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Promoting and Supporting Computer Science among Middle School Girls of Color:

Initial Findings from BRIGHT-CS

Presentation for SIGCSE 2020, Portland Oregon

Today's Presentation

1. **Background:** Understanding BRIGHT-CS's theoretical framework

2. **Interim results:** Analyzing emerging themes

3. **Implications to practice:** Applying our learning to refine the BRIGHT-CS model

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Background

Understanding BRIGHT-CS's theoretical framework

Project team

Co-Principal Investigator
Jamika D. Burge

Dr. Burge is a computer scientist with expertise in human-computer interaction (HCI), specifically in the design of technologies that support a range of communication and interaction needs.

Program Coordinator
Veronica Madrigal

Ms. Madrigal is a qualitative researcher with experience as a middle school teacher and school district project coordinator and research specializing in school and teacher improvement.

Co-Principal Investigator
Jim Egenrieder
Virginia Tech University

Dr. Egenrieder is the Director of Thinkabit Labs at Vtech. He has a background in biological field research and applied technology. He also taught high school biology in Virginia and is a master science and math educator.

Principal Investigator
Ryoko Yamaguchi
UNC Greensboro

Dr. Yamaguchi is a social scientist with expertise in research methods and quantitative analysis. Her research focuses on at-risk youth and school improvement, particularly equity and inclusive practices in STEM+CS.

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What is BRIGHT-CS?

It stands for:

Building Student **R**etention through **I**ndividuated **G**uided co**H**ort **T**raining in **C**omputer **S**cience

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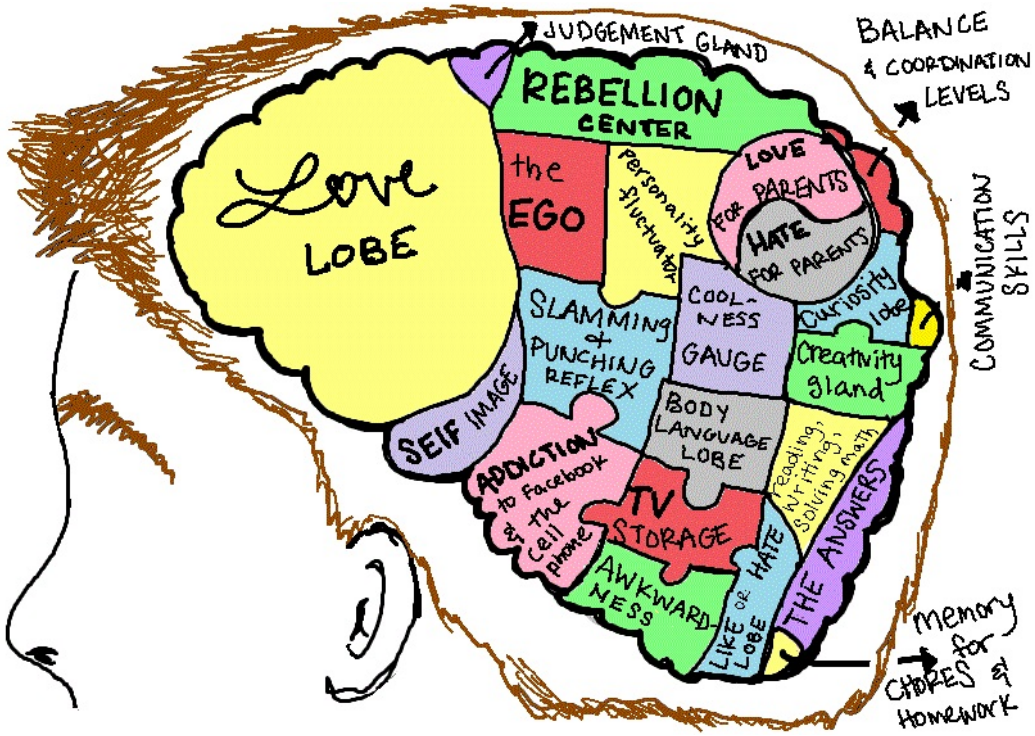
NSF

Focus on middle schools (grades 6-8)



- Importance of the middle school setting as a critical transition point for adolescent development

- Consideration of the structural, instructional, and curricular barriers of students of color to access and excel in CS

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Two goals of BRIGHT-CS

- **Create a computer science learning ecosystem** for middle school Black girls and other girls of color

- **Research the merits of the ecosystem** in supporting persistence in CS to determine best practices for broadening participation to other marginalized student groups in computing

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Creating a 12-month computer science learning ecosystem

- Grade 6-8 girls of color from a school
  - As planned: Grade 6-8 Black girls from a school
  - As implemented: At school request, grade 6-8 girls from a school (Note: in one school, one White boy attended)

Cohort Model

Creating a 12-month computer science learning ecosystem

- School CS experience in middle school
  - As planned: In-school CS club during lunch or assembly every quarter
  - As implemented: At school request, after-school CS club every week

Creating a 12-month computer science learning ecosystem

- Summer CS experience
  - As planned: Same group of girls from each school has two-week summer camp
  - As implemented: In Arlington VA, split up one-week camp right after end of school year and one-week camp right before school year started

Creating a 12-month computer science learning ecosystem

- Cultural empowerment & leadership
  - As planned: Use of already established and tested curricular materials (e.g., ECS, code.org, etc.)
  - As implemented: Adapted curriculum to incorporate leadership and culturally responsive content

Creating a 12-month computer science learning ecosystem

- Personalized mentoring from CS professionals
  - As planned: Quarterly face-face visits from CS professionals
  - As implemented:
    - NYC - Virtual mentors video conference biweekly
    - Arlington VA – Face-face quarterly visits from community leaders (school and county board members, police, superintendent), parents, & CS professionals

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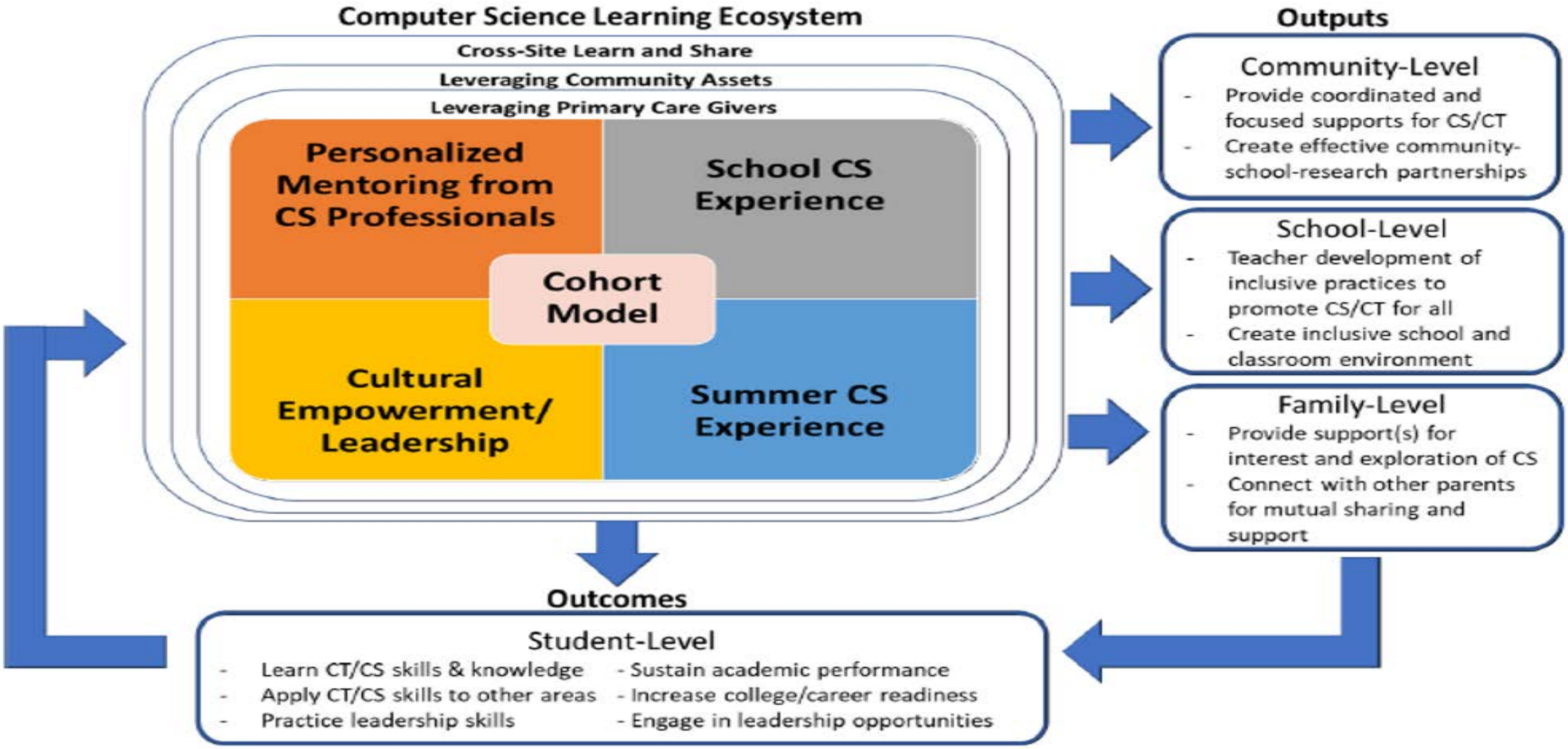
BRIGHT-CS conceptual framework



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Interim Research Findings

Analyzing emerging themes

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Interim results summary

Sample	Data collected	Findings
In its first semester, BRIGHT CS included: • Four middle schools in NY and VA • **46 students--**primarily Black girls (65%), with the remaining girls being Latinx (20%), White (11%), and Asian and multi-racial (4%)	***Baseline student survey*** • **Experiences in computer science** (adapted from the Google/Gallup survey & ELS) ***Qualitative data*** • **Interviews** with students, parents, mentors, school staff sponsors, and program instructors at multiple time points • **Observations** of afterschool and summer sessions • **Program documents** and **computing artifacts**	***BRIGHT CS has potential to:*** • **Counter implicit school messages** that girls of color do not bring value to STEM+CS • Mitigate stereotype threat by **providing social reinforcement** for the idea that challenges are a normal part of learning • **Nurture feelings of self-efficacy in CS** among girls of color

BRIGHT-CS students are culturally and linguistically diverse

DEMOGRAPHIC INFORMATION	COUNT (N)	PERCENT (%)
GENDER		
FEMALE	45	98
MALE	1	2
RACE/ETHNICITY		
WHITE	5	11
BLACK	30	65
HISPANIC	9	20
OTHER RACE & ETHNICITY (ASIAN, MULTI-RACIAL, OTHER)	2	4
GRADE LEVEL		
6 GRADE	17	37
7 GRADE	14	30
8 GRADE	15	33
ENGLISH LANGUAGE		
ENGLISH ONLY	32	70
SPEAKS ENGLISH AND ANOTHER LANGUAGE AT HOME *	14	30

* Other languages included Spanish, Somalian, Amharic, Urdu, Bengali, Tigrinya (east African language), Haitian Creole, Farsi, and Hausa.

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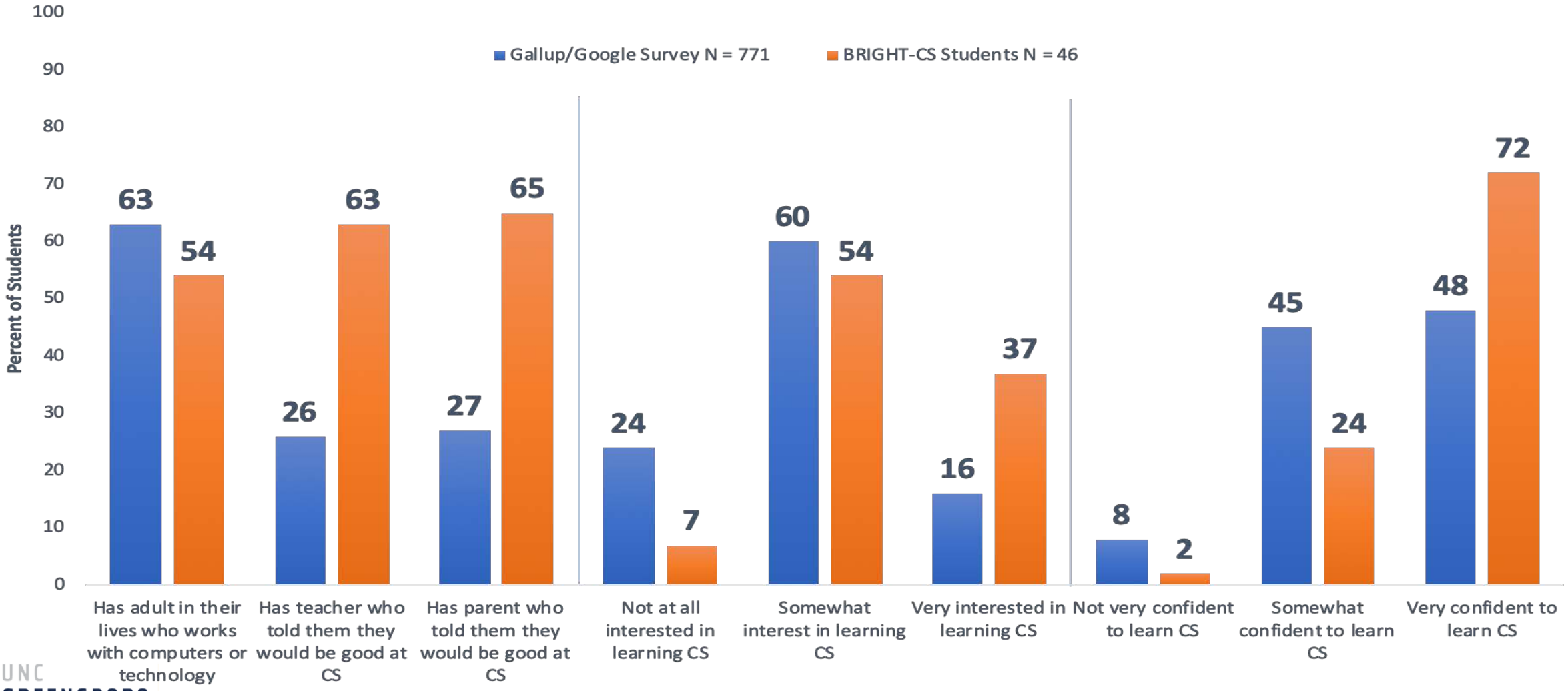
BRIGHT-CS students are very interested in and confident to learn CS at baseline



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Theme 1: Implicit messaging about equity and success

As mentors, female STEM professionals of color subtly reversed school messaging that Black girls primarily bring deficits, not value, to STEM

- *Student 1*: “[Our mentor] told us about her project to teach kids with games, and I thought maybe I could give her some advice.”
- *Student 2:* “She doesn’t leave anyone behind. She makes sure everyone is on track.”
- *Student 3*: “Some people just move on [at school]. But she really took the time to understand each of us and make sure we understood the program.”

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Theme 2: Explicit messaging about personal challenges and improvement

Mentors and peers normalized difficulty as part of STEM learning (e.g., “trial and error”), encouraging students to persist through challenges and seek out solutions

- *Student 4*: “I learned a lot from that… about mistakes we can could make and how to fix that.”
- *Student 5*: “[The thing about the program that helped me learn most was] asking for help and trying it, even if you messed up, you can go and fix it. Like trial and error.”
- *Student 6*: “I don’t really ask questions, but I need to start working on that because otherwise I won’t be able to understand. I started asking more questions to help with my project. It actually helped.”
- *Student 7*: “[Mentor] constantly asks us if we have questions. She makes it kind of comfortable that we can ask any question. So I feel like if I do, people won’t make fun. It feels like a safe environment.”
- *Student 8:* “BRIGHT-CS helped me build relationships, so whenever I needed help with anything, I would ask, can you help me with this.”

Theme 3: Naïve confidence to authentic self-efficacy

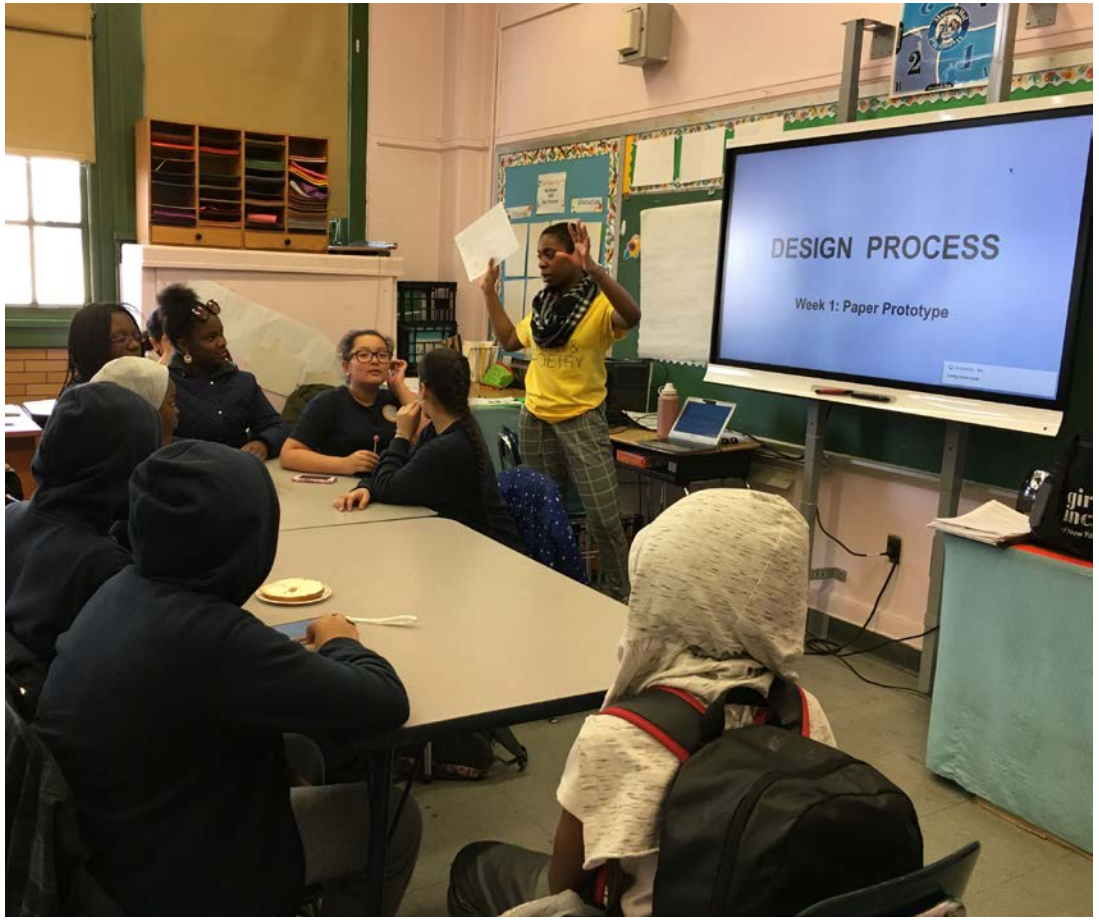
Students moved from focusing only on “easy” tasks to ”complicated stuff”:

- *Student 8*: “When I got stuck, I just kept trying new things. Even though sometimes I knew it wasn’t going to work, I still wanted to try it. Because it’s a trial and error process, and it’s actually kind of fun.”
- *Student 9*: “It takes me a little second to process what’s going on, but it’s really cool when it gets all done.”
- *Student 10*: “To add mobile [features] is a lot of complicated stuff but it’s going to help me. Now, the challenge is just to learn a new skill to do the next step.”

Implications to practice

Applying our learning to refine the BRIGHT-CS model

Curricular opportunities to generate a real-life CS product



- Generate evidence of "*I can do CS*" among girls by…
  - Supporting them to create their own working tech product, with instruction focused not on CS per se but on CS as a tool to complete the product
  - Creating experiences of growth through opportunities for "trial and error" such as debugging (whether on your own or by asking for help)

Purposeful mentoring where students partner with a CS professional to solve a CS problem

- Focus mentoring on navigating an authentic CS problem to…
  - Normalize difficulty
  - Create social support for developing specific strategies to press through difficulty in CS
- Recruit mentors who…
  - Already see girls of color as successful with high aptitude
  - Are open to discuss their lived experiences of growth

Strategic teaming to help girls develop peer support for their interest in STEM-CS

- Support student persistence in a program by…
  - Using recruitment that targets pairs or triads of friends (rather than individuals)
  - Learning site-specific barriers for students to persist in a program and problem solve with administrators, teachers, and students

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