

STUDENT-CENTERED PROJECTS: RURAL HIGH SCHOOL STUDENTS LEADING PROJECTS IN TECHNOLOGY, IDENTITY, AND SOCIAL JUSTICE

Sabrina De Los Santos Rodríguez, Anya Carbonell, Michael Cassidy, & Maria Ong
TERC (USA)

Abstract

CompuPower is a student-centered program integrating computer technology, identity exploration activities, and community outreach projects. The program was implemented in six rural high schools in Arizona, USA between 2019 and 2021. Students worked in groups in project-based learning environments to create technology-based products (for example, websites, social media campaigns, and public service announcement videos) and to explore their individual identities and skills as they set education and career goals. To understand the CompuPower program from the students' perspective, our research team conducted a qualitative, retrospective interview study using photo elicitation (Harper, 2002). This paper reports on the experiences of 13 rural high school student participants from diverse backgrounds. It explores students' CompuPower experiences, including the technical and non-technical skills they gained throughout the program as they worked on community outreach efforts.

Keywords: *Student-centered projects, rural computing education, technology-based projects, social skills, high school STEM education.*

1. Introduction

Imagine walking into a high school classroom where students are working in teams on projects about a wide range of social issues. Some students are in one corner of the classroom creating a flyer to gather a group of community members and create awareness about their carbon footprint. Other students are setting up a meeting with their administrators to create a student council. Another group is developing a survey asking students about substance abuse in their personal lives and communities. As part of the curriculum, these same students are talking openly about who they are and how their intersectional identities relate to their interests, values, and positions of power in society. While getting to know each other more deeply, they set goals for their projects and for themselves. They talk about how their projects could influence their schools and their communities, and they learn to use different technologies to research, develop, and disseminate their work. The teacher acts as a facilitator guiding students through the activities, yet the students are deciding how to present themselves, what projects to work on, how to divide their work, and what to prioritize. CompuPower is a student-centered program focusing on community outreach projects, identity exploration, and computer technology. During the 2019-2020 and 2020-2021 school years, 146 tenth and eleventh graders attending one of six schools in rural areas of Arizona, USA participated in CompuPower. This was one of the first computing courses for most participants and it was conducted face-to-face, with some hybrid and virtual sessions at the peak of the pandemic. CompuPower addresses the shortage of culturally responsive STEM (science, technology, engineering, and mathematics) courses that ensure rural high school students feel a connection to the curriculum and a sense of belonging in tech spaces (Jenkins, 2009). This paper contributes to filling the current knowledge gap in literature related to rural high school students technological and social skills gained when working on self-directed social action projects.

2. Literature review on student-centered projects using technology

Student-centered learning (SCL) is a learning process in which students have autonomy and responsibility for their own learning (Hannafin & Land, 1997; Lee & Hannafin, 2016). Classes that focus on SCL often encourage individual or group projects where students choose their topic of interest, conduct research, consult with others, and share their project outcomes (Lee & Hannafin, 2016). SCL

programs that integrate technology imitating the way “professionals use it in the workplace...can enhance academic achievement, civic engagement, acquisition of leadership skills, and personal/social development” (Moeller & Reitzes, 2011, p. 7). Furthermore, research shows that using technology for constructivist activities such as researching, collaborating, writing, analyzing, and publishing has a greater impact on student achievement than using it for drills, tutorials, and grammar (Warschauer & Matuchniak, 2010).

When students work in self-directed groups to develop projects of interest, they tend to build skills related to teamwork, critical thinking, communication, information access, and technology (Arches, 2012). Moreover, students working on self-directed group projects aimed at social change gain both cognitive and social skills and are more positively perceived by teachers (Wilson et al., 2007; Arches, 2012). These skills include enhanced confidence, empathy, and increased interest in academic endeavors (Arches, 2012).

3. Research methodology

During the fall of 2021 and winter of 2022, our qualitative research team conducted one-hour retrospective interviews and/or focus groups with 13 high school students who participated in the 2020-2021 iteration of the CompuPower program. Students came from five different rural schools in Arizona and were sophomores and juniors (ages 15 and 16) when they participated in CompuPower. Seven students were male and six were female. Two males and two females self-identified as Black or Hispanic/Latinx; three males and four females identified as white or Caucasian; and two students did not identify racially or ethnically. Two students identified as LGBTQ+ (lesbian, gay, bisexual, transgender, queer, and other sexual identities). Researchers worked with TERC’s Institutional Review Board (IRB) to protect the rights and welfare of study participants. Parents and students both signed consent/assent forms, and students were given an option to select their own pseudonyms. All interviews were conducted over Zoom or face-to-face on school campuses. When asking questions about the CompuPower activities and group projects, researchers took a photo elicitation approach, sharing images of the work students had completed during the program to help them remember and describe specific aspects of their work, which made the interviews more valid and reliable (Harper, 2002). Student work included identity collages, project logos, public service announcement videos, presentations slides, project websites, and social media campaigns. Our research questions related to student group work were:

- What technical skills did students learn?
- What non-technical skills did students learn?

Our team conducted thematic analysis to answer these research questions (Miles & Huberman, 2018; Swain, 2018). We developed a codebook with deductive codes from Scott’s (2021) CompuGirls research which was used to develop the CompuPower program, and derived inductive codes identifying new patterns and themes from student interview data (Glaser & Strauss, 2017). We used the NVivo qualitative data analysis software to store our interview data, assign codes and notes to our transcripts, and link multiple data sources. We assigned interview transcripts to two pairs of researchers to code, and periodically coded as a whole team to verify coder drift and provide further trustworthiness of our analysis.

4. Findings

4.1. Gaining technology-related skills

In the CompuPower program, students learned about technology as a means to collect and disseminate information, conduct research, and design project artifacts. CompuPower offered basic programming language lessons that students could use to develop a personal and/or project website. There were lessons on graphic design, video development, creating presentations with Google Slides, and using Zoom. During the interviews, all students talked about some technological tool or skill they gained or honed when participating in the program. David (all names are pseudonyms), who identified as white, talked about the technology skills he learned, “I learned about **HTML** and **programming**. I learned how to deal with **Google Slides** a lot better and with ease. I did a lot with that.” He mentioned how he has continued to use these skills when creating slides, advertisements, and videos for a “World in Conflict” college course he is taking as a junior in high school.

Damian, who identified as Black, mentioned his group created a website, surveys, PowerPoint slides, and a video about the negative effects drugs can have in one’s life. He mentioned the experience was new, saying, “It’s always **nice to try new things**,” and added that because technology is everywhere,

learning about all these tools and being able to create his own websites is important. Bryce, who identified as white, talked beyond the technology aspect, describing some of the groupwork and bonds that formed as they created the project website:

The website was really good too. We all worked on that too. So, we learned a lot about how to make one. **We watched so many videos and research about it**, and it was fun. [The] **design of the website was pretty complicated, but it was still really good**. And we all came together again. We always came together on everything. It was the most I've seen we all worked together ever, and I've been with that class for a long time, because we mainly know a lot of people that have been here forever and everything. So, yeah, the website was very nice, and we all agreed on it, and that's what really mattered in the end.

Some students mentioned learning about technology and its relation to other topics such as race and the brain. When asked about the two most important things learned in CompuPower, Rosie, who identified as white, mentioned:

I think a **big one that actually stuck with me was AI [Artificial Intelligence] and race**. That was something that I had never heard about before, and **I've never heard it talked about, even in all of the research that I've done**. And that was really something that was quite interesting to me, being that I am pretty Eurocentric. So, I have never been like, oh, okay, this isn't picking up my features.

Another student who identified as white, Venus, talked about a lesson on technology and the brain, "And there was another one where we looked at the brain, and we had to see **how technology and computers can look at the brain** and see little details in it, and I thought that was really cool." One student summarized her experience learning about different technology topics with her classmates. Burke, who identified as white, described how students focused on skills they were interested in learning. She expressed:

I think this project was a really good idea, 'cause I know a lot of **my classmates had different interests**. So, I really liked that **we kind of learned them on our own and then taught everyone** with presentations about it, instead of all of us learning, 'cause I knew I'd be a lot **more interested in graphic design than coding**, but some people were super interested in the coding. And so, I really liked how we did this project.

These examples demonstrate how CompuPower offered technology-related lessons that students could focus on based on their interests, apply to their group projects as needed, and use beyond this class.

4.2. Gaining non-technical skills

CompuPower was also a space for students to gain social skills and other non-technical skills when working with others, and to get to know themselves more deeply. Bryce talked about CompuPower as an "**eye-opening**" experience where he learned from everyone around him and got a deeper understanding of their personal lives. Another student, Sky, who identified as Latina and described herself as shy and nervous, talked about getting a better understanding about her whole self, "I think [it's] about your own personal life and how you view yourself as a person. How do you **learn to help yourself and view yourself now differently**, in a way?"

Her classmate, Josh, who identified as white, expressed how one cannot know a person's story "until you really get to know them" and it's important to understand that because people "could have **different beliefs**" and "everybody is different." Their teacher, who was present during the student interviews, said, "There's a lot we learned together, and having a lot of open conversations, you know, I think made us a lot closer. And **I saw you guys become good role models inside our school**" (originally cited in Ong et al., in press).

Some students talked about growing personally and professionally. Three students in the same school, Thalia (who identified as biracial), Max (who identified as Latino), and Josh (who identified as white) mentioned they became more confident after presenting to a group of 60 people as part of their final project. Thalia also mentioned learning, "to **speak more powerfully and clearly**, so you can actually reach others and have others hear you."

Venus, who identified as white, talked about learning skills like working with a new partner, being fair when assigning tasks, and making sure they worked things out when they didn't see eye to eye while developing their final project. She expressed, "I definitely think that working with my partner on

the group project helped me figure out **how to work in a bigger environment** with more people.” Another participant, Burke, talked about what she learned from her group dynamics:

I learned that **group effort is really important**, and that I think **assigning roles really helped us**. And I think that making sure that your point is getting where you wanted it to, I think that was our biggest focus. I think what I learned is to **focus on what you want to say and what you want to get across**, and not focus on everyone else, 'cause then that's when it gets all tangled up.

Throughout the program, students worked together strengthening bonds with their peers, and becoming more understanding of people's needs and beliefs. They developed teamwork skills that can be transferred to other educational and professional settings. Furthermore, students led community outreach projects that helped develop their leadership skills and social justice agent identities. Armando, who did not specify his racial/ethnic identity, led a teen mental health project with his group. They created an anti-depression website where students could find information about how to tell if someone is depressed and how to offer help. They included a suicide hotline, a contact information for group members, and an anonymous email address where students could vent. Armando explained:

We felt like **there wasn't enough being done to help**. We felt like the **students felt like they were alone**. They had no one to talk to, and sometimes that is true. Some people don't have anybody. And we just wanted to make it feel like they had somebody, and the teachers are a big part of that, to make them feel like they're somebody. We told the teachers, and basically taught them how to be somebody for them.

Another group of students led an environmental justice project and surveyed people to measure their carbon footprint. Burke described:

We really wanted to figure out how to help and **raise awareness to the earth and the animals that are being affected**. And so, we really wanted to get across that we care... We kind of tried to make it **easier to understand**, 'cause I know reading into some of it is harder to understand. So, we tried to break that down for our audience.

5. Discussion

Interviews with CompuPower participants provided a lens to understand how self-directed projects can enhance technology-related skills and non-technical skills in rural high school settings with students coming from diverse racial, ethnic, and gender identities. CompuPower students had the autonomy to work on projects that were valuable to them and to their communities, choosing topics such as teen suicide prevention and environmental justice. While preparing these projects, students were exposed to different technologies such as programming languages, presentation programs, website design, and video editing software. As mentioned earlier, one student David said he continued to use his video and presentation skills in a college course he is taking a year after participating in CompuPower. Several students mentioned the importance of learning how to develop presentations, videos, and websites to create awareness and address issues in their community. Moreover, they described ways they imagined using these skills beyond the CompuPower course, including developing presentations for future courses, creating a personal website to find a job, and filming and editing videos for sport reels. These examples demonstrate how the program taught practical technologies that can be transferred to multiple settings (Moeller & Reitzes, 2011).

Beyond technology skills, students gained skills related to communication, teamwork, confidence, and empathy (Wilson et al., 2007; Arches, 2012). Thalia felt empowered to “speak more powerfully and clearly” to reach her audience. Venus realized the importance of working as a team and assigning roles to work more efficiently. One teacher related that the course helped everyone bond, and he saw students become role models in their school. Student-centered programs like CompuPower can not only enhance students' skills, but can also build stronger relationships between peers, and between teachers and students (Wilson et al., 2007).

6. Conclusion and recommendations

Our study found that within CompuPower, rural high school participants were motivated to pursue projects that would make an impact in their schools and neighboring communities. These self-directed projects encouraged them to remain curious and find creative solutions to issues they encountered in their everyday lives. Through their projects, they gained technical skills as well as non-technical skills preparing them for future coursework, diverse careers, and leadership roles. For educators interested in providing students, especially rural students and members of other underrepresented groups in STEM, with powerful learning experiences, we recommend promoting project topics that center marginalized identities and community values. We also recommend engaging in activities that encourage students to understand each other more deeply and become peer mentors, fostering collaboration, empathy, and self-confidence.

Acknowledgments

We are grateful for the students who shared their CompuPower program experiences, as well as their values and goals with our research team. We thank the Arizona State University CompuPower team for developing this program and supporting our research, Dr. Kimberly Scott (Principal Investigator), Dr. Tara Nkrumah, and Elaine Arrieta-Bohn. We also thank the CompuPower teachers who helped us recruit students for our research interviews, and the families who allowed us to spend some time learning about their children's projects and goals. This project is funded by the US (United States) Department of Education Grant #U411C160121.

References

- Arches, J. (2012). The role of groupwork in social action projects with youth. *Groupwork*, 22(1), 59-77.
- Glaser, B. G., & Strauss, A. L. (2017). *The discovery of grounded theory: Strategies for qualitative research*. Routledge.
- Hannafin, M. J., & Land, S. M. (1997). The foundations and assumptions of technology-enhanced student-centered learning environments. *Instructional science*, 25(3), 167-202.
- Harper, D. (2002). Talking about pictures: A case for photo elicitation. *Visual studies*, 17(1), 13-26.
- Jenkins, H. (2009). *Confronting the Challenges of Participatory Culture: Media Education for the 21st Century*. Cambridge, MA: The MIT Press.
- Lee, E., & Hannafin, M. J. (2016). A design framework for enhancing engagement in student-centered learning: Own it, learn it, and share it. *Educational technology research and development*, 64(4), 707-734.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2018). *Qualitative data analysis: A methods sourcebook*. Sage publications.
- Moeller, B., & Reitzes, T. (2011). Integrating Technology with Student-Centered Learning. A Report to the Nellie Mae Education Foundation. *Education Development Center, Inc.*
- Ong, M., Cassidy, M., De Los Santos, S., & Carbonell, A. (in press). Rural Students Exploring Identity, Techno-Social Justice and Safe Spaces in a Culturally Responsive Computing Program. *IEE Computer Society*.
- Scott, K. A. (2021). *COMPUGIRLS: How Girls of Color Find and Define Themselves in the Digital Age*. Urbana: University of Illinois Press.
- Swain, J. (2018). *A hybrid approach to thematic analysis in qualitative research: Using a practical example*. SAGE Publications Ltd.
- Warschauer, M. & Matuchniak, T. (2010). New Technology and Digital Worlds: Analyzing Evidence of Equity in Access, Use, and Outcomes. *Review of Research in Education*, 34, 179-225.
- Wilson, N., Dasho, S., Martin, A. C., Wallerstein, N., Wang, C. C., & Minkler, M. (2007). Engaging young adolescents in social action through photovoice: The youth empowerment strategies (YES!) project. *The Journal of Early Adolescence*, 27(2), 241-261.