Authentic Invitations: Offering Girls of Color Voluntary, Contextual, and Responsive Opportunities to Develop Computing Identities

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Abstract: Broadening participation in computing requires a deeper understanding of how to support girls of color in developing computing identities, or views of themselves as active participants within computing. We propose the concept of *authentic invitations* as a promising avenue for supporting girls of color in developing computing identities. To illustrate the three proposed dimensions of an authentic invitation, we highlight the experiences of Deandra, a 16-year-old Black girl who participated in an informal computing program for girls of color hosted in public libraries. Our findings show how offering voluntary, contextual, and responsive invitations to participate in computing can support girls of color in authoring computing identities that integrate their social and personal experiences.

Introduction

Opportunities for girls of color to meaningfully participate in computing continue to be inequitably distributed in K-12 education (Garcia, et al., 2020). When girls of color do have access to computing education, they often face racialized and gendered stereotypes that position them as lacking motivation and unable to master challenging course content (Allen & Eisenhart, 2017). In this paper, we examined how informal computing programs can design nurturing learning spaces that proactively dispel stereotypes and foster positive computing identities, or views of oneself as an active participant who can contribute and belong within computing (Mahadeo et al., 2020). We propose the concept of *authentic invitations* as a promising avenue for supporting girls of color in developing computing identities that are grounded in their lived experiences. We conceptualize an *authentic invitation* as an offer to participate in learning that is 1) voluntary and not mandated; 2) contextual and not conditional; and 3) responsive and not dismissive of girls' past, present, and future selves. To illustrate the three proposed dimensions of an *authentic invitation*, we highlight the experiences of Deandra, a 16-year-old Black girl who, while pregnant and working a part-time job, participated in an informal computing program for girls of color hosted in public libraries. Ultimately, we argue that providing meaningful connections between girls' lived experiences and computing identities can result in broader and more inclusive conceptions of what it means to participate in computing, especially in ways that extend beyond academic performance and career goals.

Conceptual framing: Authentic invitations to author a computing identity

Our work draws on disciplinary identity models that explain how learners develop feelings of recognition, interest, and capability within disciplines (Mahadeo, et al., 2020). The process of "authoring" a disciplinary identity involves performing behaviors, actions, and speech that are valued and recognized by peers and educators (Johnson et al., 2011). Students can be positioned by educators and peers in specific ways based on their race, gender, class, and the context (Allen & Eisenhart, 2017). These positionings can influence how they author their identities and come to imagine their future as active experts in science fields. We examine how girls of color develop computing identities, which describes the extent to which a learner identifies as a "computing person," within the context of an informal computing education program (Rodriguez & Lehman, 2017). Prior conceptualizations of a computing identity typically involve performing behaviors that are recognized as related to the discipline of computer science, such as learning to program (Harrington et al., 2019). Instead of developing a performance-based computing identity model, our work examines how *authentic invitations* to participate in a learning environment that equally values personal meaning making and computing skills impacts the development of computing identities among girls of color. Our conceptualization of an authentic invitation is informed by community-based practices that acknowledge that "transformation occurs through choice, not mandate," that community building supports "people to participate and own the relationships, tasks, and process that lead to success," and that invitations are "the call to create an alternative future" (Block, 2008). Based on these community-based practices, we describe an authentic invitation as one that is 1) voluntary and not mandated; 2) contextual and not conditional; 3) responsive and not dismissive of girls' past, present, and future selves. Thus, invitations to learn should support student agency (voluntary), consider obstacles to participation (contextual), and provide opportunities for girls of color to thrive on their own terms (responsive).

Research design

The study context is an informal computing program hosted at a library in an urban city in Southeast Michigan, USA. The curriculum consisted of twenty hours of activities that introduced girls to computer programming using an Arduino, an opensource microcontroller. While we evaluated the curriculum effectiveness, we do not present those results in this paper. The program enrollment was capped at 10 girls per implementation. Recruitment was conducted by librarians who hosted "open houses" and focused on recruiting girls, ages of 13-16, who identify as Black, Latina, and Native American. Two researchers attended each program session and collected field notes and audiovisual recordings of participant artifacts such as group projects and expressive artwork. Three members of the research team analyzed the data using an inductive coding process and collaboratively conducted thematic analysis. The analysis process included cross-checking interpretative claims using data triangulation that converged information gathered across the textual, audio, and visual forms of data.

Findings

Rather than report a summary of whole group experiences, we focus on the experiences of one participant to present a unified account of how authentic invitations can influence the development of a computing identity. Deandra was chosen as the exemplary narrative because her experiences exemplify the construct of interest in a particularly interesting manner given her initial reluctance to participate in the program, her decision to complete the program twice, and her life circumstances. While her experiences may not be "typical," exemplary narratives can still be used to understand a wide range of developmental processes because they represent the upper ends of development and allow for the inclusion of detail, context, voice, and emotion (Bronk, King, & Matsuba, 2013).

An introduction to Deandra

At the time of the program, Deandra was a 16-year-old Black girl who worked at a local doughnut shop and attended the program in her work uniform since she started her work shift shortly after each session. She participated in two full implementations of the program (40 hours total); first in the summer of 2019 and again in the fall of the same year. While Deandra demonstrated her interest in the program by adjusting her work schedule, she also positioned herself as someone who was "too cool" for the program. During her first experience participating in the program, Deandra positioned herself as someone who was mainly interested in the program because of the "snacks" and was not afraid to announce "I ain't doing that" when asked to participate in an activity. Although Deandra publicly dismissed most of the program activities, she attended while pregnant, chose to return for a second implementation, and ultimately accepted invitations to participate in computing.

Authentic invitations as voluntary: Deandra becomes "good at this type of thing"

Deandra arrived late during a session when the girls were learning to use an Arduino because she had been experiencing morning sickness. The librarians invited her to participate in the session but did not mandate her participation. When she realized how far along the other girls were on the project, she used humor to deflect from her nervousness. She peered over girls' shoulders to look at their projects and when she saw fumes rising from the soldering iron one of the girls was using she exclaimed, "Oh no! I'm not doing that!" Deandra chose not to participate and spent the remainder of the session sitting at a table with her head down. She was never asked to leave, and she was never chastised because the invitation to participate was always voluntary and not mandated. At the end of the session, the librarian, Sarah, encouraged her to return, "I hope you feel better. See you tomorrow!" Deandra did return the next day. She boisterously grabbed an Arduino and began joking again when Sarah invited her to learn how to integrate a photoresistor with the Arduino. "Oh no no no," she said as she proceeded to grab all the materials she needed to complete the project. Sarah laughed at her feigned trepidation as she helped Deandra get settled. By the end of the session, Deandra had learned to use variables to store the resistance value of a photoresistor (int sensorValue = 0) in the Arduino Integrated Development Environment. After successfully getting an LED to respond to changes in light using the photoresistor, Deandra proclaimed, "I'm good at this type of thing!" While it may seem counterproductive to accept Deandra's refusal to participate, respecting her decision underscored the voluntary nature of the authentic invitation to learn new computing skills and highlighted her ability to have control over how and when she wanted to learn.

Authentic invitations as contextual: Deandra becomes a "veteran"

When Deandra enrolled in the program, she arrived with her grandmother, sister, and cousins. Before Deandra's grandmother signed her up, she asked Sarah, "Is it okay if one of them is pregnant?" Although we had not planned for meeting the needs of a pregnant participant, the invitation we offered to participate in computing was contextual and not conditional. We worked with the librarians to consider the context of Deandra's specific life

circumstances and agreed to find ways to support her participation by accommodating her doctors' appointments, the physical demands of pregnancy, and her evolving familial relationships. As previously described, Deandra did not always feel well enough to participate. She struggled with morning sickness, swollen feet, and headaches. She also balanced her work and doctors' appointments with her program participation. While participating in computing was a valued program outcome, the librarians accepted that Deandra could not always participate and continued to communicate their investment in her success through persistent and consistent academic and emotional support. After several sessions, it became clear that the program served as a refuge for Deandra. During an activity that introduced girls to the concept of an algorithm using dance steps, Deandra shared that she "loved coming here because at home everyone is focused on the baby." She also later shared that learning new things helped her stop worrying about "drama" with her family. The program offered Deandra a safe space to learn new computing skills and a refuge from the evolving context of her life and family relationships. When the next program implementation began in the fall, Michelle, one of Deandra's cousins enrolled but Deandra did not show up. Sarah asked Michelle to encourage Deandra to return, "Next time you see Deandra, let her know we miss her, and we hope she comes with her baby." Michelle responded, "Is that allowed? Can she bring her baby?" Deandra did show up during the next program session and she lovingly showed off her baby, "His stomach is so big but then he has these little chicken legs." The librarians and researchers took turns holding the baby while Deandra participated in the program activities. As she participated, Sarah positioned Deandra as a leader with prior experience. Deandra also positioned herself as a "computing person" by offering to help "newbies." When a new participant struggled, Sarah said, "Well it's a good thing Deandra is here. She is a veteran. She can help you." By describing Deandra as a "veteran," Sarah positioned her as knowledgeable and skilled and acknowledged her as someone capable of continued participation in computing.

Authentic invitations as responsive: Deandra becomes a member of the group

Deandra struggled to form relationships with other girls in the program and tended to stay near her cousins. After Deandra refused to participate in an icebreaker designed to build trust between participants, Sarah shared her frustration, "Deandra refused to get up for the icebreaker. She just did not want to engage at all. It made it awkward and weird for the other girls. Everyone felt it." Deandra and her cousins also giggled when other girls showed excitement over completing computing activities, which caused the other girls to feel self-conscious. Deandra's behavior was a clear violation of the shared norms the girls had collaboratively created, which included "Be kind and respectful to others." Part of being responsive and not dismissive of girls' sense of self involves having them honestly examine their attitudes and beliefs about themselves and reflect on how those attitudes and beliefs influence their intrapersonal relationships. Sarah reminded Deandra that it was important to "build each other up" and asked her why she was behaving "outside of the boundaries" the group had agreed upon. After reflecting on her behavior, Deandra explained that she was just "messing around" and agreed to be more mindful about how her behaviors affected others and asked to be held accountable if she lost her "filter." Deandra's commitment to change was tested during the next program session when she told a member of the research team, "You're big." The researcher replied, "Oh, you mean like fat?" Deandra tried to play the comment off as a joke, but the researcher held her accountable, "If in the next few hours you feel like you want to apologize to me for that, I'm here to hear you. Just anytime, I do expect it though." Within a couple of minutes, Deandra apologized, "I have no filter. Yeah, I'm sorry." Over time Deandra began to interact with the other girls, entering the space within the agreed community norms. Sarah described the change she saw in Deandra, "She started feeling more trusting and she started making more positive comments to the other girls by the end of the week. She was receptive because I think she felt safe and felt accepted by us." By supporting personal reflection on past and future behaviors, Sarah's invitation to continue participating was responsive to Deandra's sense of self. She left the possibility open for Deandra to change her behaviors in the future.

Discussion

By allowing program participation to be voluntary and not mandatory, Deandra was free to refuse our invitation to learn new computing skills. Accepting Deandra's refusals required reframing how non-participation was viewed in the program and it pushed us to consider how an invitation to participate could be authentically voluntary and still supportive of girls' personal and academic growth. Deandra taught us that an authentic invitation must support and not suppress opportunities for decision-making and agency throughout the learning process, even if the decisions do not always align with the goals of the program. An approach that treats the invitation to participate in computing as a voluntary decision may help support the development of more agentic computing identities that allow girls to see themselves as having choice and control over how they use computing skills in their lives. In our program, an authentic invitation also meant encouraging girls to bring their whole selves to the learning environment. The invitation to participate in the program was not conditional and did not require

the girls to leave their multiple identities, prior experiences, and personal lives at the door. Deandra and her cousins openly talked about their families, crushes, and worries - all while participating in computing. Respecting the context of Deandra's life circumstances and inviting her to bring her home life into the learning environment, such as welcoming her baby, resulted in her continuing to show up to the program. She participated in the program on her own terms and authored a computing identity that aligned with her life circumstances. Finally, by making space for girls to reflect on their academic and self-growth, we were responsive and not dismissive of girls' past, present, and future selves. For Deandra, the process of authoring a computing identity involved using humor to persist through computing activities that made her feel nervous. The librarians were responsive to Deandra's mode of identity work and invited her to participate in computing in ways that felt comfortable for her. The librarians were also responsive to Deandra's future self and worked with her to author a computing identity that could include her baby. Yet, an authentic invitation also included challenging Deandra to change behaviors that were comfortable but detrimental to forming positive relationships with other girls. The librarians supported Deandra in developing a computing identity that included views of herself as "good" at computing, integrated her life as a mother, and laid the foundation for positive peer relationships.

Conclusion

In this paper, we present the concept of *authentic invitations* as a promising avenue for supporting girls of color in developing computing identities. We acknowledge that analytically focusing on one participant limits the extent to which readers can understand the variety of experiences that girls could have in these programs. However, we posit that Deandra's exemplary narrative helps illustrate the upper ends of identity development and demonstrates the potential of using authentic invitations to foster computing identities among girls of color. Future work will focus on developing more formalized roles for returning participants and examine how serving as a near-peer mentor influences their development of a computing identity. By illustrating how authentic invitations can be used within an informal computing program, we contribute a greater theoretical and empirical understanding of how girls of color author computing identities and offer our approach as an avenue for expanding narrow performance-based computing identity models in ways that account for girls' lived experiences.

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