RESEARCH ON TAP

Broadening Participation in Computing

Tuesday, April 18

bu.edu/research/events

BOSTON UNIVERSITY

Boston University Office of Research

Agenda

- Welcome Remarks
- Presentations
  - Cynthia Brossman
  - Cliff Freeman
  - Paul Trunfio
  - William Tomlinson
  - Junia G. Janvier
  - Eli Tucker-Raymond
  - Shateva Long
  - Reggie Jean / Emily Walton
  - Hailey Lenn Gordon
  - Ziba Cranmer
- Closing Remarks

CAS LERNet Programs

Cynthia Brossman

Creating Pathways for Young Women in CS
Learning Resource Network/CAS

LERNet Mission (established 1998)

- **Stimulate interest in STEM disciplines among K-12 students**
  - Coordinate enrichment programs
  - Provide Information about careers in STEM disciplines
  - Share BU resources and research activities
- **Provide professional development programming for teachers**
- **Serve as a centralized resource**
  - Share information, connect faculty, and foster collaboration
  - Assist Faculty with the development of Broader Impacts for proposals
- **Increase Retention of STEM undergraduates**

the ARTEMIS PROJECT

- A five-week summer program for 9th-grade girls;
- Introduces girls to the creative thinking and problem-solving skills that are at the core of computer science;
- BU undergraduates majoring in Computer Science or Engineering teach the curriculum;
- Participants learn computer languages such as Scratch, AppInventor, HTML, CSS and Python;
- Introduction to robotics, circuits, algorithms, cryptography and artificial intelligence;
- Learn about careers from guest speakers and field trips.

CODEBREAKERS

- Four-week program with Focus on cybersecurity;
- First week devoted to learning to code in Python;
- Use programming skills for problem sets related to cryptography and network security lessons during remainder of the program;
- Curriculum covers Simple Ciphers, One-Time Pad, Symmetric & Public Keys, Cookies, Privacy, Hacking and Malware;
- Learn about careers from guest speakers and field trips.

AI4ALL@BU

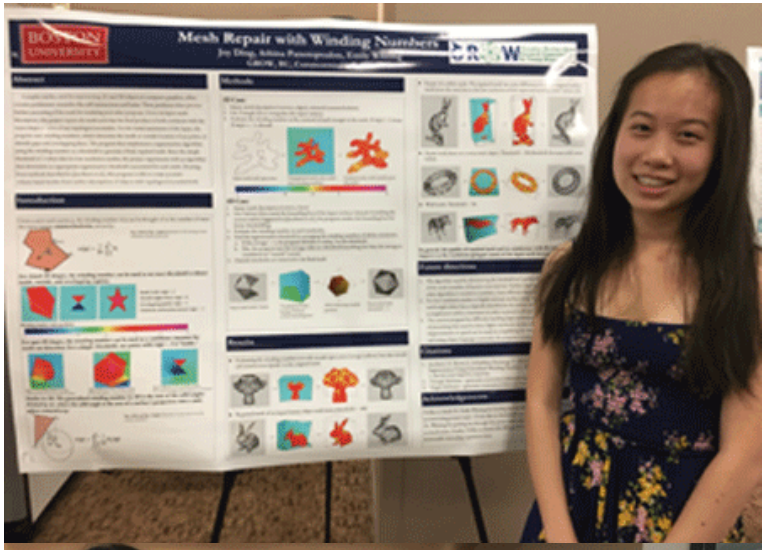
- Three week program taught by BU Undergraduates/Grads;
- Coordinators are hired for a 10-weekresearch/education internship
- Provides technical exposure to AI skills, content and practice;
- Helps students understand the impact of AI on society;
- Participate in a group research project;
- Community of students with shared interest in AI;
- Learn about careers in AI from guest speakers and field trips;
- Gain empowerment and self-esteem in the AI space.

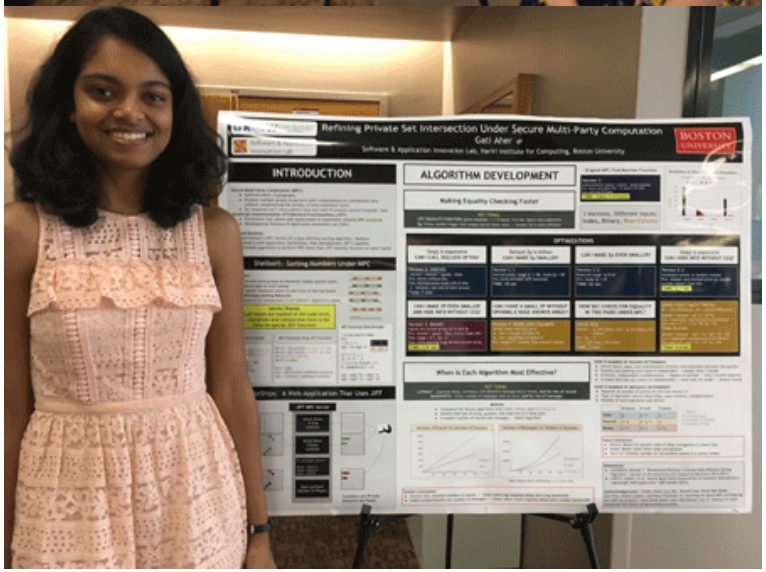
SHARED PROGRAM MODEL

- Engaging activities that reinforce that computer science is creative and collaborative;
- Students are exposed to a wide range of careers and female role models working in all facets of CS via invited speakers and field trips to local tech companies;
- Mentorship via “near-peer” undergraduate coordinators who are able to relate easily to the participants;
- Participants meet other like-minded, intelligent girls with whom they can share their scientific interests, ideas, and experiences;
- Maintain contact with participants and encourage their participation in other CS programs such as Reunions, SET in the City, MAHAcks, Technovation Challenge, Science and Communication etc.

GROW Greater Boston Area Research Opportunities For Young Women

- Six-week research internship program;
- Targets young women are rising seniors in Boston area high schools;
- Students receive a $1,500 stipend for successful completion of requirements;
- Paired with a research mentor in chemistry, biology, physics, engineering or computer science.
- In 2018, the program had two internships in Computer Science and three in 2019 (with Red Hat).





WAYS for Faculty & Students to Participate

- Host a student for GROW and include funding in your grant proposals.
- Encourage your students to apply for Coordinator positions
- Be a guest speaker
- Leverage your connections with industry for field trips
- Introduce Jessie Guinn (jguinnjr@bu.edu)
- learn@bu.edu

A Radical Solution

Cliff Freeman

Graduate Student Researcher
Mathematics Education
Wheelock College of Education &
Human Development

National Director of STEM Programs
The Young People's Project

Rising Above The Gathering Storm, 2007 & 2010

Recommendation A: Increase America's talent pool by vastly improving K–12 science and mathematics education.

What are the top 10 actions, in priority order, that federal policymakers could take to enhance the science and technology enterprise so that the United States can successfully compete, prosper, and be secure in the global community of the 21st century?

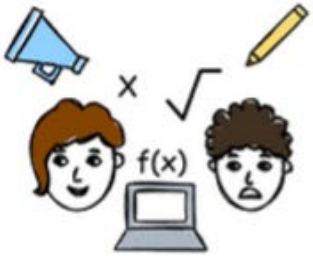
10,000 Teachers for 10 Million Minds

The Young People's Project

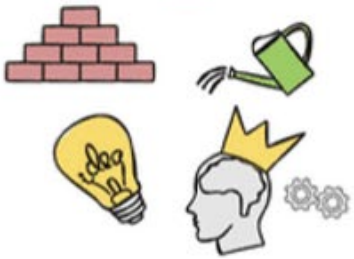
What kind of math learning experiences do young people need in order to achieve full citizenship, a good career, and the best chance for a quality life in the 21st century? - Bob Moses

a radical solution.

Math Literacy Worker (MLW)
2010 - 2011



College Math Literacy Worker (CMLW)
2012 - 2016



Director of STEM Programs
2017 - Now

50 Participants (per week)

Full Year (80 hrs/ yr)

60 MLWs (per year)

Full Year (10-15 hrs/ wk)

Multiple Programs (per year)

Full Year (40+ hrs/ wk)





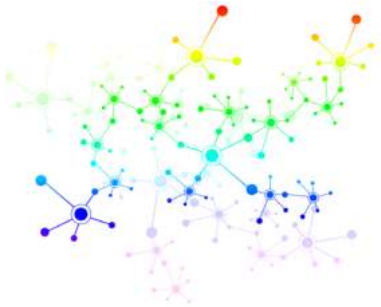

Young people have shown us they can do it.

How Do We Build Teacher Capacity in Computer Science Education?

Building Capacity in Computer Science (CS) Education and Student Near-Peer Classroom Mentorship

#2031455

Network Science For All: Positioning High Need Youth for Success in Pursuing STEM Pathways



Paul Trunfio*

Sr. Research Scientist & Lecturer

Physics, College of Arts & Sciences

Wheelock College*: Kimberly Howard, Scott Solberg, Chong Park, Deyja Enriquez

STEM Fellows*: Michalina Jadick, Ariana Margolis, Isabel Powell, Jackson Rozells

Government & Community Affairs*: Cecilia Nardi

Community Partners*: Alexandra Oliver-Davila, Juan Maldonado, Angelica Rodriguez, Paola Carpio Diplan, Naz Akdilek

www.bu.edu/networks

BOSTON UNIVERSITY

Boston University Office of Research

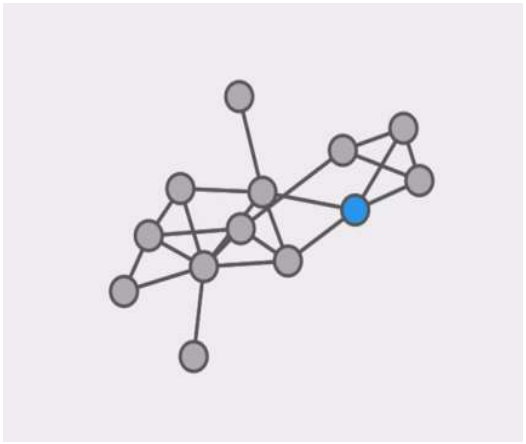
A Community-University Collaboration for "K-12"

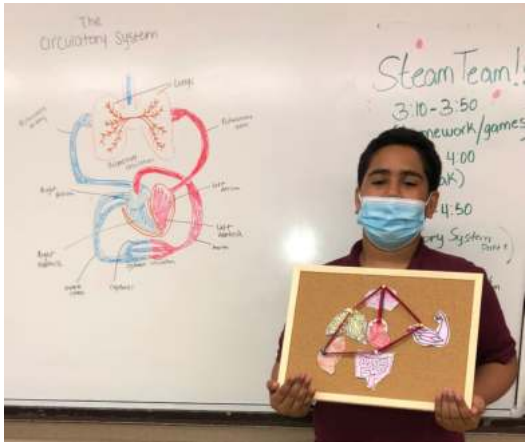
Not "K-12" outreach, but rather a K-12 partnership infrastructure

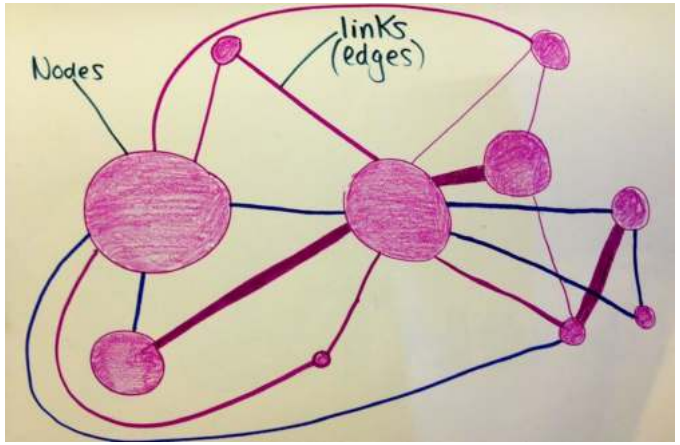
- *Pillar 1* – Prior curriculum and professional development reimagined:
  - Data and network science education
  - Career development initiatives
- *Pillar 2* – Community partner, Sociedad Latina, already making impact in Boston with Latinx students
- *Pillar 3* – Robust collaborations and partnerships at BU, including Wheelock Education, Physics, Government & Community Affairs

STEAM Curriculum

- Using core STEM standards, we develop curriculum focused on “how things are related”. For example, network themes in…
  - Water in chemistry
  - Electric circuits in physics
  - Spreading of diseases in biology
- Empowers students to discover meaning of data and inter-relations
- Embeds curriculum in a context of layered mentorships







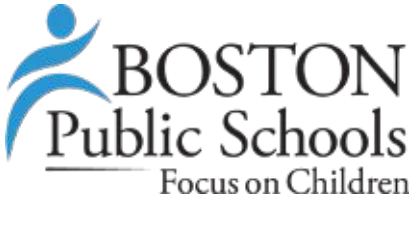
Career Development

- Using MyCAP (My Career Access Plan) curriculum lessons, students develop awareness of STEM education, training, and occupational opportunities:
  - Identifying STEM related occupations
  - Exploring STEM related talent and skills aligned with future goals
  - Connecting with role models
  - Civic engagement

Paths to Broadening Participation in Computing & STEM?

- What does "Broadening Participation" mean for K-12?

- **Can it mean scalable impact in K-12 space and higher education space (e.g., at BU) if we share a common vision and work collectively toward common goals?**



Anchored in Diversity: *SAIL's Role in Bridging the Representation Gap in Computing*

William Tomlinson, PhD

Director, SAIL

Software & Application Innovation Lab

Rafik B. Hariri Institute for Computing and Computational Science & Engineering

SAIL at a Glance

Our Mission: To provide ***researchers*** *with professional* ***software development*** *capacity* ***(full-stack, web and mobile applications)*** *in support of projects that require cutting-edge solutions*

Exemplifying Diversity in the Field

SAIL is Majority Minority















Expanding our Reach

SAIL is forming partnerships to increase representation and enhance students technical skills

BU Spark!

Mentors, Workshops, Project Leaders

BU Academy

Mentors, Job Shadowing, Project Leaders, Workshops, Hackathons

NSF Workshops

Applying domain specific skill sets with full stack SW development and coding best practices

Upward Bound

Workshops, mentoring, shadowing

Upward Bound Math and Science (UBMS)

SAIL will be hosting UBMS the week of April 18th, 2023

Goal:

- *Conduct technical, hands-on workshops for high school students*

Content:

- *Software Engineering and Machine Learning*

Audience:

- *9th, 11th and 12th grade*
- *10 students*
- *Varying levels of Computer Science exposure*

Program Expansion Support:

- *Create skill-level appropriate projects*
- *Other places/labs for students to learn*
- *Access to dedicated mentors*

Cultivating Student Autonomy in Diversity, Equity, and Inclusion

Junia G. Janvier

Student JEDI Project Manager
BU Spark!

Justice, Equity, Diversity, and Inclusion

CDS DS291: EXPLORING DEI IN TECH

Accredited BU Course

Fourteen-week two-credit course that has taught over 40 students so far

Student-led approach

Valuable skills in teaching, facilitation, and public speaking

About DS291

This workshop will explore topics related to diversity, equity, inclusion, and justice (JEDI) in the technology sector. The course will implement the theory and practice of DEIJ across the tech sector. Through this course, students will learn how to engage in and facilitate impactful discussions about diversity, equity, inclusion and justice.

Our impact

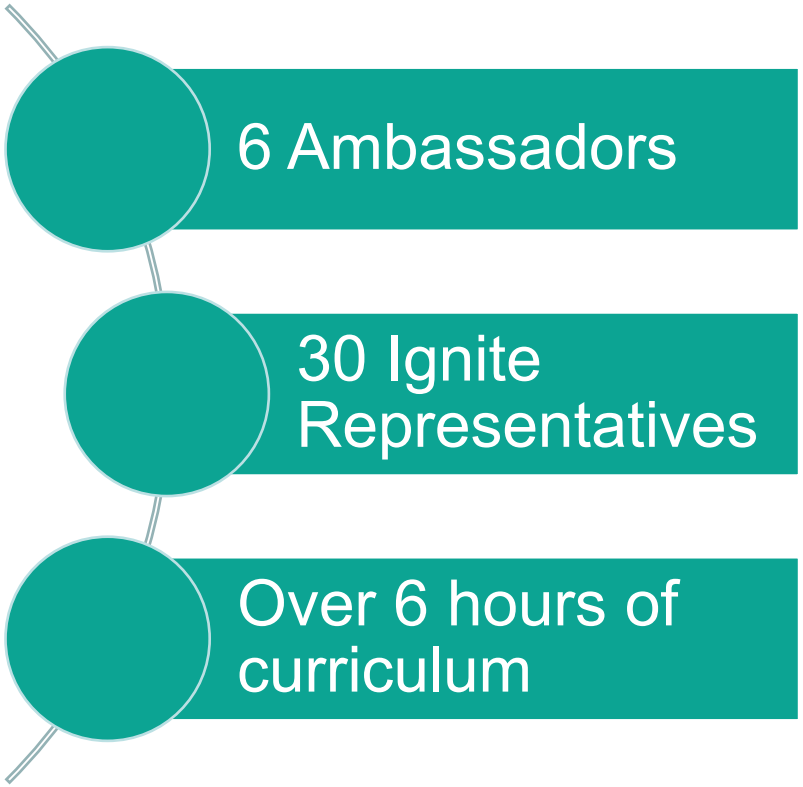
Over twelve guest speakers such as Snap Inc., Intel, and Data4BlackLives

Grant-Awarded

Spring 2022 Recipients of the Diversity & Inclusion Office Catalyst Grant

Justice, Equity, Diversity, and Inclusion

SPARK! STUDENT CONSULTING GROUP



- The role of SGC:
  - To develop student DEI leaders on campus
  - To offer peer-focused support to clubs, students, and the Spark! Community
  - To offer educational outlets and opportunities for students to engage with DEI conversation
  - To build a long-lasting pipeline centered on advocacy and transformational leadership

Justice, Equity, Diversity, and Inclusion

SPARK! STUDENT CONSULTING GROUP: ONLINE MODULE

A means to set a baseline…

- How to familiarize students early on so we can dedicate our additional efforts in building the infrastructure?
- How can we design something that incorporates student voice and leadership in this role?
- The module covers 3 topics:
  - Diversity in Tech
  - Equity in Tech
  - Inclusion in Tech

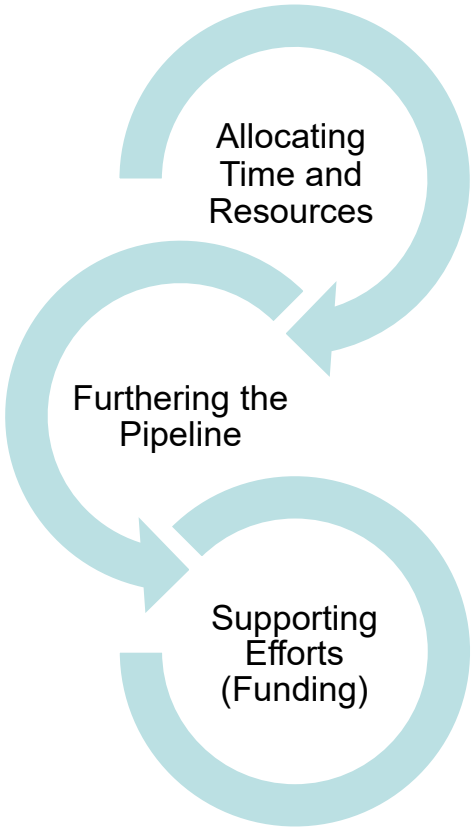
1
- University Support (The Shipley Center)
- Semester Roadmap

2
- Onboarding
- Research and content

3
- Media production
- Course organization

Justice, Equity, Diversity, and Inclusion

WAYS TO SUPPORT OUR EFFORTS



- Some ways to contribute to our efforts
  - Funding: directly feeds into DS291 expenses and Consulting Workshops/Programs
  - Recruitment:
    - Aiding in the acquisition of students to JEDI, and in connecting students to resources/connections in the DEI in Tech sector
  - Mentorship and Expertise:
    - Being a DS291 speaker
    - Working with JEDI in educational content

Expansive Computing in Ecologies of Love

Eli Tucker-Raymond*

*Ada Ren, Aditi Wagh, Adriana Alvarado, Amon Millner, Ayana Allen-Handy, Brian Gravel, Chad Milner, Christopher Wright, Clara Mabour, Cliff Freeman, Dionne Champion, Juan Gutierrez, Kimmone Bartley, Maisha Moses, Maria Olivares, Rasheda Likely, Samara Fair, Susan Klimczak

Research Associate Professor

Earl Center for Learning and Innovation

Wheelock College of Education and Human Development

Mural of Mel King, Madison Park High School, Dorchester Reporter, Nov 27, 2019

Ecologies of Love

- Helping others → Computing for the public good
- Teaching others → Flipping the purpose of learning
- Intergenerational Relationships → Cascading mentors
- Arts/Expression → With and about technology
- Socializing → Building relationships
- Historical Freedom Struggle → Historicized and Politicized

Expansive Computing Ecologies for Identity and Learning

(Lee, 2008; Nasir & Cooks, 2009)

- **Ideational** – ideas about computing and hip hop
- **Relational** – multi-aged group membership
- **Material** – DJ battle station – computers, copper tape, LPs, paint—Arts and expression
- **Spatial**—the floor of a dance studio—sliding the computer back and forth, laying on the ground

Hi Tech Social Futures

- ***Broadening Participation in Computing*** means bringing computing to the people for the people.
- Consider relationships to each other and to computing, and between computing and other people.
- Cultivate the ecological resources for developing those relationships.
- Form partnerships with communities and scholars from the communities you are attempting to serve

Broadening Participation in Computing by Assessing the Climate of Tech at BU

Shateva Long

Undergraduate Student
Computer Science, College of Arts and Sciences

The Question(s)

What is the experience of a student in a tech and computing related field?

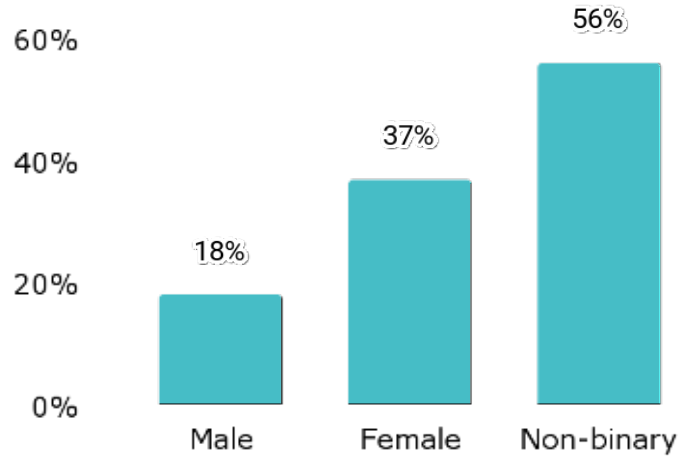
+

Does this experience differ between students with different identities - if so, how?

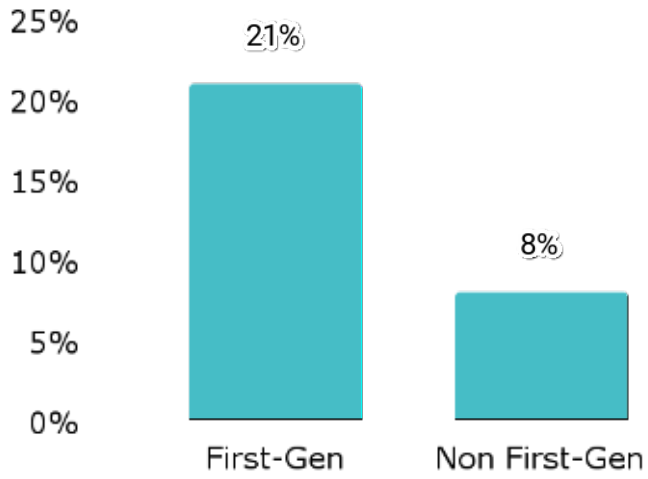
The Solution Process

- Surveyed 632 undergraduate students from CS, CE, DS, IS, and M+S
- Conducted a series of focus groups with 13 students in total
- Created an online, interactive data report

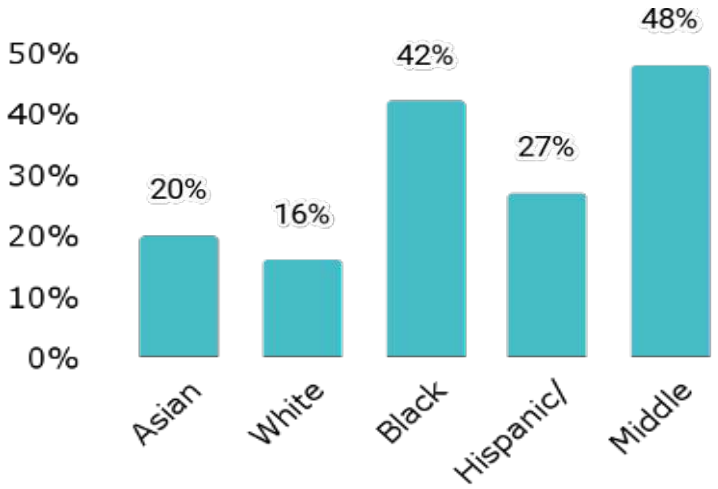
Students who responded “Sometimes” and “Often times” to “I am overlooked or ignored when working in a group.”



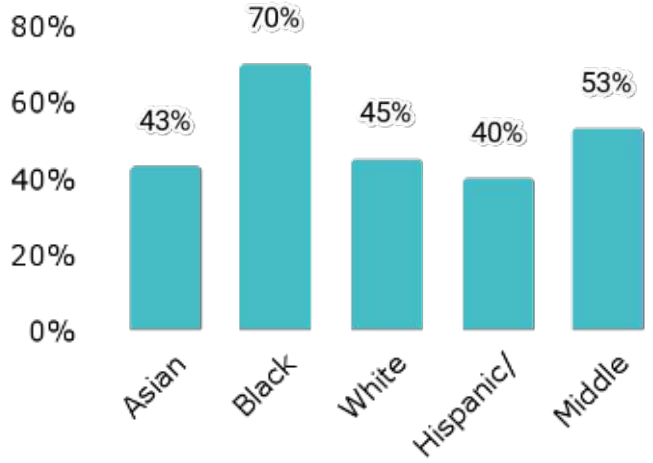
Students who responded “Strongly Disagree” and “Disagree” to “I had an easy transition from highschool to college.”



Students who responded “Never” and “Rarely” to “I am comfortable going to my advisors for my major”



Students who responded “Sometimes” and “Often times” to “I feel like an outsider”



Based on these findings, Boston University's Broadening Participation in Computing plan should incorporate goals that focus on…

- Enhancing support for historically underrepresented students

- Creating and encouraging a culture of collaboration, inclusion, and belonging amongst students

Scan the QR code above to review the full report and interact with the data

Connecting Underrepresented Boston and Chelsea High School Students to Computing and STEM

Reggie Jean & Emily Walton

Director / Program Manager
Upward Bound Math Science, WED

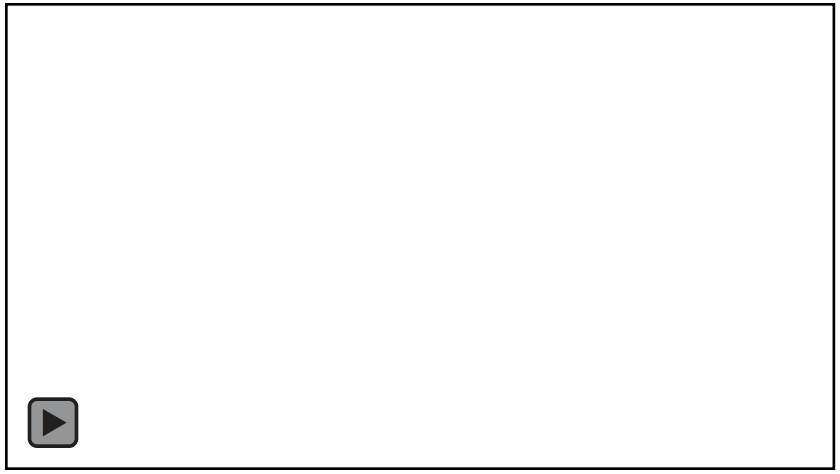
Upward Bound Math Science

Upward Bound programs began in 1964 as a result of Civil Rights Movement and President Lyndon B. Johnson's War on Poverty Legislation

UBMS is a year-round program for first generation college potential and low-income Boston and Chelsea high school students that prepares them to study STEM majors in college success

After school program services include: tutoring & homework help by BU undergrads; MCAS & SAT preparation classes; workshops on and one-on-one assistance with college and financial aid application processes; and **3-day science labs taught by BU STEM faculty during February or April vacation.**

Summer program services include: six-week residential experience; high school preview courses in science and math, and enrichment classes in literature, writing, **computer science**, and either MCAS/SAT prep or Latin; outdoor team building; afternoon study hall; Shakespeare performance; evening recreational activities and team projects; and **summer science Wednesday labs taught by BU STEM faculty.**

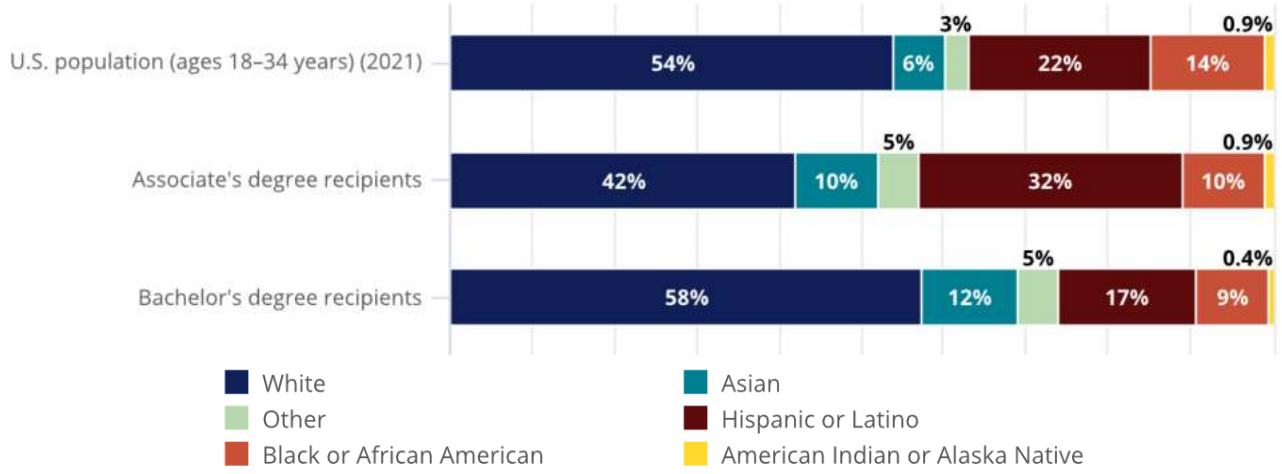


Why?

National Center for Science and Engineering Statistics | NSF 23-315

Figure 7-4

U.S. population ages 18–34 and S&E degree recipients, by degree level and race and ethnicity: 2020



In the 2020-2021 school year:

- 78% of Massachusetts public high schools offer a foundational computer science course
- **Just 5.8% of Massachusetts high school students were enrolled in a computer science course**
- Urban schools were less likely to offer computer science than suburban and rural schools

(Massachusetts Business Alliance for Education)

Past Projects

- Data Extraction and Machine Learning with Python
  - April 2023, Software & Application Innovation Lab (Will Tomlinson)
- Global Climate Models (cloud-based data modeling)
  - Summer 2022, with Professor Ian Sue Wing, CAS Earth & Environment
- STEMCees: STEM, Hip Hop, and Computing
  - February 2022, Earl Center for Learning & Innovation (Eli Tucker-Raymond)




Addiction Medicine, Earth & Environment, Chemistry, Engineering, Space Exploration, Public Health/COVID, Microbe Biology, Neuroscience, Virtual Reality in the Media, Medical Science, the Science of Fast Fashion, Catalysis, Ant Biology…

Ways to be involved

Summer Lab Track

- Host 10-15 students for 3 full days of hands-on, engaging work or instruction Wednesdays in July

Summer Mini-Internship

- Host 1-2 rising 12th graders for full-day internship over 3 Wednesdays in July (students paid by UBMS)

Vacation Week Program

- Host 10-15 students for 3 days of hands-on, engaging instruction or activities during Feb or Apr school vacation week

Apply to be a summer Teacher (professionals/grad students) or Tutor-Mentor (undergrads)

Email Emily to discuss collaborating:

ewalton@bu.edu

Broadening Participation Through BioTechnology Outreach

Hailey Lenn Gordon

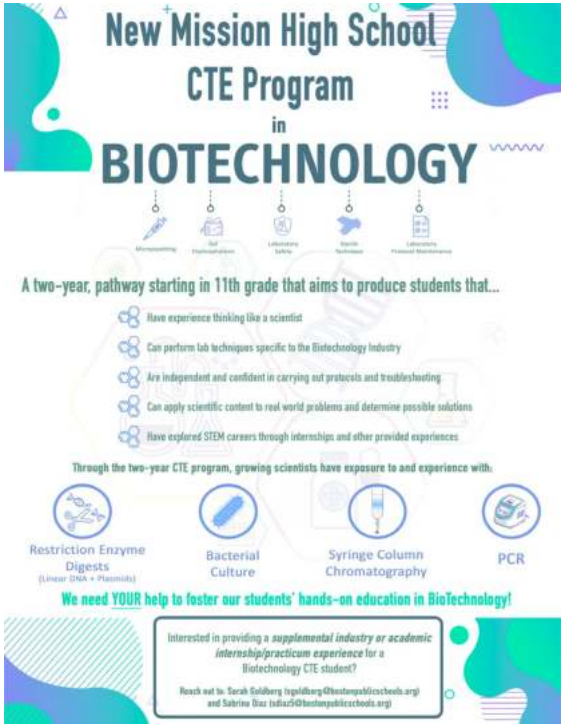
Director

STEM Pathways, College of Engineering

STEM PATHWAYS

The Ecosystem

STEM PATHWAYS Outreach events



Software Track

iGEM

BOSTON UNIVERSITY

Boston University Office of Research

Neptune

How can you connect with STEM Pathways?

National Science Foundation

Research Offerings

(High School, Undergraduate)

iGEM

Seminar Speakers

(Sharing about your field/research)

Specialized Outreach

(Writing support, event planning)

hlgordon@bu.edu

https://linktr.ee/stempathways617

Hacking Hackathons to Broaden Participation

Ziba Cranmer

Director, BU Spark!
Faculty of Computing & Data Sciences

Hackathons are...

a place to learn critical skills
an opportunity to build project portfolios
a place to get noticed by employers
a rite of passage for college students

Hackathons are generally not...

diverse
accessible
inclusive

MLH MAJOR LEAGUE HACKING

TechTogether

in 2017

18%

of MLH Hackers identified as female or non-binary

in 2022

41%

of MLH Hackers identified as female or non-binary

Source: https://news.mlh.io/the-state-of-the-league-2020-09-08-2020

HACKATHON PATHWAYS @SPARK!

high school

increase applications to BU

~100/ year

first years @BU

facilitate connections & demystify hackathons

~100/ year

gender diversity @BU

create a safe space for underrepresented genders in tech.

~500/year

equity + civic tech

centering challenges that address issues of equity in society led by an organizing team from NSBE

~100/ year

ORGANIZERS

HACKERS

COLLABORATORS

Sponsor a challenge + prize on a topic of relevance to your research

Fund a hackathon organizing team

Join as a hackathon mentor

Lead a workshop

Serve as a judge

Build the pipeline!

THANK YOU!

UPCOMING EVENTS

Learn more & RSVP: bu.edu/research/events
Topic ideas & feedback: bu.edu/research/topic-ideas

RESEARCH ON TAP

Neuroscience to Data Science and Back
Tuesday, May 2, 2023 | 4-6 pm

RESEARCH HOW-TO

Community-Engaged Research to Advance Health Equity: Co-Creating Knowledge through Research
Wednesday, April 19 | 3-5 pm

Meet the Research Corporation for Science Advancement
Thursday, April 20 | 1-2 pm