Bridge to Computing: An outreach program for at-risk young men

Veronica Cateté, Dave Bell, Amy Isvik, Nicholas Lytle, Yihuan Dong, Tiffany Barnes
NC State University *NC State University* *NC State University* *NC State University* *NC State University* *NC State University*
Raleigh, NC, USA Raleigh, NC, USA Raleigh, NC, USA Raleigh, NC, USA Raleigh, NC, USA Raleigh, NC, USA
vmcatete@ncsu.edu dbell5@ncsu.edu aaisvik@ncsu.edu nalytle@ncsu.edu ydong2@ncsu.edu tmbarnes@ncsu.edu

***Abstract*—In 2017, our police department and the Give Back Organization (GBO), a local non-profit, contacted our university about hosting a game development summer camp. The camp was proposed to keep boys ages 12-15 living in a community with high levels of gang enrollment off the streets while providing an opportunity to learn about college and computing careers. The police also wanted to improve officer-youth relations. Our lab provided camp counselors, space, and content for the camp. Each camp supported a total of twelve African-American boys. Over three years, we refactored the curricula and organization of the camp and present our lessons learned from the experience.**

***Keywords*—at-risk youth, K-12 outreach, computer science education, computational thinking, community**

I. Introduction and Background

As computer science (CS) education becomes increasingly important for *every* student, programs to introduce CS to more students at the K-12 level are hoping to broaden participation by closing the achievement gap. This gap starts early in the education pipeline as lower-income and minority students receive, on average, far less STEM educational support than other students [1]. General purpose K-12 CS programs do not sufficiently close the achievement gap [2]; therefore, specific and targeted after-school programs must also be considered.

Research into designing CS outreach programs for at-risk youth is scarce [3]–[5]. Lower socioeconomic status predicts that at-risk youth have less access to CS courses and receive less encouragement by educators or their parents to study CS [6]. This is unfortunate as CS jobs can provide students with an opportunity for upward economic mobility.

Resnick & Burt developed a model for categorizing adolescent risk, factoring in environmental antecedents such as poverty, neighborhood, and family dysfunction, as well as early markers like poor school performance and interactions with child services. Potential risk outcomes and behaviors include drug and alcohol abuse, crime/imprisonment, school dropout and other serious issues. Many children ages 10-15 do not yet show risk outcomes, but could be classified as high risk if they share a combination of factors [7].

Studies have demonstrated that programs focusing on mentoring and teaching at-risk kids new skills tend to have positive outcomes [3], [5]. Programs like KLICK! [4] and Launch-It [5] provide at-risk kids access to creative computing activities such as web development, robotics, flash animations and games. They also feature mentoring components such as working with university students and listening to guest lectures and exploring career paths through industry field trips. Students in these programs showed increases in school value perception and computing ability [4] and positive perceptions of computer use [5]. As we develop programs for marginalized communities, it is important to understand what factors are important to students and communities. Below, we discuss the evolution of Bridge to Computing, a game design camp for youth at-risk for gang involvement.

II. Bridge to Computing

Year 1 The police and Give Back Organization (GBO) proposed game development as the focus of the camp as it is effective for engagement. Utilizing curricula from the STARS Computing Corps [8], two graduate students alternated leading the 8-hour day, 3-week camp, with 1-2 undergraduate volunteers taking shifts to support them. Additionally, an armed police officer in uniform was present in the on-campus camp to develop relationships with the campers and assist with possible behavioral incidents.

The project-based curriculum included four projects, one each in Scratch, Weebly, and JavaScript, and a final project in any language. Campers learned to code games in Scratch, then made a Weebly website advertising their games. We planned for campers to learn JavaScript through CodeAcademy exercises, and create a JavaScript game by the 4th week. The last two weeks were spent on final project. Each week campers *learned* how to use the relevant tool through an instructor guided example project. The campers formed pairs to *pitch* and *develop* a game idea, getting feedback from the class. Finally, campers would *present* their projects, providing a demonstration and describing what they learned. Requirements for final projects were developed with GBO: create a game that provides players with a sense of the realities of gang life and demonstrates the campers' aspirations to escape gang influence. The final game was to be presented in an expo attended by faculty, officers, family and friends.

To reduce monotony, project time was interspersed with free-time as well as other learning and outdoor activities. We invited various speakers including faculty, researchers, professional game developers, and college athletes. Speakers

Funding provided by Cisco and the Give Back Organization

978-1-7281-7172-2/20$31.00 ©2020 IEEE

shared personal experiences, their path to higher education, and advice. The goal was to introduce role models and increase interest in higher education. We included field trips to science labs and local businesses to develop student interest in academics and STEM careers.

Unfortunately, we did not have a prior understanding of the campers' levels of digital literacy. Most campers had limited access to traditional computers and keyboards, thus having underdeveloped typing skills. To mitigate this, campers played typing games and we revised the coding curriculum to use block-based environments, including introductory lessons from the online BJC curriculum [9]. In the final week, campers used the online story-telling tool Twine to make interactive autobiographies about their communities and personal lives.

Year 2 In spring 2018, we hired a graduate student with prior outreach experience to develop and teach a modular, cohesive curriculum. We also hired two Black recent high school graduates to act as full-time near-peer mentors, who were from an at-risk neighborhood and had positive experiences using Snap*!*, to provide more consistent role models for campers. Officers wore plain clothes to be more approachable and had official police training in youth interaction.

The goal of the 2018 curriculum was to better scaffold campers as they transition from block-based development into JavaScript and HTML while also allowing for inconsistent attendance. Based on 2017, we predicted most campers would miss a few lessons, therefore we created independent modular assignments that would allow campers to succeed despite absences. Morning warm-ups for campers were logic puzzles to facilitate computational thinking. We interspersed programming with other activities including learning to type, creating presentations, and content from other STEM fields. We continued inviting guest speakers from industry and the police department as students were typically more engaged in hearing from industry professionals rather than faculty.

During the last three weeks of camp, the lead counselor introduced campers to classic computer science problems, including checking for whether Euler paths are possible in graphs and developing solutions to the travelling salesman problem. Counselors emphasized that university students were also learning about these classic CS problems, helping campers to see themselves as being capable of succeeding in college.

Year 3 For year three, we hosted two three-week camps, doubling the participation of students and increasing the end of program retention rates. We also changed the venue of each camp, as the previously used Linux-based machines required high digital literacy and campers struggled typing in generic usernames and complex passwords to login. The first of the two camps occurred in a collaboration classroom equipped with Chromebooks. This allowed the students more freedom to move around. The second session occurred in a computer lab using new Windows machines.

Four camp counselors were hired from a local historically Black university. One returned from the prior year and recruited three additional counselors. We greatly diminished officer presence as their involvement was not as fruitful as we hoped. Campers persistently challenged directives from the officers. Officers were only present for one in-class activity a week to lead discussions on soft skills for personal development or participate in recreational activities.

Working with Snap!, campers completed online introductory lessons in BJC and developed projects in pairs. The new curriculum emphasized soft skills more than programming. Students practiced conflict resolution and would talk as a group about problems facing them and their communities. For a more meaningful experience with industry tours, both sets of campers attended full-day field trips to the primary sponsors' location. The company's Blacks in Technology group organized activities and provided campers with the opportunity to share their personal experiences and talk to a panel of diverse employees at the company.

III. Discussion & Conclusions

Generally, our program worked to effectively keep at-risk youth off the streets and we made large steps towards teaching CS while developing officer-youth relations. We believe the transition of the officer's role from disciplinarians to facilitators of leadership training and outdoor activities improved their engagement with campers by utilizing their strengths. As the nature of the police officer's role has changed, so has our administration of these camps. We realized that having an individual with shared, relatable experiences was also necessary, so our HBCU student staff were critical in creating meaningful bonds and developing relatable and engaging lessons.

Finally, we have also shifted perceptions of educational outcomes as the years have progressed. By having too many elements in Year 1 that were perceived as being "school" to the kids (such as having faculty guest lectures or having multi-day assignments that are "due" at the end of the week), campers engaged less with the material. As such, our focus has shifted towards providing engaging, meaningful, and impactful activities that inspire students and increase their intrinsic desire to continue to attend and pursue STEM in school.

References

[1] J. Margolis, *Stuck in the shallow end: Education, race, and computing*. MIT Press, 2010.

[2] W. L. Bainbridge and T. J. Lasley, "Demographics, diversity, and k-12 accountability: The challenge of closing the achievement gap," *Education and Urban Society*, vol. 34, no. 4, pp. 422–437, 2002.

[3] I. Blau and N. Benolol, "Can designing self-representations through creative computing promote an incremental view of intelligence and enhance creativity among at-risk youth?" *Interdisciplinary J. of E-Skills and Lifelong Learning (IJELL)*, vol. 12, pp. 267–278, 2016.

[4] M. Girod, J. Martineau, and Y. Zhao, "After-school computer clubhouses and at-risk teens," *American Secondary Education*, pp. 63–76, 2004.

[5] G. D. Blank and H. U. Odi, "Launch-it," 2008.

[6] J. Goode, "Increasing diversity in k-12 computer science: Strategies from the field," in *ACM SIGCSE Bulletin*, vol. 40, no. 1. ACM, 2008, pp. 362–366.

[7] G. Resnick and M. R. Burt, "Youth at risk: Definitions and implications for service delivery," *Amer. J. of Orthopsychiatry*, vol. 66, no. 2, pp. 172–188, 1996.

[8] V. Cateté, K. Wassell, and T. Barnes, "Use and development of entertainment technologies in after school stem program," in *Proc. of the 45th ACM tech symp. on CS education*. ACM, 2014, pp. 163–168.

[9] D. Garcia, B. Harvey, and T. Barnes, "The beauty and joy of computing," *ACM Inroads*, vol. 6, no. 4, pp. 71–79, 2015.