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Culturally Responsive Computing for Black Boys Through Sports Technology

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Abstract: Identity and intersectionality must be foregrounded in design interventions for computing and STEM education. In this paper, our research team presents findings from a sports and technology intervention we developed with the culturally responsive computing framework. We implemented the intervention in a local summer program for young Black boys entering grades 3-8. Data were collected and analyzed from caregiver interviews. Findings suggest that youth recognized relationships between digital technologies and sports, and conceptualized more expansive ways for technology to mediate their sports interest. The interviews also revealed the need for greater intentionality in facilitating family engagement.

Introduction

Learning Sciences literature on the relationship between sports and technology highlights approaches to engaging minoritized youth in CS-STEM (STEM and computer science) learning experiences by situating them in athletics (Drazan et al., 2017; Jones et al., 2020). Efforts for disciplinary learning that introduce or expose the CS-STEM practices and knowledge within non-traditional learning contexts – while reinforcing youths' cultural practices and knowledges – can enable minoritized youth to recognize CS-STEM within their interests. We present findings for an intervention on sports and wearable technologies at Brothas Camp, a summer program for Black boys in elementary and middle school. We engage the following research question in this study: What do conversations at home reveal about CS-STEM interest development for youth that are exposed to sports technology through a sports camp?

Positionality statement

Responding to the charge that Vakil et al. (2016) gave academic researchers to "critically examine the role that race, racialization, and power play across the arc of DBR [design-based research] projects" (p. 205), we acknowledge here our diverse positionalities. All the authors of this paper are People of Color. The fourth author is a Black male engineer who plays sports to this day and who facilitated our sports technology curriculum. Our first and third authors facilitated several of the sessions and played sports in their youth. They were able to provide context where necessary, expanded on the youths' ideas, and teased with them. One of the authors is also a former teacher who leveraged her blackness when interacting with youth and camp staff. Although our second author did not interact with the camp, she was integral to the data analysis and writing the findings. We also acknowledge our outsider relation to Brothas Camp. None of us grew up in the city where Brothas Camp took place, and our intervention pushed into the camp, which kept us relatively separate from the camp community.

Literature review

Disciplinarity (in learning, practice, and identity) can function as a means for excluding and othering. Research on CS-STEM interest development (Wang et al., 2017; Dou et al., 2020) and the "identity turn" in CS-STEM education (Shaw & Kafai, 2020) has noted how existing identities should be foregrounded in interventions for broadening participation. Many of these research efforts address stereotypes, such as the notion of CS-STEM as acultural, apolitical, and decontextualized, and CS-STEM identity as "singularly-focused," "asocial," "competitive," and "male" (Lewis et al. 2016). However, exposure to computing content that engages participants in larger critiques about a technology's purpose, potential, and impact tends to be more interesting to minoritized youth (Margolis et al., 2015; Webb et al., 2012; Vakil & Ayers, 2019). Research on "practice-linked identities" (Nasir & Hand, 2008; Nasir & Cooks, 2009), "practice-linked learning and environments" (Jones et al., 2020), and "everyday learning" (Philip & Azevedo, 2017) demonstrates the need for broadened access to disciplinary resources for diverse learners.

Culturally responsive computing (CRC; Eglash et al., 2013; Scott et al., 2013) is a pedagogical framework for computing education that uses culturally-responsive values to validate learner interests, identities, and cultures. The framework includes several important tenets. Tenet 1 sets the expectation for youth use existing tools innovatively and construct artifacts that represent big ideas, irrespective of prior knowledge or exposure;

Tenet 2 supports unique learning contexts where youth explore a technology's capabilities, consider their limitations, and transform them; and Tenet 3 attends to learners' identities and the importance of intersectionality in helping youth understand the multiple dimensions of self. By engaging in critique and interacting with tools, youth in CRC learning environments realize their identities in relation to power and become empowered to actively resist these dynamics. Tenet 4 describes the role of digital technology in equipping youth to reflect on and reimagine their identities through counternarratives and counternormative images. Tenet 5 invites youth to reappropriate disciplinary and research practices to dismantle systems and empowers their communities. Importantly, CRC affirms the critical role that caring adults such as parents and community members have in guiding and advocating for youth.

Design of intervention

Brothas Camp (renamed for anonymity) was a summer program that offered Black boys in grades 3 through 8. Camp sessions for elementary students occurred separately from the middle school students, and youth within each session were organized by their grade levels. The Brothas Camp designers incorporated several communal aspects to instill pride and promote camaraderie. Staff members and college mentors – all Black men – were affectionately referred to as "brothas," and the group became "my family". Our work with Brothas Camp provided youth the opportunity to explore, de-settle, and reconcile their relationship with athletics and CS-STEM.

Contextualized learning opportunities for CS-STEM provide alternative conceptions of what computer science is to youth who do not selectively engage in CS-STEM activities (Drazan et al., 2017; DiSalvo et al., 2014) or who do not benefit from "preparatory privilege" (Margolis et. al, 2015; Isaac & Gardner-McCune, 2021). Such activities can essentialize dominant epistemologies, which for our American context meant (whether intentionally or unintentionally) requiring participants to forsake their identities to develop CS-STEM identities and practices. Our intervention exposed youth to sports wearables while attending to both their heritage culture (blackness) and vernacular culture (sports) (Eglash et al. 2013). Similar to other sports technology interventions, learning was situated on the court and field to connect these sites of sports practice and activity to CS-STEM experiences involving wearable physical computing kits. We conducted three 45-minute sessions with middle school youth and four with elementary school youth. Middle school youth completed activities for track and field with pedometers and smart watches, soccer activities with micro:bit microcontrollers, and basketball drills with sensor-enabled basketballs. Elementary school youth engaged with the same activities for track and basketball, and also drew their dream sports technology.

Methods

Some qualitative and quantitative data – including youth drawings – were published in the Wallace et al. (2023) study. For this paper, we focus on qualitative jottings and interviews with youth's caregivers. Members of the research team engaged in participant observation, recording jottings about the implementations and youth insights. These data helped support our sensemaking around youth experiences with the design intervention. We include data from three semi-structured interviews conducted with caregivers after Brothas Camp. The interview protocol focused on: what the child shared with family members regarding their camp experience; the child's interests in sports and how they engage with or build digital technologies; impressions of the child's relationship with school and extracurricular activities; and suggestions for program improvements. The Brothas Camp director recruited caregivers to participate in the interviews. Caregivers completed an intake process form and consented to participating in the study. Interviews were audio-recorded and machine-transcribed with a web conferencing platform. Transcripts were then corrected by the authors and reformatted for analysis.

The first and second authors coded short passages within the transcript to identify speech related to how caregivers described youth interactions with the sports-technology intervention and their perceptions of the technologies. These codes referenced parent wording. The second iteration of coding looked for instances of youth's connections between sports and technology. We used Braun and Strauss' thematic analysis (Vaismoradi et al., 2013), to find thematic codes within the data by identifying, analyzing, and presenting those themes. These more detailed codes were grouped into categories: at-home connections to technology and sports, building community, and academic and athletic identities.

Findings and discussion

In all three interviews, at-home connections between technology and sports emerged from interactions around smartwatch technology. The interviews revealed how conversations from the camp made it home, and how the families structured communication around the day's events. Youth brought up ways that this technology could track heart rate, step counts, and sleep. Parents immediately recognized their youths' excitement with these

technologies and mentioned nuances around their talkativeness. One youth used the tech to regulate their physical movement with the hourly reminders. Another one enthusiastically compared the features of their smartwatch with the features of their parent's smartwatch, and they explored the system in a way that the parents had not done themselves. A third child was passionate about sound engineering and wanted to explore ways to connect to this technology. Even so, there was difficulty in remembering events when not explicitly prompted to recount them. One caregiver remarked, "He mentions some of these things, but because I didn't have a reference point for them, you know, when I'm like, 'How is camp? What was your favorite thing?' I don't think he used these exact words." Caregivers recommended that discussion prompts and general information be shared in future implementations to reinforce learning at home.

The interviews were an opportunity for caregivers to address the scholar-athlete identity. They wanted to expose their Black boys to opportunities beyond being "just an athlete" so they see themselves as knowers and practitioners at the intersection of technology and sports. They also noted identities outside the scholar-athlete that connect sports to technology: "...my son loves sports, right? But I want him to be both an athlete and a scholar. And so, there are so many jobs that are within sports that kids don't see outside of the athlete. Somebody who tracks all this stuff as a statistician…Because he's really interested in that. So if I can keep him engaged in this way, he'll see different avenues". Involvement also meant helping their youth navigate the difficulties of discrimination and intersectional spaces. As one parent called out: "He's just not really into sports like that…and you know that's something that all Black boys are supposed to do." This parent stated that they manage the societal expectation for Black boys by validating their child's desire to do whatever activities they enjoy. There are stereotypes around athletic identity and academic acumen, which they referred to as, "this challenge of being able to bring that athletic identity to the academic space without being stigmatized." The families relayed the importance of having affirming spaces that promote possibilities and choice for Black boys when raising them in environments that can be unwelcoming. All three praised the Brothas Camp's emphasis on fostering brotherhood. One caregiver stated, "I'm super excited for him to be in this space of Black joy…everybody looks like me".

Our intervention for Brothas Camp introduced the youth to CS-STEM and to the technology community within sports. Yet, identities are not developed from exposure alone. For youth to conceptualize a CS-STEM identity will require multiple and sustained opportunities for practice and collaboration with caregivers and communities. We designed the intervention with CRC in mind, but connected learning presents an additional framework for facilitating these family engagements in more intentional ways. According to Ito et al. (2013), "Connected learning is realized when a young person pursues a personal interest or passion with the support of friends and caring adults, and is in turn able to link this learning and interest to academic achievement, career possibilities, or civic engagement." Caregivers' desires for deeper discussions with youth reinforced to us the importance of family engagement in sustaining culturally-responsive learning.

Limitations

Relationship dynamics between researchers and those involved in the research are fragile due to race and power (Vakil et al., 2016). For this study, we interviewed caregivers instead of the learners themselves. We wanted to preserve the sanctity of the Brothas Camp community since the activities of Black boys are already heavily surveilled and critiqued in society. Though well-intentioned, this did make data analysis challenging. For instance, our data collection methods prevented us from making claims about the youth participants' CS-STEM identity development. We also do not present the "authentic voice of Black boys" (Coleman, 2016). Nevertheless, caregiver interviews provided us with insights into their thinking and suggestions for extending learning at home.

Conclusion

As an endeavor in culturally-responsive computing (CRC), our sports technology intervention expanded the Brothas Camp youth participants' conceptualizations of CS-STEM. Exposure to various technologies within the sports context created new opportunities for youth to reflect on technology through conversations at Brothas Camp and at home. Several youth also got the chance to ideate future innovations in sports technologies. While we were able to note changes in youths' perceptions of sports and technology, it is unknown what effects the intervention had on their identities, and to what degree. Consequently, future directions for this project include: designing interventions that shift CS-STEM interest in middle school students, communicating our programming to families to extend its effects to home, and considering thoughtful data collection methods that attend to researcher and educator goals while also attending to the interests and concerns of minoritized youth. Our recent research (Wallace et al., 2023) found that CS-STEM interest increased for the elementary school students, which aligns with the current literature. Facilitating family engagement could support CS-STEM identity development, in addition to providing more data on the ways in which caregivers guide youth to connect sports and technology. We envision environments where youth learn to code on the court and on the field, allowing their passion for

sports to support the development of new interests and identities. These explorations will certainly require envisioning more creative data collection methods.

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