“Decomposing Myself”: Computational Thinking in an Identity Context

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Abstract: Despite widespread efforts to broaden participation in computing, girls and women of color continue to be drastically underrepresented in computing fields and careers. Our work aims to diversify the entry points to computational thinking (CT) in ways that are grounded in girls’ identities and experiences. We address the following question: *How can grounding learning activities in girls’ identities provide an entry point for practicing computational thinking?* We present findings from a qualitative study of CompuGirls, an informal technology program for girls of color (ages 13-17) that is implemented in collaboration with three public libraries. We highlight a lesson designed to connect CT practices to self-knowledge by examining girls’ complex identities using decomposition and abstraction. Our findings indicate that grounding learning activities in girls’ identities facilitated personal reflection supported the transfer of disciplinary practices from a personal context to a STEM context. This paper illustrates the potential of our approach to expand the entry points educators can use to engage girls in CT.

Introduction and background

As part of the widespread efforts to broaden participation in computing, the goal of our research is to design a learning environment where what counts as knowledge is grounded in girls’ personal identities. We (re)contextualize computational thinking (CT) learning activities from being solely associated with computing content, practices, and presumptions to being grounded in girls’ identities. In doing so, we explore how educators can diversify entry points to CT (Wing, 2006) in ways that leverage girls’ experiences as “funds of knowledge” (Calabrese Barton & Tan, 2008). Here, we refer to an *entry point* as an introduction to disciplinary knowledge that fosters interest and provides opportunities to build competency in the subject. Motivated by research on the pedagogical utility of centering girls’ identities in curriculum materials (Garcia & Scott, 2016; Pinkard et al., 2017), our study promotes identity exploration as an *entry point* to CT practices. Our findings indicate that grounding CT learning activities in girls’ identities facilitated personal reflection and supported the transfer of disciplinary practices from a personal context to a STEM context. These findings suggest that the entry points to CT can be expanded through identity exploration.

Research design

CompuGirls is run in collaboration with three different library partners in Michigan, Arizona, and California, and focuses on supporting girls of color aged 13-17. In total, 64 participants from diverse backgrounds were recruited to participate in pilot implementations of the program. Data was collected during nine pilot implementations of the program offered from June 2017 to July 2018, all run as five-day camps at each library. The observational data collection approach yielded systematic field notes and photographs of student-created artifacts such as group projects and expressive artwork, which we examine here. Data was analyzed using an emergent process that examined the girls’ experiences participating in identity-based activities and how they served as entry points to practicing CT skills. We present an in-depth look at one lesson to illustrate the potential of our approach and the benefits of grounding disciplinary practices in girls’ identities and lived experiences.

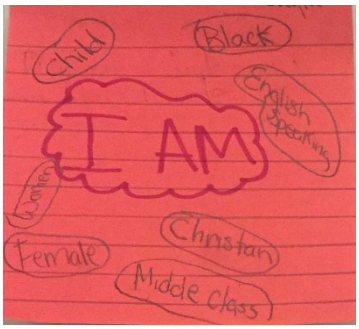

Figure 1. "I Am" statement.

The “I Am” lesson connects CT practices to self-knowledge by examining girls’ complex identities using decomposition and abstraction. Girls were provided with a list of social identity categories (i.e., race, gender, ability) and were asked to construct an “I Am” statement using decomposition to “break down” their complex identities into the identity categories that they felt most impacted their everyday experiences. Next, girls were given an opportunity to transfer their knowledge of decomposition to a STEM context by completing paper circuits and analyzing concepts, such as the relationship between voltage, current, and resistance. The three areas—personal identity, CT, and circuitry—were then combined in an “expressive circuitry” activity where the girls abstracted their knowledge of circuitry to create a free form artwork that incorporated paper circuits. Finally, as a

knowledge checkpoint, girls were asked to reflect on how they used decomposition throughout the identity and circuitry activities.

Findings

Using self-knowledge to practice decomposition. As illustrated in Figure 1, Sarah (all names are pseudonyms) used decomposition to express her identity using categories such as age, race, gender, class, religion, and language. While sharing her "I Am" statement, Sarah explained that she was surprised by how many social identity categories she shared with other participants and expressed frustration that girls were not able to "talk about themselves" in "regular school." Thus, Sarah was able to use decomposition as a practice for better understanding herself and her connections to other girls in the program.

Bridging self-knowledge and disciplinary knowledge. Additionally, while the girls were given paper electronics materials to work with such as construction paper, LEDs, and batteries, Lauren requested different materials. Lauren was a returning participant who positioned herself as a leader in the program. She expressed confidence in her ability to abstract her knowledge of how paper circuits work to new mediums – fabric and conductive thread. Thus, when the new participants worked on their paper circuits, Lauren experimented with e-textiles and created an LED flower necklace (Figure 2). The librarians verbally praised Lauren for her willingness to "take risks" and "try something new." She proudly modeled her necklace and confidently assured the new participants that they too would be able to do more "complex" projects as they continued to learn.

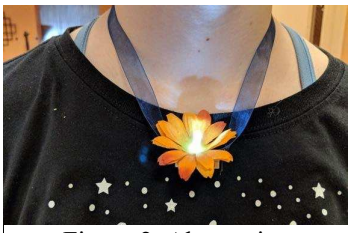

Figure 2. Abstracting knowledge to e-textiles.

Reflecting on the Learning Process. After the end of the "I Am" lesson, the girls were asked to reflect on their experience applying decomposition to their identities and circuits. Their responses were recorded in the form of an "Ink Think" where each participant wrote a sticky note about what they learned about decomposition from the lesson. Interestingly, the girls' responses revealed that both identity-based activities and unplugged STEM activities provided entry points to the practice of decomposition. For example, Melinda grounded her understanding of decomposition in both the identity and circuitry activity (Figure 3). Melinda described using the skill of decomposition as being helpful because it helped her think of "3 things" that described her identity. She describes this process as "decomposing myself." She also describes transferring her ability to practice decomposition to the context of circuitry by using the skill of "breaking down" the circuit in order to help her understand what "she needed to do" to successfully complete a circuit.

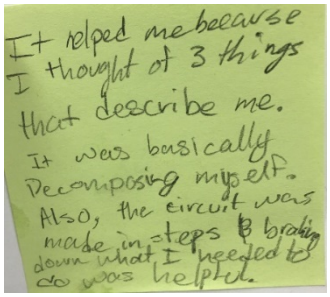

Figure 3. Connecting decomposition to identity and circuitry.

Conclusion

In this paper, we explore the use of identity-based activities as entry points to CT practices. Our findings indicate that grounding learning activities in girls' identities facilitated personal reflection, supported the transfer of disciplinary practices from a personal context to a STEM context, and expanded the entry points educators can use to engage girls in CT. By leveraging the girls' identities in the process of learning, the curriculum re-imagines computational experiences by fostering interactions with CT practices from a personal perspective. For our next steps, we plan to further explore how identity exploration can be used as mutually reinforcing pedagogical tool and not solely as an entry point. We plan to iterate on the design of the curriculum and conduct further implementations across all three sites.

References

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