



Changing Expectations  
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# Developing Digital Makers in the Coding Makerspace to Include Boys of Color in Computer Science Learning and Cybersecurity Workforce Development

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RESEARCH & EVALUATION

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## Approach



The MBK Coding Makerspace engages Black and Hispanic males who often feel like outsiders in computer science to persist in computing. The MBK Coding Makerspace creates an inclusive learning environment that celebrates Blacks and Hispanics in STEM and computer science as role models who have had challenges but have succeeded in spite of them. We use Python coding and the Raspberry Pi to develop secured Internet of Things (IoT) devices.

## Changing Expectations' My Brother's Keeper Coding Makerspace

The Coding Makerspace builds making skills & partners with the tech industry for job shadowing and mentoring. We focus on supporting workforce development by learning about soft skills, resume prep, and creating a cyber career roadmap.



We recruit Black & Hispanic boys regardless of their formal STEM and computing education. We encourage them beyond a growth mindset perspective & encourage their ability, and we support their intentions to persist in computing.

MBK Coding Makerspace students make Internet of Things (IoT) home automation projects that reflect their experiences and cultures to help them feel welcome, comfortable, and empowered. Projects are secured from hacking & cyber threats and solve a problem in the home, school, and/or community.

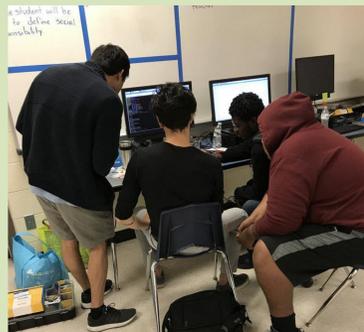


A total of 95 students attended for 4,912 contact hours in the program.

71 of the 95 students (75%) attended the minimum of nine 5.5-hour sessions each semester for nearly 50 hours of contact per student per semester.

## Students enjoyed the Changing Expectations Coding Makerspace.

All students were satisfied or very satisfied with the Changing Expectations Coding Makerspace program.



I liked having the opportunity to learn from real professionals and being able to work with other people to learn more... and receiving the knowledge of how to actually get a job in a technical field.

My favorite aspect about the activities is they helped us kids with diverse backgrounds to meet in one place and learn how to change the world by learning how to code.

This program was awesome and taught me more about the computer world and how it connects to our lives. It gave us chances and information about participating in the computer world.

It exposed me to different careers that I otherwise wasn't aware of, and I was able to work in teams and learn about security and coding.

All students highly rated the mentors, staff, and coaches of the program, saying they helped them learn new skills, encouraged them to pursue computing as a career, and were like mentors to them.

What I liked about [staff member] is that he just didn't give us the answers he made us work for it.

They were very patient with me, encouraged me to find out how to solve the problem, and challenged me to think.

THEY'RE AWESOME: friendly, helped us understand a lot of things, taught us many different skills, wasted their time to help us on our projects, ...which we are really thankful for.

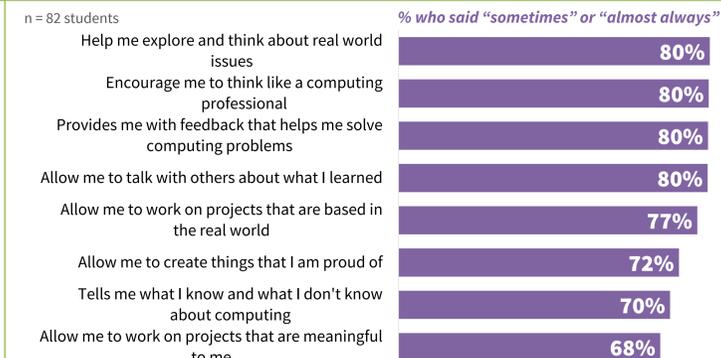
## Students rated Changing Expectations as very engaging.

After each session, participants responded to eight indicators of engagement as described by the flow model of engagement (Csikszentmihalyi, 1990), rated from 1 = *not at all* to 4 = *very much*. **Overall, the 66 students across the three semesters thought the Changing Expectations Coding Makerspace was interesting, enjoyable, and important.** Students also rated they had to concentrate hard and use their skills. Few students wished they were doing something else during the activities. Challenge of the activities were rated low compared to all other indicators. Average ratings after each session matched their overall engagement ratings in the end-of-program survey, as well.



## Participants rated the Changing Expectations environment as thickly authentic.

A creative place is one that promotes a thickly authentic learning environment that encourage creativity and learning activities that are simultaneously aligned with the interests of the learners, the structure of a domain of knowledge, valued practices, and the modes of assessment use (Shaffer, 2005; Shaffer & Resnick, 1999). **Overall, the 66 students across the three semesters rated the creativity of the environment highly at the end of the program, saying Changing Expectations "almost always" felt the environment allowed them to create things that are realistic and they are proud of.**



## Students' attitudes towards computing improved from before to after Changing Expectations.

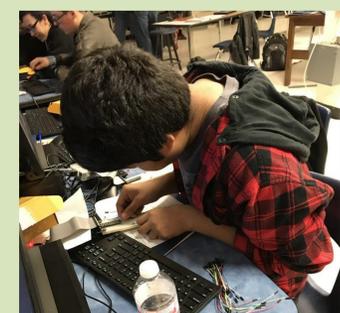
Students rated their attitudes towards computing before and after the program. **Overall, students rated their attitudes as greatly increasing, from neutral to agree across multiple attitudinal items.** Furthermore, many students see themselves persisting in computing and can see themselves working in a computing field in the future.



## Students feel Changing Expectations prepared them to succeed in computing jobs

Students rated their "soft skills" (i.e., teamwork, organization, communication, problem-solving, and determination and enthusiasm) and "hard skills" (i.e., write a resume, conduct a job interview) needed to succeed in computing jobs. **Overall, nearly all students felt Changing Expectations at least moderately prepared them for the job skills needed to succeed.**

Students also participated in workforce development activities, and engagement was high and increased across these sessions. Qualitative responses indicated they enjoyed learning how to create resumes in particular.



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