls, culturally relevant pedagogy

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1 INTRODUCTION

Many out-of-school time programs have emerged over the years to fill the gap in computer science courses offered at the K-12 level. Course offerings (or lack thereof), placement outside of the academic core curriculum, lack of teacher preparation and instructional resources, all result in wide disparities and the lack of availability and quality of CS education opportunities for students of color [16]. These structural barriers are then compounded by additional social barriers, including classroom and campus climate, stereotype threat, and the lack of role models, mentors, and peers [6], all of which affect the enrollment, persistence, and completion of computing-related degrees among students from underrepresented backgrounds [29].

To address these structural and social barriers, there has been an increased effort to broaden the participation of girls and/or those in racial and minority groups in computing at the K-12 level [4, 7, 9, 10, 13, 28, 30]. However, more should be done to specifically address the issues of Black and Latina girls as it relates to their confidence and persistence in Computer Science [26], as their intersectional experiences play a role in their self-efficacy. Rankin and Thomas [23] have presented the term "Intersectional Computing" - a tool for promoting diversity, inclusion and equity within the field of computing while shedding light on the plurality of lived intersectional experiences that exist among the broader computing demographic. When designing informal learning opportunities for both Black and Latina girls, it is imperative to take the overlapping social constructs of race and gender into consideration and apply Intersectional Computing as part of the design process.

In response, our approach builds on prior work that shows promise for *representation* in informal learning experiences for Black and Latina girls in computing. Programs specifically for Black and Latina girls that have a staff, mentors, and peers that are reflective of the girls in the program have been shown to increase

their confidence and overall interest in tech [5, 11, 15, 17, 22, 24–26, 31, 35]. Madrigal and her colleagues [15] created the BRIGHT-CS computer science learning ecosystem for middle school girls in which they had mentors who were women of color and showed that both the implicit and explicit messaging about equity and success moved girls from naive confidence to authentic self-efficacy. In addition to ensuring that there is representation in staff and mentors for Black and Latina girls during computer science learning experiences, ensuring representation in the content presented through culturally relevant pedagogy is equally important, increasing student engagement by connecting curricular to life experiences; building their self-efficacy, and supporting them in their efforts to support their community through using tech for good [11, 14, 22, 32, 33].

Drawing on this work, in this paper, we explore the use of representation in the community of attendees, teachers, guest speakers, and the content of a summer camp as part of an intentional design strategy to foster confidence for Black and Latina girls in computing. Specifically, we seek to answer the following research questions:

- Does having camp attendees and a staff that is majority Black and Hispanic help increase confidence in Black and Latina girls who attend?
- Given the need to pivot to online delivery in response to the COVID-19 pandemic, can the inclusion of representation through a virtual summer camp increase confidence in Black and Latina girls?

2 INTECH CAMP FOR GIRLS: DESIGN PRINCIPLES

INTech Camp for Girls was founded in order to ensure that Black and Latina girls have opportunities to learn about technology, computer science, and engineering and to have access to lucrative tech-focused career paths. Specifically, INTech engages Black and Latina girls in grades 6-12 across the US in out-of-school time experiences through summer camps and after school programs. These INTech experiences are designed around 3 pillars:

- **Inform.** INTech provides girls with opportunities to master essential computer science concepts, such as creativity, abstraction, algorithms, and programming, and to learn about different potential pathways for technology careers.
- **Inspire.** INTech introduces young Black and Latina girls to women with a background in the technology industry, who share their educational and career experiences.
- **Innovate.** INTech provides girls with opportunities to work together in lightweight teams [12] in which they learn how to create and implement technology solutions. Working in a team setting, girls reap the benefits of peer teaching, peer learning, and increased student engagement [12].

To date, INTech has offered 36 camps that reached over 1,200 girls in North Carolina, South Carolina, and California. Through the INTech Summer Camp, middle school girls spend 5-days learning HTML, CSS, and Javascript and hear from women in tech. Typically, summer camp is hosted in person on college campuses; however, due to the COVID-19 pandemic, INTech pivoted to a virtual summer camp experience in order to provide opportunities to prevent widening of achievement gaps and the digital divide [18].

Given this opportunity to reformulate the camp for a virtual setting, we explored the incorporation of design elements in the camp that emphasize representation of Black and Latina women in tech, promoting representation of Black and Latina girls in the community of attendees, representation of Black and Latina women in tech as camp leaders, teachers, and guest speakers, and through the use of culturally responsive pedagogy in computing-focused instruction. The remainder of this section highlights design elements of our camp that aim to address representation as a strategy for increasing confidence of Black and Latina girls in computing.

2.1 Virtual Summer Camp

The INTech Virtual Summer Camp was hosted via Zoom for 120 girls across the USA and Canada. To foster community among attendees, we hosted 12 different Zoom classrooms with 10 students and two instructors per classroom. Since our students came from all over the country, engagement was important as many of them didn't know each other. The schedule was planned to include collaborative work and engaging activities as a strategy for building a sense of belonging and community. To attend the camp, there was a fee and scholarships were available to those who could not afford the fee. Each student received an INTech Box in the mail which included an INTech shirt, mask, buttons/pins, headphones for zoom calls, and a Lingo Coding Kit [34] which they were able to tinker with outside of camp activities.

2.2 Representation in Staff and Speakers

One of the main ways in which INTech seeks to increase the confidence of Black and Latina girls in tech is by being intentional about ensuring there is significant representation of Black and Latina women as part of our camp staff and guest speakers. In ensuring representation among staff and speakers, we address a social barrier, providing girls with an opportunity to see someone like themselves "doing CS" [6] and to benefit from implicit mentorship [16].

Hosting a virtual camp allowed us to have more Black and Latina women in tech represented through our camp activities, with speakers from across the country joining the camp to meet with attendees online. This year, 93% of our teachers were Black and Latina women. Of the men who served as an instructor, 66% of them identified as Black as well. All camp staff members were paid a stipend at the end of camp.

To further emphasize the representation of Black women in tech, our students heard from 11 Black women and two Latina women for a 30 minute guest speaker series. Through highlighting one woman each day of camp, our students were exposed to entrepreneurs, a cyber security engineer, data scientists, test and computing automation engineers, as well as, iOS and hardware engineers. Since we understand that girls at this age lack exposure to computing careers, which could impact their advancement in tech [29], we ensure that they know what options exist for them. Now our students are aware of tech roles at companies like Facebook, Salesforce, Bank of America, Microsoft, SAS, Calm, as well as what its like to build their own company.

Table 1: Speaker Demographics

Race/Ethnicity		Gender	
African American	11	Women	13
Hispanic	2	Men	0

2.3 Culturally Responsive Curriculum

Key to the development of computing knowledge were culturally responsive projects that allowed camp attendees to explore what was important to them through the application of computing concepts. Through these projects, students were also supported in exploring and expanding critical literacy, i.e., the awareness of the various social, ideological, cultural, and political contexts in which language and literacies of power operate [20].

The virtual camp consisted of two different tracks:

- **Track 1 - Coding 101** in which girls who are new to INTech learn how to build websites using HTML/CSS/Javascript
- **Track 2 - App Development** in which girls who have attended INTech previously learn how to use HTML/CSS/Javascript to build mobile applications

We used BSD Education (BSD) as the platform for our students to complete their projects during camp. BSD is an education technology organization that is dedicated to creating programs for students between the ages of five and eighteen to learn digital skills. They use real-world, project-based Technology Education Curricula to design each activity [2, 8]. BSD has code packs on their platform that include 3-4 projects focused around a particular theme. Through the BSD projects, students were able to build a strong foundation of HTML, CSS, and Javascript knowledge and apply it to engaging, real world examples.

The online poster module, in particular, emphasized our culturally responsive use of BSD curriculum. Students were directed to use their knowledge of HTML, CSS, and Javascript to create a online poster that captured information, an idea, or concept that they felt it was important to share through their use of technology. Camp leaders facilitated student-led discussions around topics to explore, with interests ranging from personal concerns, social issues, educational interventions, and business concepts. Examples of resulting student posters are shown in Figure 1. When given the choice to select any topic of interest, students largely chose to create posters about social issues that impacted them directly: the Black Lives Matter movement, colorism, being safe online, and the COVID-19 pandemic are only a few examples. This aligns with Black feminist theory, epistemologies and practices, which reflect the consciousness, interests and experiences of Black girls and women [3].

2.4 Collaboration

In order to foster community amongst the girls at camp, Zoom breakout rooms were utilized to promote collaborative work between the students [8, 12, 27]. Working together in this way has shown to improve the experience with course material compared to those who don't. Community building for Black and Latina girls is important as they continue to build up their confidence and provide support for each other in their careers.

3 METHODS

3.1 Participants and Research Design

We used a quasi-experimental one-group, pretest-posttest research design [19] for this study to analyze the effect of the program on computing confidence, intent to persist, social supports, and computing outcome expectations among Black and Latina middle school girls who learn in a virtual camp setting. We recruited girls who identify as Black, Latina, or mixed-race, in grades fifth to ninth to participate in the virtual summer camp. We accepted 120 attendees from 21 states and Canada. Of the 120 who registered, 116 students attended a full week of camp. Table 2 shows the breakdown of the demographics by race and grade for the students who attended.

Table 2: Student Demographics

Race/Ethinicity	%	Grade	%
African American	85.3	3rd-5th	32.8
Hispanic	9.5	6th	27.6
Asian/Pacific Islander	2.6	7th	22.4
White/Causcasian	1.7	8th	15.5
Biracial/Multicultural	.9	9th	1.7

3.2 Survey

We administered a pre- and post-survey to the virtual summer camp participants. Adapted from an existing survey used by the National Center for Women and Information Technology [28], there were 22 items that align with four key concepts, Computing Confidence, Social Supports, Intent to Persist, and Computing Outcome Expectations (Table 4). Cronbach's alpha values were computed to examine the reliability of each composite. The values were acceptable at 0.80, 0.77, 0.72, and .74, respectively. Survey validity is supported through construct validity as the questions are tied to social cognitive career theory [28].

3.3 Data Collection Procedures, and Analysis Instruments

To analyze the impact of the virtual summer camp program we looked at the effect of the program on each of the four survey composites: Computing Confidence, Intent to Persist, Social Supports, and Computing Outcome Expectations. Computing confidence scaled from 1 (Don't know/Never tried) to 5 (Very Confident). Social supports and Computing Outcome Expectations scaled from 1 (Strongly Disagree) to 4 (Strongly Agree). Intent to persist scaled from 1 (Not at all) to 4 (A lot).

We used these scales to calculate composite scores for each composite using Principal Component Analysis at pre- and post-camp time points. To see if the observed differences in composite scores are statistically significant, four paired-samples t-tests were conducted (i.e., one for each composite). In this kind of analysis, student growth from pre-to-post time points were examined, meaning that

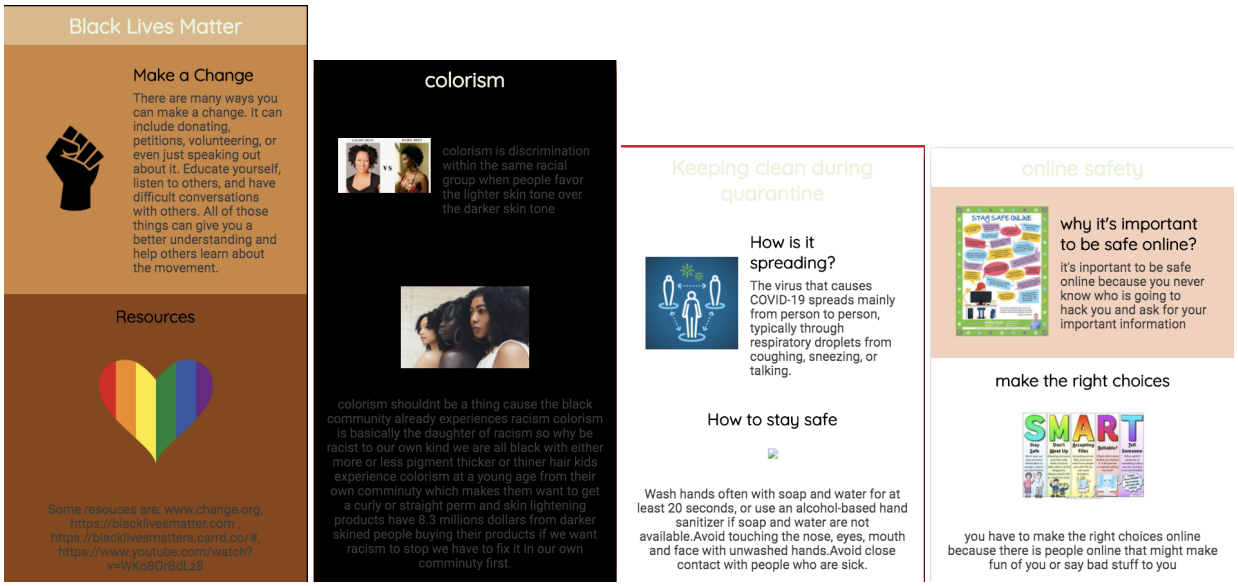

Figure 1: Attendees created posters highlighting interests in the application of computing to solve problems they find important and relevant. Themes included (left to right) racial justice, colorism, COVID-19 health and safety, online safety.

Computing Confidence	Social Supports
Right now, how confident are you in your ability to: *Response options: Don't know/Never tried, Very confident, Confident, A little confident, Not at all confident* 1. Program computers 2. Use new software programs 3. Design new software 4. Solve computing problems 5. Imagine new computing inventions	***Please mark your level of agreement or disagreement with the following sentences:*** *Response options: Strongly agree, Agree, Disagree, Strongly disagree* 6. Important people in my life think it's good for me to learn computing 7. People like me can do well in learning computing 8. Other students think it's cool that I learn computing 9. People like me can do well in computing jobs 10. People like me can create new computing inventions
Intent to Persist	**Computing Outcome Expectations**
How much would you like to … *Response options: A lot, Pretty much, A little, Not at all* 11. Take future classes to learn how to make apps 12. Take future classes to learn how to create new computing systems 13. Get a college degree 14. Get a computing-related college degree 15. Get a computing-related job when you get older	***If I were to get a college degree in computing, I would probably …*** *Response options: Strongly agree, Agree, Disagree, Strongly disagree* 16. Make good money 17. Get respect from other people 18. Do work that I would enjoy 19. Get a job that my family would be proud of 20. Do work that can 'make a difference' in people's lives 21. Find a job easily

Figure 2: Survey constructs [28]

only students with data at both time points are included in the analysis. Using this approach, we were able to use responses from 84 participants.

4 RESULTS

Computing confidence from pre- to post- program was analyzed to determine whether the intervention resulted in significant increase in confidence. There was a difference that was statistically significant, $t(84) = -7.30$, $p < .001$ (M_{PRE}=12.3, SD=4.28 to M_{POST}=15.4, SD=2.65), showing that the virtual summer camp was able to increase confidence.

Additionally, computing outcome expectations from pre- to post-program were analyzed to determine whether the intervention resulted in significant increase in computing expectations. There was a difference that was statistically significant, $t(84) = -4.87$, $p < .001$ (M_{PRE}=12.9, SD=1.74 to M_{POST}=13.8, SD=1.96), showing that the virtual summer camp was also able to increase computing expectations.

Social supports and intent to persist did not change substantively and the difference at pre- and post-test was not statistically significant ($p = .82$ and $p=0.451$ respectively). Descriptives are shown in Table 3.

5 DISCUSSION

Overall, we found that our virtual summer camp increased computing confidence and computing outcome expectations of the Black and Latina girls who participated and took our surveys. Though this was a small-scale study, it shows promise in the design of the camp where students were able to see peers and implicit mentors who looked like them in computing. We also saw some indicators of increased interest in computer science learning opportunities, with 19 attendees returning to INTech for a second or third summer, and four camp one attendees also attending camp two.

We did not see a significant increase in the social supports or intent to persist components, which could imply that these students already have a strong support system at home. The fact that they

Composite	N	Time	Mean	Std. Deviation	Min	Max	p-value
Computing Confidence	84	Pre	12.3	4.28	3.72	18.6	<.001*
		Post	15.4	2.65	7.61	17.7	
Social Supports	84	Pre	11.7	1.73	6.38	14.5	0.82
		Post	11.8	1.51	6.56	13.9	
Intent to Persist	84	Pre	9.1	2.52	4.33	13.3	0.451
		Post	9.28	3.13	3.39	13.6	
Computing Outcome Expectations	84	Pre	12.9	1.74	6.01	16	<.001*
		Post	13.8	1.96	5.46	16.8	

Table 3: Pre- to Post-Survey Results: Descriptive Statistics

are participating in the INTech Virtual Summer Camp could also imply that they are already interested in taking future tech classes or obtaining a college degree. During our speaker series, students asked questions about support systems *"Was your mom the only one that was supportive of your career?"*, course rigor *"How did you get through challenging courses like statistics?", "Was there ever a time where your job or studies got to be too much and you felt you had to give up or take a break from them? If so, how did you deal with those thoughts?"*, success as a Black woman *"Was it hard to be successful as a Black woman?"*, as well as, understanding how being bilingual helped with success in a career path *"Did it make your career easier since you could speak two languages?"*. These questions show that Black and Latina girls are inquisitive about these implicit role models and were connecting their own perceptions and experiences about computing to what was shared; such interactions can increase social capital and provide new role models [21, 29].

6 RECOMMENDATIONS

Facilitating Collaborative Work in a Virtual Environment. Collaborative work has been pointed to as an effective strategy for engaging girls and women of color in computing. In an attempt to replicate the kinds of collaborative work that we would employ in an in-person camp, virtual breakout rooms were used to support group work, with breakout rooms comprised of 2-3 students. However, not all participants found the breakout rooms to be helpful, and camp leaders frequently abandoned them to bring the group of 10-12 students back together to work collaboratively. Collaborative work in larger groups seemed to work better for students and camp leaders in the virtual setting, while smaller groups have previously been perceived to be more effective for facilitating community and learning outcomes during in-person camps.

Timing for Facilitating Virtual Work. In moving the camp to a virtual setting, we recognized that attendees required almost double the time that we anticipated would be required to complete a learning module. With camp being strictly online, connectivity issues were experienced widely. In addition, our scholars used a wide variety of devices, including phones and tablets, to support their work, which meant that camp leaders had to navigate a wide range of potential issues and configurations and camp participants had different experiences due to the device platform used.

Virtual Camps Offer Opportunities for Office Hours. After receiving feedback from teachers and students, we learned that there was interest in extending the camp to include virtual office hours, during which students could check in with a camp leader to help them with IT issues related to how to configure their devices at home to support the learning platforms, to ask questions about the camp content, and to continue to connect and work with their peers on computing activities after the end of the camp session.

Bilingual and Translanguaging support. Our target audience is families of color and our camp materials are presented in the English language. We were not prepared for the challenges faced by including family members for whom English is not their primary language in our camp activities. Particularly for camps that serve Black and Latina girls, we recommend that all materials should be prepared in both English and Spanish, and that live transcription or translation in multiple languages are planned for in advance as well, for both camp attendees and families.

7 CONCLUSION

In this paper, we highlighted the design of a virtual summer camp in computing for Black and Latina girls that emphasizes representation among attendees, teachers, role models, and through culturally responsive pedagogy as a strategy for increasing confidence in computing for Black and Latina attendees. Our findings suggest that designing a camp to focus on intersectional computing, particularly with respect to representation, is an effective way to increase confidence and outcome expectations in computing among Black and Latina girls.

As pointed out in the literature [16, 26], short term experiences, like summer camps, are not enough to sustain interest and engagement in computer science learning opportunities. Instead, a long-term strategy for devising a pathway that includes a series of

informal and formal learning experiences is needed. For example, INTech offers the INTech Academy, a 9-week program for High School Girls [1]; we would expect to see increased interest and engagement for participants in the INTech summer camps to participate in the INTech Academy.

Future work should use a mixed-methods approach to interview students and their parents to gain a deeper understanding of the survey data presented. Further, our research team plans to interview the camp staff and speakers to understand the role that representation played in their persistence in computing and their motivation to lead informal CS learning experiences for Black and Latina girls. Implications from their responses will be used to inform the design of future camp experiences.

REFERENCES

[1] Khalia Braswell. 2020. From Camp to Conferences: Experiences in Leveraging Tech Conferences to Inspire Black and Latinx Girls to Pursue Coding and Tech Careers. In *5th IEEE STCBP Conference for Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*.

[2] BSD. [n.d.]. BSD Education. http://bsd.education/

[3] Patricia Hill Collins. 2002. *Black feminist thought: Knowledge, consciousness, and the politics of empowerment*. routledge.

[4] Peggy Doerschuk, Jiangjiang Liu, and Judith Mann. 2007. Pilot summer camps in computing for middle school girls: from organization through assessment. In *Proceedings of the 12th annual SIGCSE conference on Innovation and technology in computer science education*. 4–8.

[5] Sheena Erete, Nichole Pinkard, Caitlin K Martin, and Jim Sandherr. 2016. Exploring the use of interactive narratives to engage inner-city girls in computational activities. In *2016 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*. IEEE, 1–4.

[6] Google Inc. Gallup Inc. 2016. Diversity Gaps in Computer Science: Exploring the Underrepresentation of Girls, Blacks and Hispanics. http://goo.gl/PG34aH

[7] Yasmin B Kafai and Quinn Burke. 2014. Beyond game design for broadening participation: Building new clubhouses of computing for girls. *GenderIT 2014* (2014).

[8] Shahnaz Kamberi. [n.d.]. Enticing women to computer science with es (Expose, engage, encourage, empower). In *2017 IEEE Women in Engineering (WIE) Forum USA East*. IEEE, 1–5.

[9] Shahnaz Kamberi. 2017. Exposing girls to computer science: Does the all-girl model really work? *ISEC 2017 - Proceedings of the 7th IEEE Integrated STEM Education Conference* 00, c (2017), 152–155. https://doi.org/10.1109/ISECon.2017.7910232

[10] Shereen Khoja, Camille Wainwright, Juliet Brosing, and Jeffrey Barlow. 2012. Changing Girls' Attitudes Towards Computer Science. *J. Comput. Sci. Coll.* 28, 1 (2012), 210–216. https://doi.org/10.1016/S1383-5718(03)00091-3

[11] Melissa Koch and Torie Gorges. 2016. Curricular Influences on Female Afterschool Facilitators' Computer Science Interests and Career Choices. *Journal of Science Education and Technology* 25, 5 (2016), 782–794. https://doi.org/10.1007/s10956-016-9636-2

[12] Celine Latulipe, N. Bruce Long, and Carlos E. Seminario. 2015. Structuring Flipped Classes with Lightweight Teams and Gamification. In *Proceedings of the 46th ACM Technical Symposium on Computer Science Education (SIGCSE '15)*. ACM, New York, NY, USA, 392–397. https://doi.org/10.1145/2676723.2677240

[13] Cristiano Maciel, Sílvia Amélia Bim, and Clodis Boscarioli. 2013. HCI with chocolate: Introducing HCI concepts to Brazilian girls in elementary school. *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)* 8278 LNCS, Ic (2013), 90–94. https://doi.org/10.1007/978-3-319-03068-5_16

[14] Tia C Madkins, Alexis Martin, Jean Ryoo, Kimberly A Scott, Joanna Goode, Allison Scott, and Frieda McAlear. 2019. Culturally Relevant Computer Science Pedagogy: From Theory to Practice. In *2019 Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT)*. IEEE, 1–4.

[15] Veronica Madrigal, Ryoko Yamaguchi, Adam Hall, and Jamika Burge. 2020. Promoting and Supporting Computer Science Among Middle School Girls of Color: Initial Findings from BRIGHT-CS. In *Proceedings of the 51st ACM Technical Symposium on Computer Science Education*. 247–253.

[16] Jane Margolis, Jean J. Ryoo, Cueponcaxochitl D.M. Sandoval, Clifford Lee, Joanna Goode, and Gail Chapman. 2012. Beyond access: Broadening participation in high school computer science. , 72–78 pages. https://doi.org/10.1145/2381083.2381102

[17] Dana Mcfarlane and Elissa M. Redmiles. 2020. Get Paid to Program: Evaluating an Employment-Aware After-School Program for High School Women of Color. *Annual Conference on Innovation and Technology in Computer Science Education, ITiCSE* (2020), 212–218. https://doi.org/10.1145/3341525.3387357

[18] McKinsey and Company. 2020. COVID-19 and student learning in the United States: The hurt could last a lifetime. https://www.mckinsey.com/industries/public-and-social-sector/our-insights/covid-19-and-student-learning-in-the-united-states-the-hurt-could-last-a-lifetime

[19] Donna M. Mertens. 2019. *Research and evaluation in education and psychology integrating diversity with quantitative, qualitative, and mixed methods*. sage.

[20] Ernest Morrell. 2015. *Critical literacy and urban youth: Pedagogies of access, dissent, and liberation*. Routledge.

[21] Evava S Pietri, India R Johnson, Sana Majid, and Charles Chu. 2020. Seeing What's Possible: Videos are more Effective than Written Portrayals for Enhancing the Relatability of Scientists and Promoting Black Female Students' Interest in STEM. *SEX ROLES* (2020).

[22] Nichole Pinkard, Sheena Erete, Caitlin K Martin, and Maxine McKinney de Royston. 2017. Digital youth divas: Exploring narrative-driven curriculum to spark middle school girls' interest in computational activities. *Journal of the Learning Sciences* 26, 3 (2017), 477–516.

[23] Yolanda A. Rankin and Jakita O. Thomas. 2020. The Intersectional Experiences of Black Women in Computing. In *Proceedings of the 51st ACM Technical Symposium on Computer Science Education (SIGCSE '20)*. Association for Computing Machinery, New York, NY, USA, 199–205. https://doi.org/10.1145/3328778.3366873

[24] Yolanda A Rankin, Jakita O Thomas, and India Irish. 2019. Food for Thought: Supporting African American Women's Computational Algorithmic Thinking in an Intro CS Course. In *Proceedings of the 50th ACM Technical Symposium on Computer Science Education*. 641–646.

[25] Ashley Robinson and Manuel A. Pérez-Quiñones. 2014. Underrepresented middle school girls: On the path to computer science through paper prototyping. , 97–102 pages. https://doi.org/10.1145/2538862.2538951

[26] Monique Ross, Zahra Hazari, Gerhard Sonnert, and Philip Sadler. 2020. The intersection of being black and being a woman: Examining the effect of social computing relationships on computer science career choice. *ACM Transactions on Computing Education (TOCE)* 20, 2 (2020), 1–15.

[27] Heather T Rowan-Kenyon, Amy K Swan, and Marie F Creager. 2012. Social cognitive factors, support, and engagement: Early adolescents' math interests as precursors to choice of career. *The Career Development Quarterly* 60, 1 (2012), 2–15.

[28] Mihaela Sabin, Rosabel Deloge, Adrienne Smith, and Wendy DuBow. 2017. Summer learning experience for girls in grades 7–9 boosts confidence and interest in computing careers. *Journal of Computing Sciences in Colleges* 6800 (2017), 1–9.

[29] Allison Scott, Freada Kapor Klein, Frieda McAlear, MRes Alexis Martin, and Sonia Koshy. 2015. The Leaky Tech Pipeline: A Comprehensive Framework for Understanding and Addressing the Lack of Diversity Across the Tech Ecosystem. (2015). www.leakytechpipeline.com

[30] Allison Scott, Alexis Martin, Frieda McAlear, and Tia C. Madkins. 2016. Broadening participation in computer science: Existing out-of-school initiatives and a case study. *ACM Inroads* 7, 4 (2016), 84–90. https://doi.org/10.1145/2994153

[31] Kimberly Scott, Xiaolong Zhang, et al. 2014. Designing a culturally responsive computing curriculum for girls. *International Journal of Gender, Science and Technology* 6, 2 (2014), 264–276.

[32] Kimberly A Scott, Kimberly M Sheridan, and Kevin Clark. 2015. Culturally responsive computing: A theory revisited. *Learning, Media and Technology* 40, 4 (2015), 412–436.

[33] Kimberly A. Scott and Mary Aleta White. 2013. COMPUGIRLS' Standpoint: Culturally Responsive Computing and Its Effect on Girls of Color. *Urban Education* 48, 5 (2013), 657–681. https://doi.org/10.1177/0042085913491219

[34] STEMBoard. [n.d.]. STEMLingo. https://stemlingo.com/

[35] Jakita O Thomas. 2018. The Computational Algorithmic Thinking (CAT) Capability Flow: An Approach to Articulating CAT Capabilities over Time in African-American Middle-school Girls. In *Proceedings of the 49th ACM Technical Symposium on Computer Science Education*. 149–154.