TI STEM Exchange

Computer Science and Programming to Foster STEM Interest

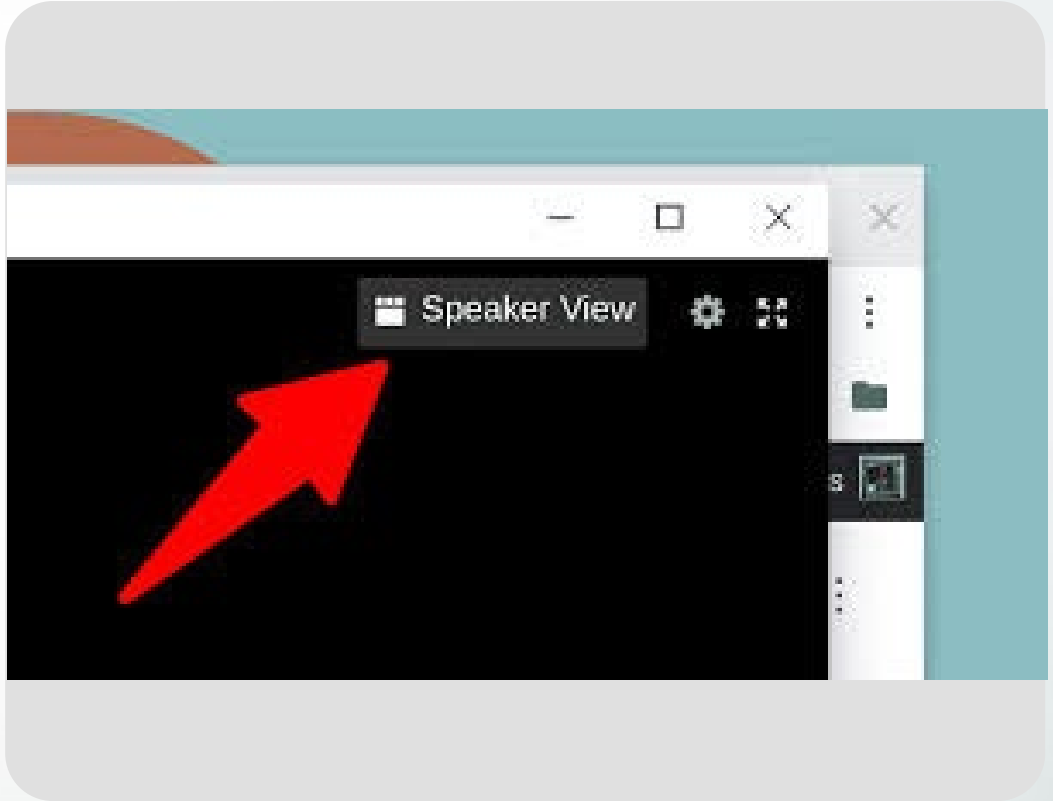
October 6, 2021 7:00 – 8:30 pm ET

TI STEM Exchange

Texas Instruments

Speaker View

- **In the upper right of your Zoom window, select “Speaker View” to ensure you’ll always see the presenter’s video.**



MODERATOR

Steve Barbato

Senior Fellow, Retired Executive Director and CEO

International Technology and Engineering Educators Association

#STEMEducation

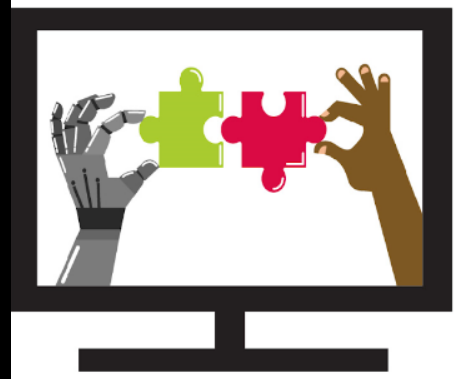
This evening's agenda

Presentations

- ExCITE Project
- AP Computer Science Principles
- ExCITE Project in action

"Reverse Panel" Discussion

- Breakout group discussions
- Panelists' reactions and connections



ExCITE

EXPLORING COMPUTATION INTEGRATED INTO TECHNOLOGY AND ENGINEERING

An NSF-Funded Partnership between Hofstra University and ITEEA (award #1923552)

ITEEA is adding a transformative HS *Computer Science Principles by Design* course to its EbD™ curriculum.

Based on the *Beauty and Joy of Computing* (BJC) curriculum

ExCITE will enable Technology and Engineering Teachers to be lead providers of AP Computer Science Principles courses nationally.

ExCITE is a Research Practitioner Partnership (RPP)

RPP Includes Teachers, Supervisors, Computer Scientists, Researchers, and Evaluators

ExCITE Lead Teachers

Matt Davis

T&E Teacher
Carroll Co., MD

Chris DeHaan

T&E Teacher
East Lansing, MI

Marnie Hill

Dept. of Comp. Sci.
NCSU

Tonya Lackey

T&E Teacher
Boquet Valley NY

ExCITE County- and State-level Supervisors

Edward (Ted) McNett
Assistant Supervisor
Career and Technical Education
Carroll Co. Schools, MD.

Scott Nichols
T&E Supervisor
Maryland DOE

Kevin Reilly
Administrative Coordinator
CTE Resource Center
Henrico Co., VA

Dan Stooks
CTE Educational Specialist
Henrico County Schools, VA

George Willcox
Director of Operations & Accountability
Office of CTE
VA DOE

ExCITE Computer scientists, Researchers, Evaluators

Tiffany Barnes
Research Consultant,
Professor of Computer Science, NCSU.

Brian Harvey, Advisory Board Chair
Professor Emeritus, Engineering and Computer Science, UC Berkeley

Deborah Hecht.
Evaluation Lead
Center for Advanced Study in Education, CUNY Graduate School, NYC

Bryanne Peterson LMS Developer
Broader Impacts, STEM Education, and CTE Scholar, Virginia Tech

Steve Holmes, Educational Software Developer, Creative Computer Labs, Ireland

Janet Kolodner Research Consultant
Professor of the Practice and Co-Director, MA Program in Learning Engineering, Boston College

ITEEA Central Office Staff

Joseph Fleming
ITEEA Website and Computer Ops Coordinator

Katie de la Paz
ITEEA Communications Director/Editor-in-Chief

Scott Weiler
Director of Innovation
ITEEA STEM Center for Teaching and Learning

Ryan Novitski
Director of Learning
ITEEA STEM Center for Teaching and Learning

ExCITE Project Management Team—Co-PIs

Tony Gordon,
Principal Investigator
Hofstra University

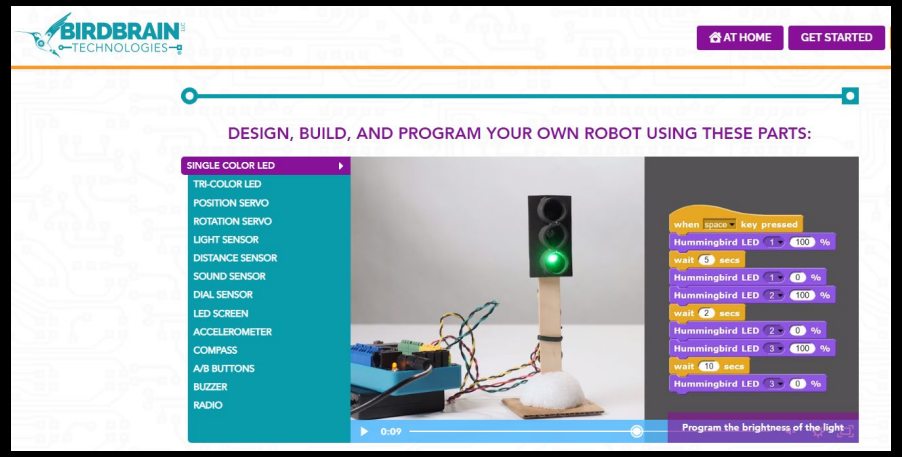
Steve Barbato
Co-Principal Investigator
CEO and Executive Director, ITEEA

Michael Hacker
Co-Principal Investigator
Co-Director
Hofstra University Center for STEM Research

Janet Kolodner
Co-Principal Investigator, and Research Consultant
Professor of the Practice,
Lynch School of Education and Human Dev't.
Boston College

A FEW MORE BITS (NO PUN INTENDED)

ExCITE IS NOW A COMPONENT OF ITEEA'S "ENGINEERING BYDESIGN™ (EbD™) PROGRAM



IT USES BIRDBRAIN TECHNOLOGY'S *HUMMINGBIRD* KIT OR LOWER-COST ITEEA COMPUTER CONTROL AND ROBOTIC KITS.

INFORMATION IS ALSO PROVIDED FOR TEACHERS TO CREATE THEIR OWN MICRO:BIT-BASED KIT.

THE CURRICULUM WILL BE DELIVERED ONLINE VIA ITEEA'S ENGINEERING BY DESIGN SYSTEM AND WILL ENABLE COLLECTION OF RESEARCH DATA.

EMS Station, Chris DeHaan; MetroCard, Tonya Lackey; Railroad Crossing, Matt Davis

ExCITE 2021-22 School Year

Cohort II: Adding New Districts, Schools, and Teachers

- Baltimore City Schools (MD)
- Prince Georges' County Schools (MD)
- Alexandria City Public Schools (VA)
- Chesterfield County Public Schools (VA)

ITEEA will provide ongoing support via summer ExCITE Professional Development institutes

Potential future expansion will include universities, schools, and districts nationwide

For Additional Information please complete this Google Form at
https://forms.gle/U6BAm7v4u5r6CMY86
Or
Contact ITEEA at ITEEA@ITEEA.ORG or Call 703-860-2100

PANELIST

Crystal Furman

Director, AP Computer Science, Curriculum, Instruction and Assessment

The College Board

@CrystalLFurman

AP® Computer Science Principles

AP CollegeBoard

Development of AP CSP

AP Computer Science A, which focuses on JAVA, has been a long-standing AP course that attracts students who know they want to pursue computer science.

We developed AP CSP to provide a broad introduction to computer science, to reach more students and help them understand all aspects of computer science, including the creative aspects of programming.

Goals

- Make computer science more engaging and accessible.
- Reach students underrepresented in computer science.
- Better prepare students for the job market of today and tomorrow.

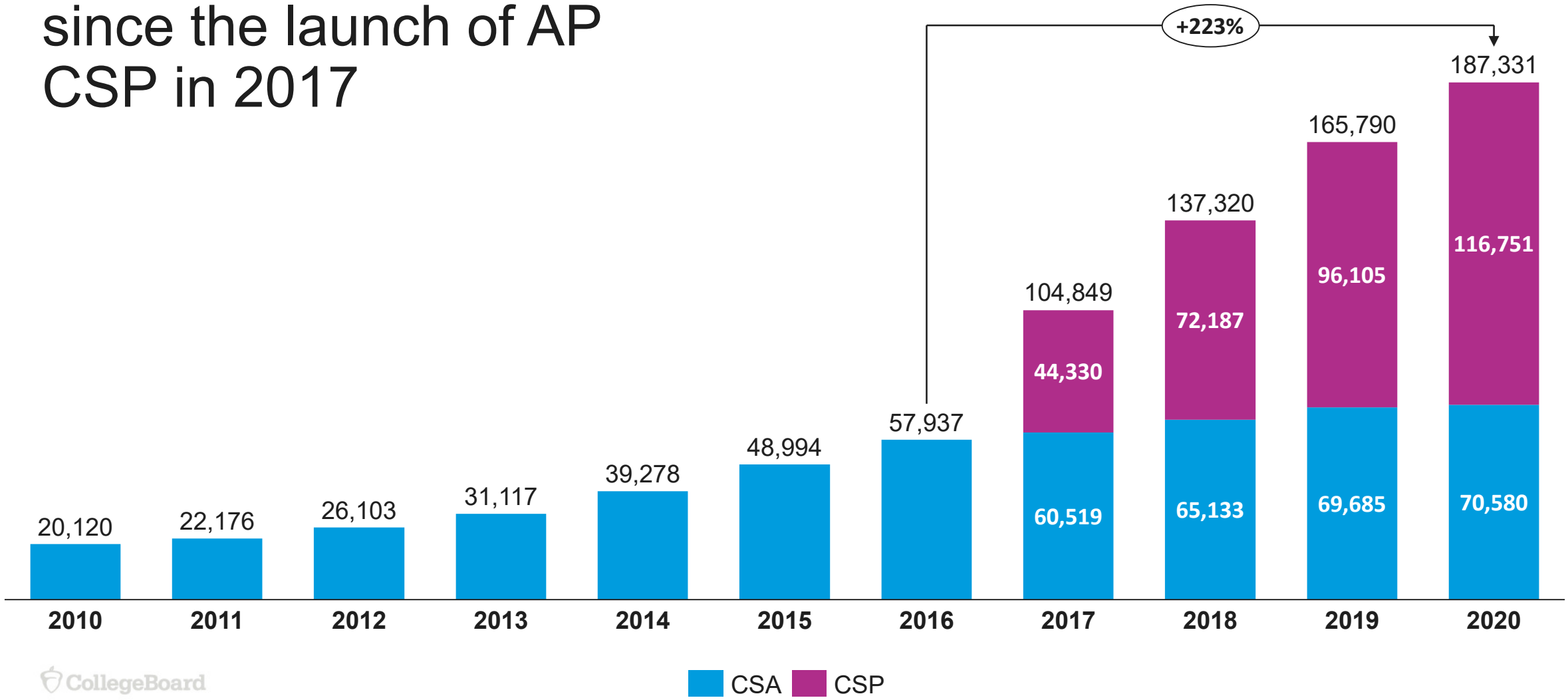
A Collaborative Process

- Partnership with the National Science Foundation since 2008.
- Educators from over 50 leading high schools and higher education institutions piloted the course.
- Over 950 colleges and universities have indicated that they will create policies to grant credit, placement, or both for the exam.

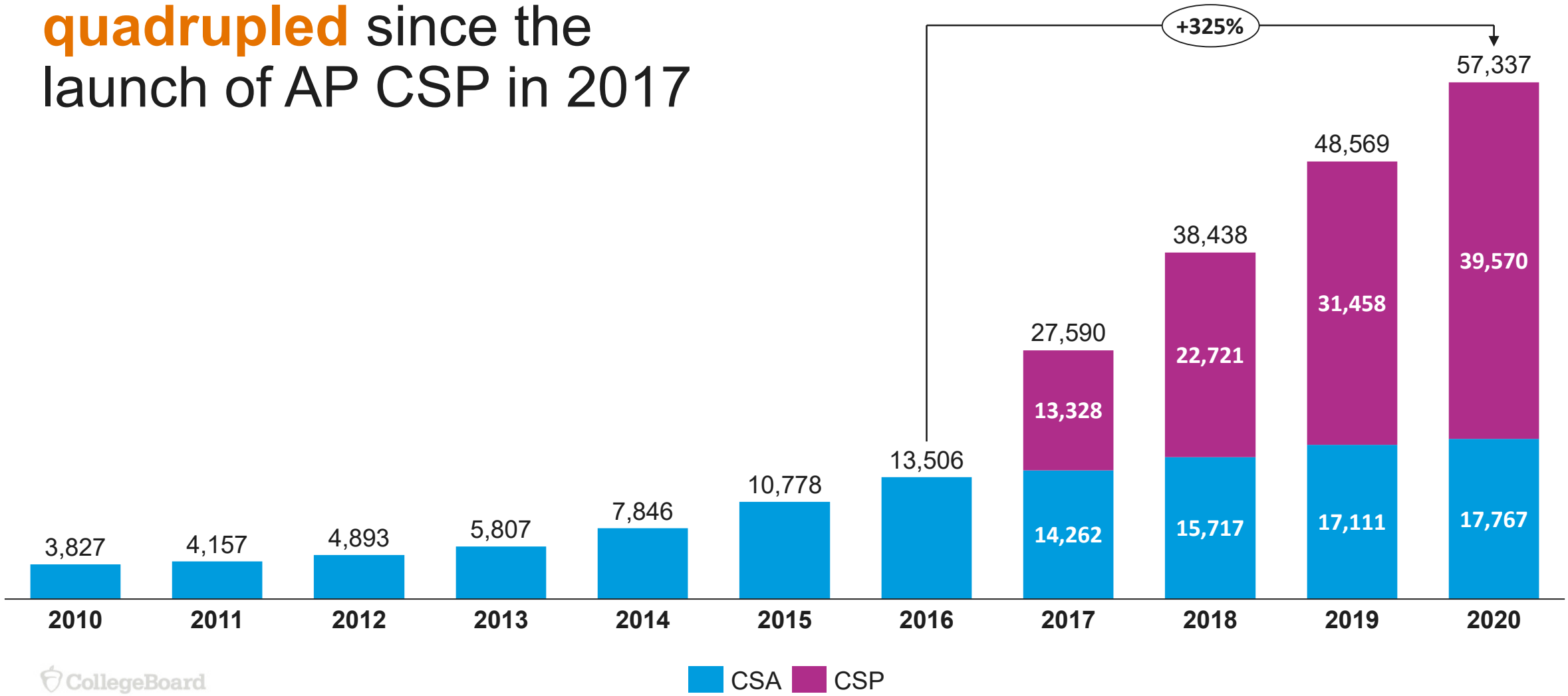
AP Computer Science Principles adoption has **doubled** since launch year.

	In 2016	In 2021
	**2,500** SCHOOLS	**5,300** SCHOOLS
	**2,700** TEACHERS	**5,800** TEACHERS

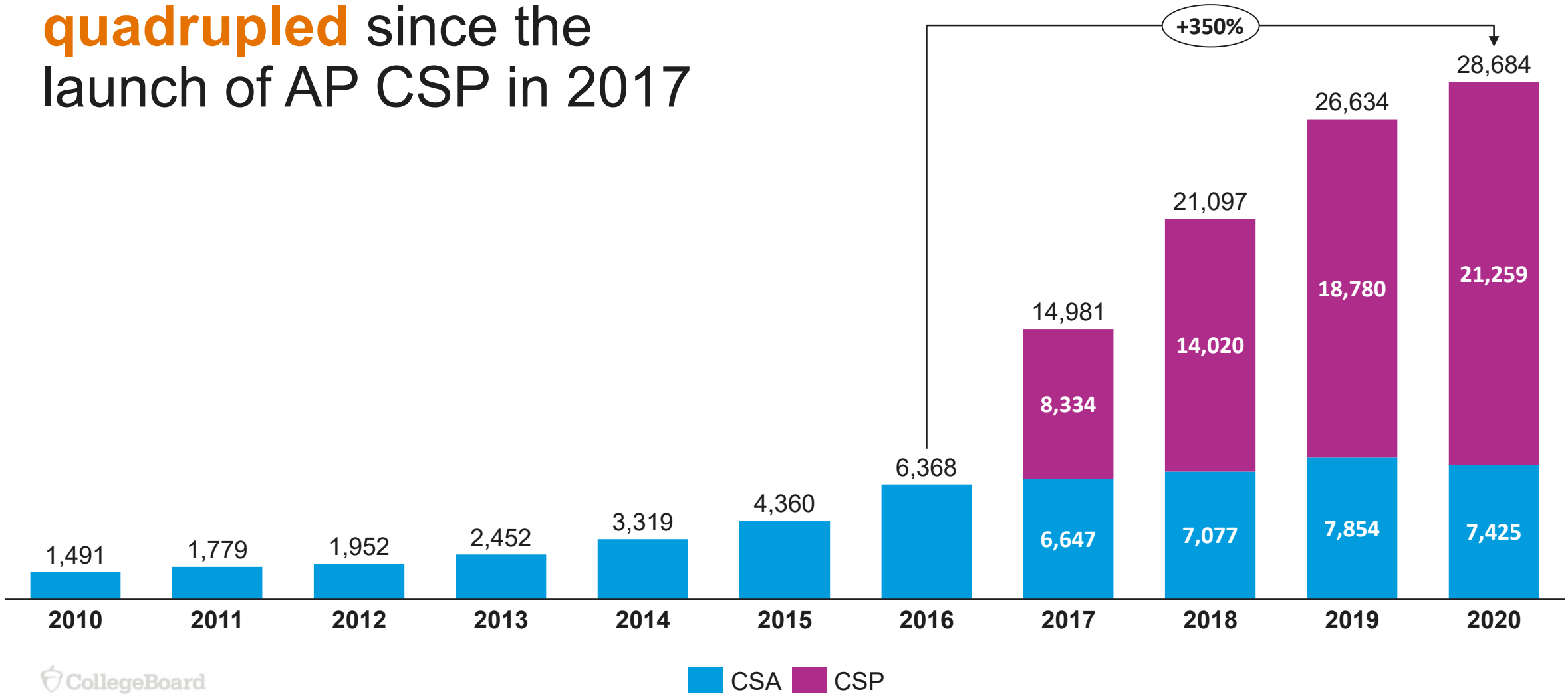
Annual AP CS participation has **tripled** since the launch of AP CSP in 2017



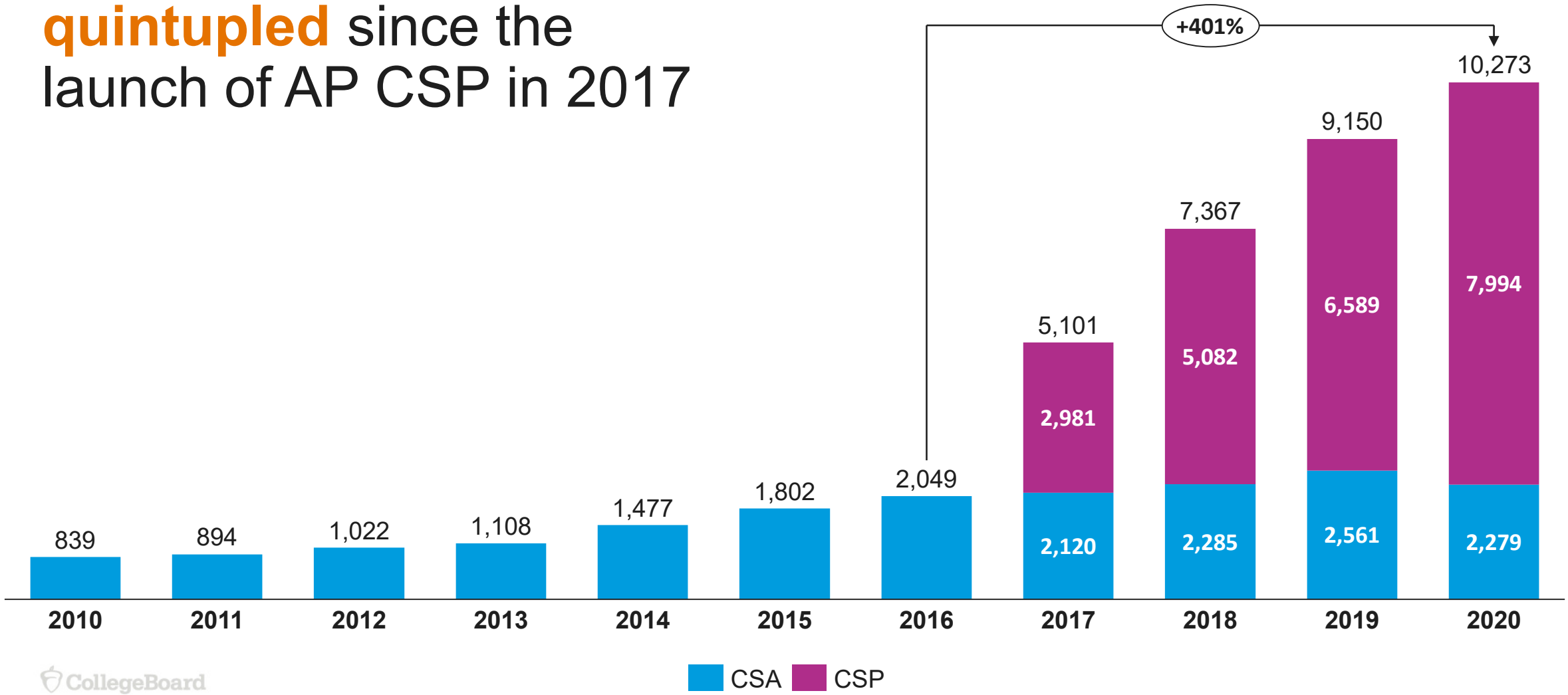
Annual AP CS participation of **Female** students has **quadrupled** since the launch of AP CSP in 2017



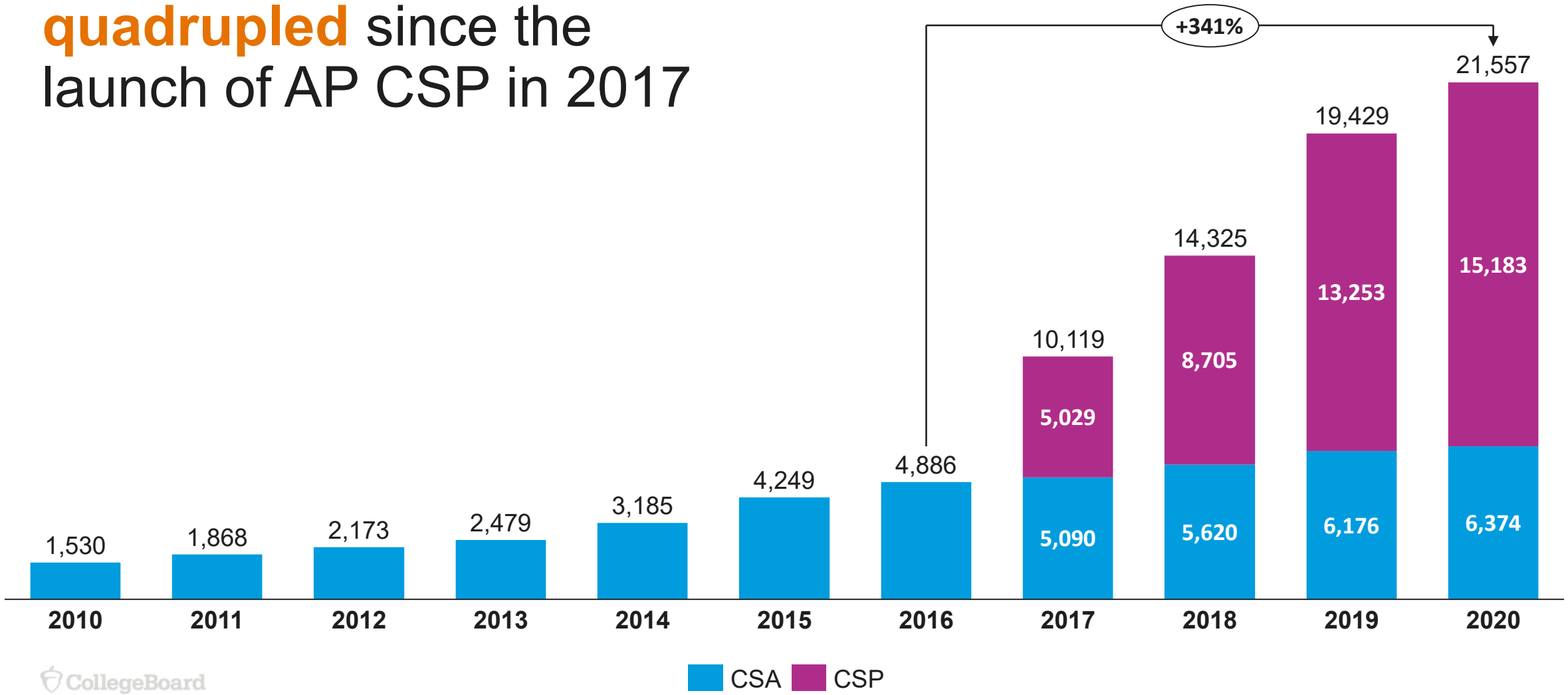
Annual AP CS participation of **Latinx** students has **quadrupled** since the launch of AP CSP in 2017



Annual AP CS participation of **Black** students has **quintupled** since the launch of AP CSP in 2017



Annual AP CS participation of **Rural** students has **quadrupled** since the launch of AP CSP in 2017



Research findings for AP CSP

AP Computer Science Principles and CS / STEM Diversification

Diversification

CSP is the first AP STEM Exam for many Black, Hispanic, and first-generation students.

STEM Persistence in HS

CSP students are more likely to take AP STEM and AP CS courses in high school.

Majors in College

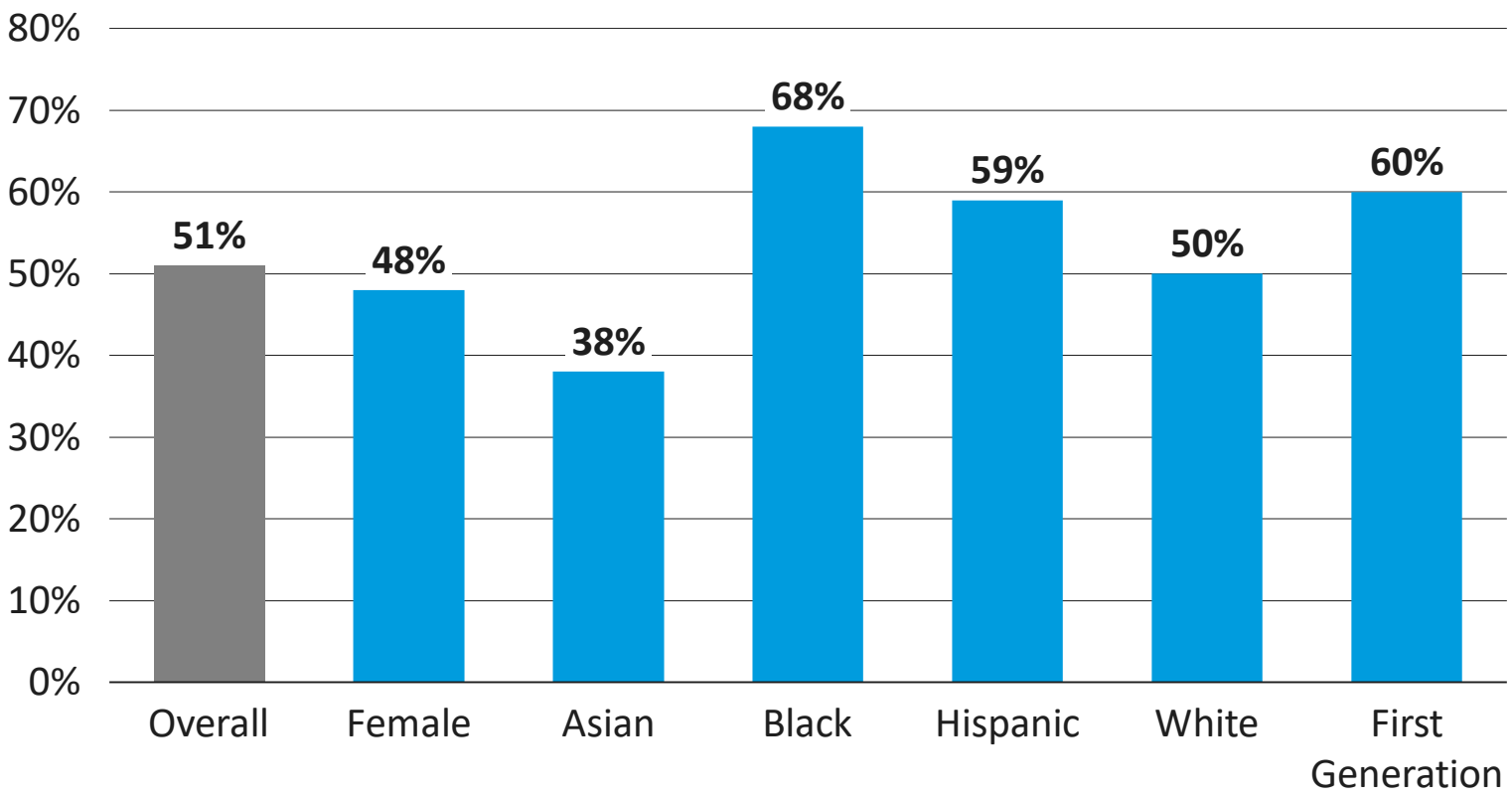
CSP students are more likely to major in STEM and CS in college.

https://apcentral.collegeboard.org/pdf/ap-csp-and-stem-cs-pipelines.pdf?course=ap-computer-science-principles

CSP as an Introduction to AP STEM

CSP is the first AP STEM Exam for many Black, Hispanic, and first-generation students.

The Percentage of CSP Students for Whom AP CSP is their First AP STEM Course

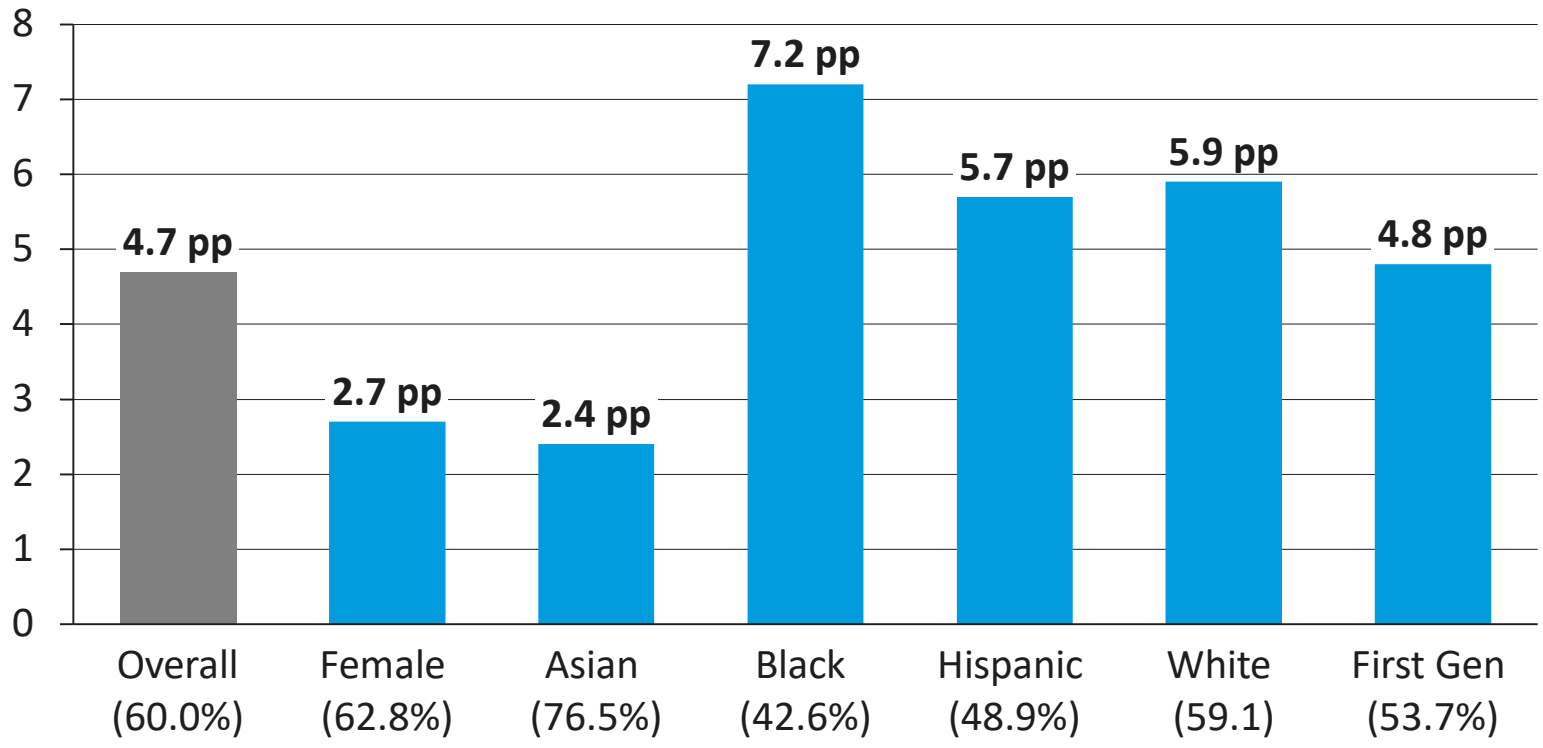


STEM Persistence

CSP students are 4.7 percentage points more likely to take AP STEM Exams in high school than otherwise similar non-CSP students.

For all student groups, CSP students are more likely to take a STEM AP than non-CSP students.

Increase in Subsequent AP STEM Participation Associated with CSP Participation



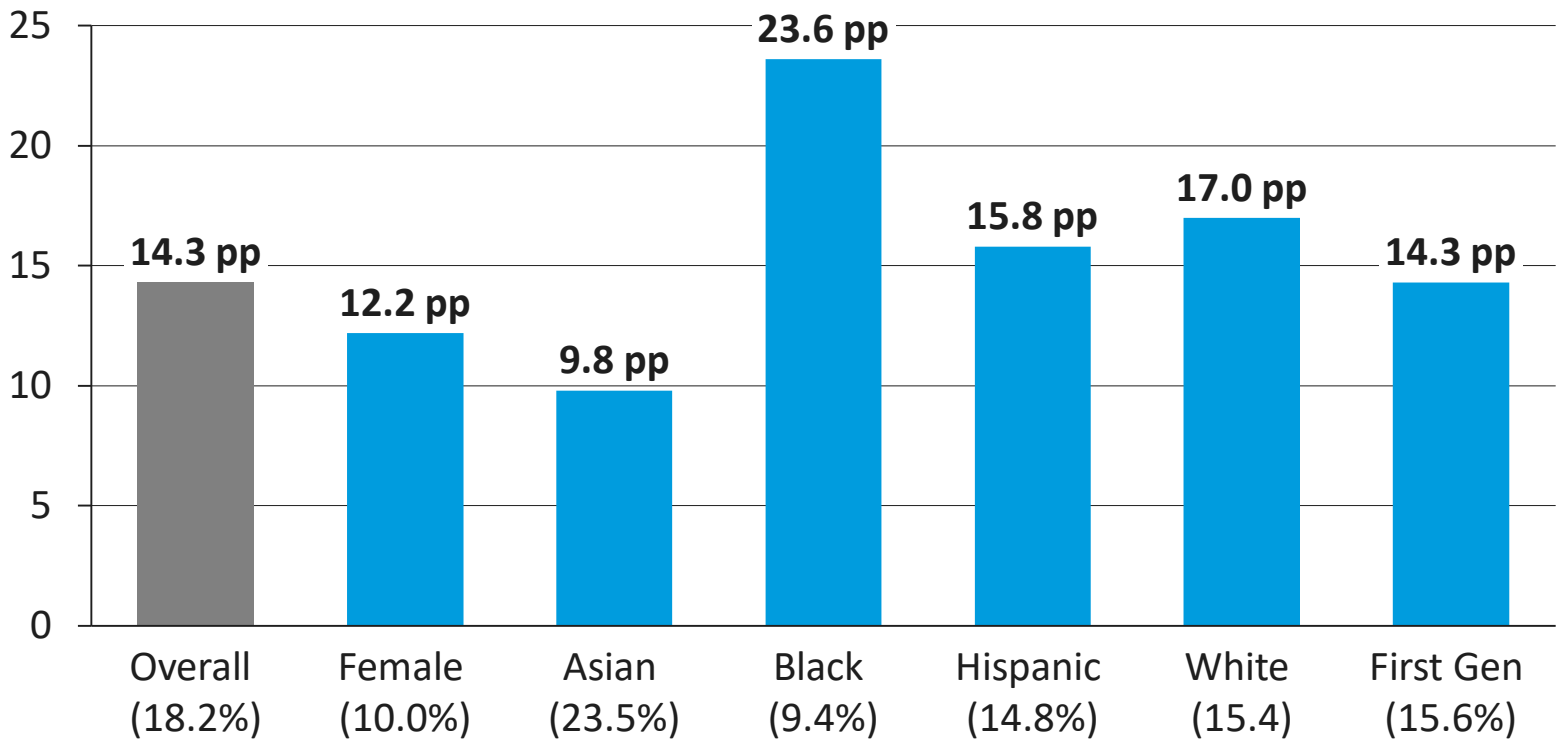
Note: Horizontal axis numbers in parentheses are the percentage of the non-CSP students in the subgroup who take the AP STEM Exams. For example, 60% of non-CSP students take AP STEM, while 64.7% of CSP students take AP STEM for a 4.7 percentage point increase associated with CSP participation.

CS Persistence

CSP students are 14.3 percentage points (pp) more likely to take an AP CSA Exam in high school than otherwise similar non-CSP students.

While all groups of CSP students are more likely than non-CSP students to take AP CSA, the difference is most notable for Black students.

Increase in Subsequent AP CSA Participation Associated with CSP Participation



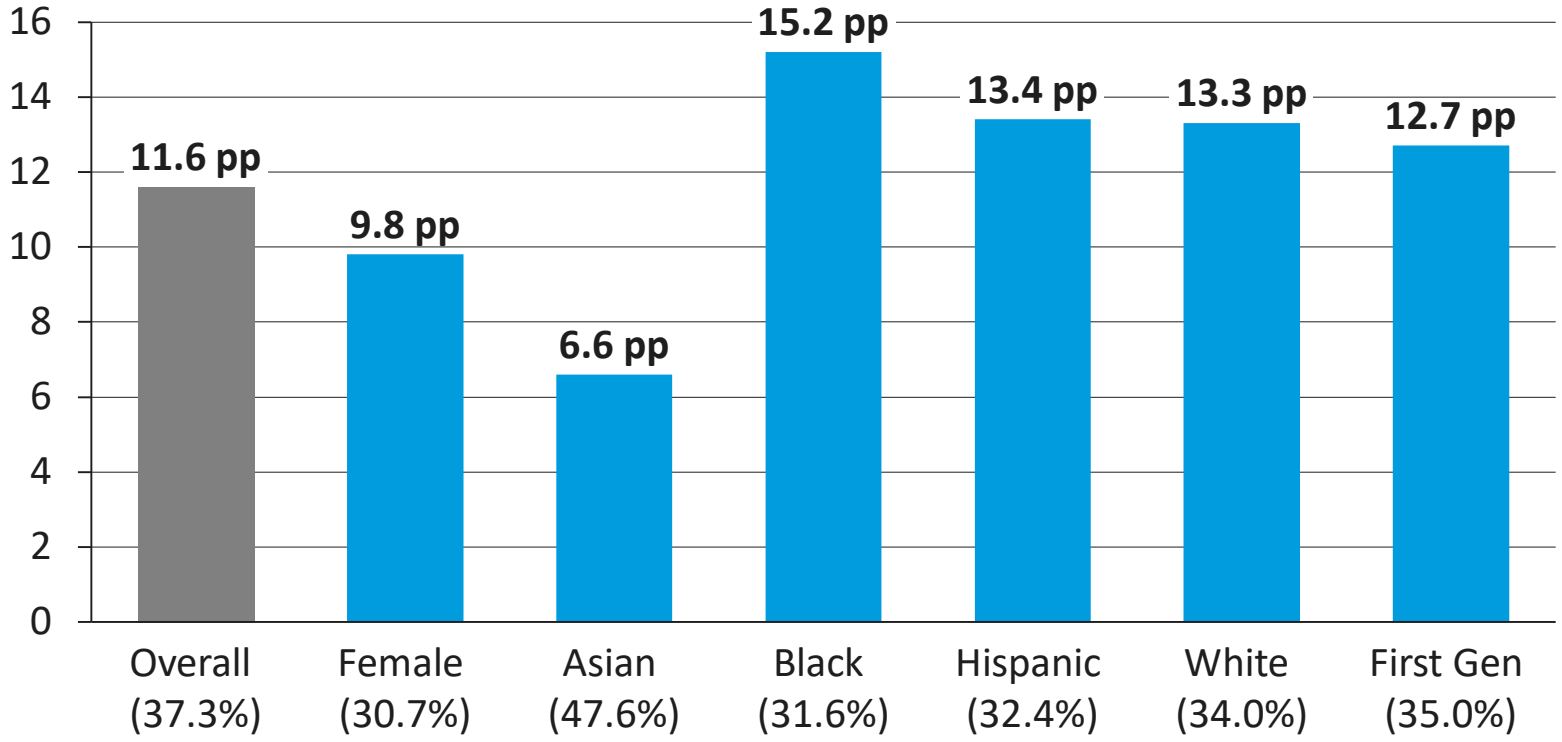
Note: Horizontal axis numbers in parentheses are the percentage of the non-CSP students in the subgroup who take an AP CSA Exam. For example, 18.2% of non-CSP students take AP CSA, while 32.5% of CSP students take AP CSA for a 14.3 percentage point increase associated with CSP participation.

STEM Major Declaration

CSP students are 11.6 percentage points more likely to declare a STEM major in college than otherwise similar non-CSP students.

CSP students are more likely to major in a STEM field, particularly Black, Hispanic, and first-generation students.

Increase in STEM Major Declaration Associated with CSP Participation

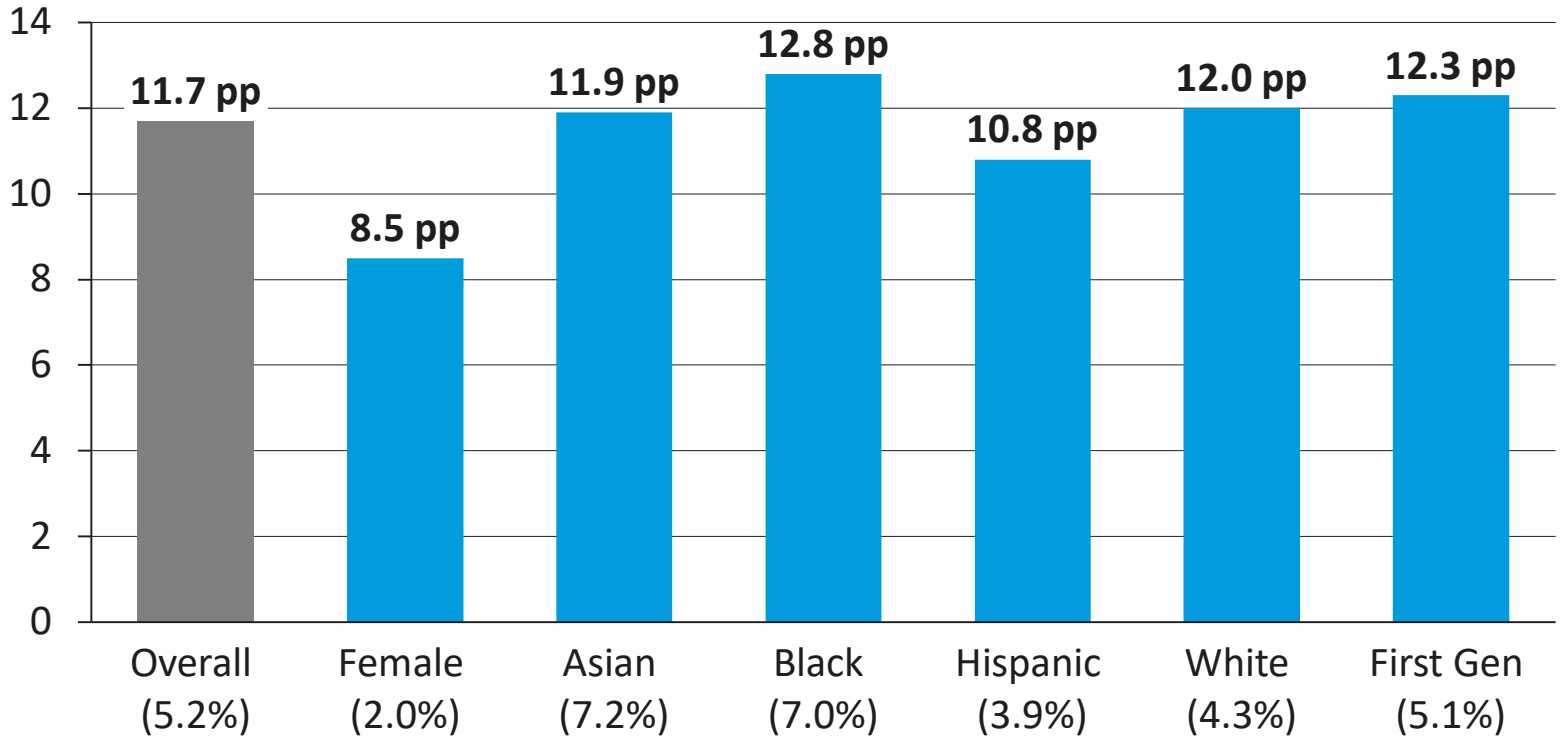


Note: Horizontal axis numbers in parentheses are the percentage of the non-CSP students in the subgroup who declare a STEM major. For example, 37.3% of non-CSP students declare a STEM major, while 48.9% of CSP students declare a STEM major for a 11.6 percentage point increase associated with CSP participation.

CS Major Declaration

CSP students are 11.7 percentage points more likely to declare a Computer Science major than otherwise similar non-CSP students.

Increase in CS Major Declaration Associated with CSP Participation



Note: Horizontal axis numbers in parentheses are the percentage of the non-CSP students in the subgroup who declare a CS major. For example, 5.2% of non-CSP students declare a CS major, while 16.9% of CSP students declare a CS major for a 11.7 percentage point increase associated with CSP participation.

Teachers love student enthusiasm for AP CSP

“The collaborative and exploration aspect of the curriculum helped me to create an atmosphere in which the students were truly interested and excited to learn.”

“Student enthusiasm ... they loved AP CSP. Several said it was the best class they had ever taken.”

“Student engagement and interest in the subject matter was amazing.”

“One of the aspects that went well this year is the student engagement. … I was very surprised when some of them said it was their favorite class, and it was from students I did not expect.”

Educator Panelists

PANELIST

Daniel Fancett-Stooks

Career and Technical Education Specialist

Henrico County Public Schools

PANELIST

Ted McNett

Assistant Supervisor of Career and Technical Education

Carroll County Public Schools

PANELIST

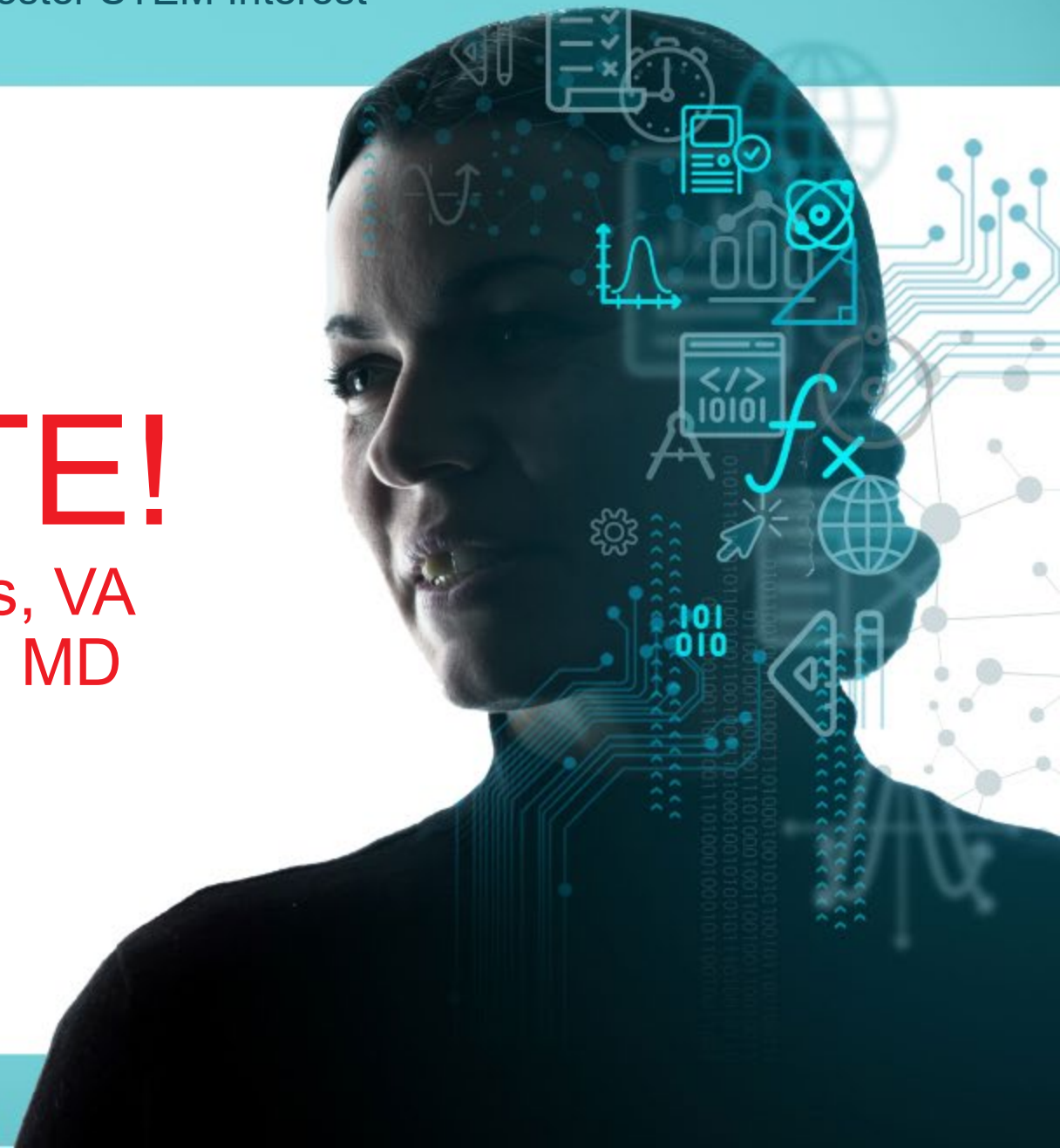
Matt Davis

Computer Science and Technology Education ExCITE Lead Teacher

Carroll County Public Schools

Project ExCITE!

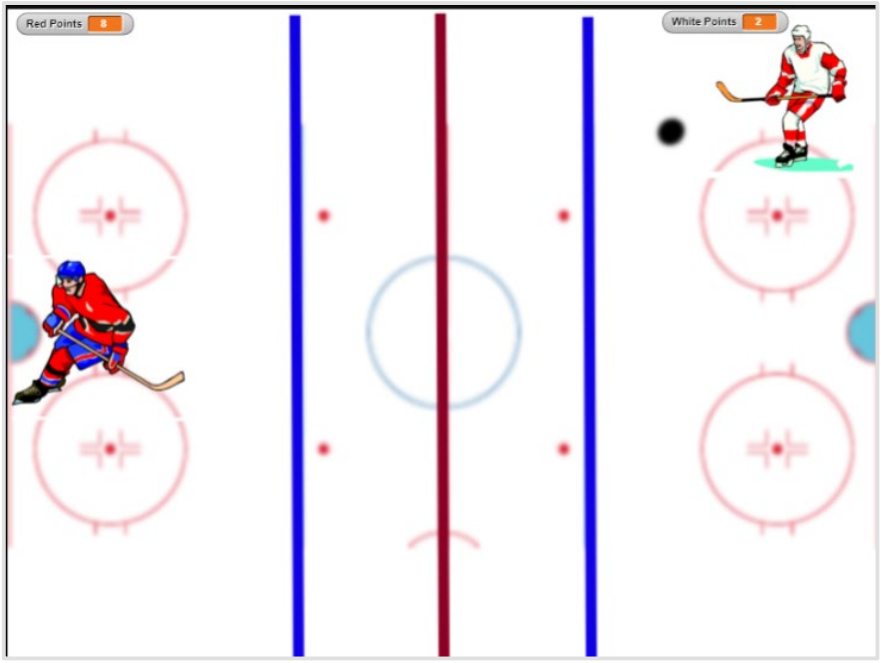
Henrico County Public Schools, VA
Carrol County Public Schools, MD

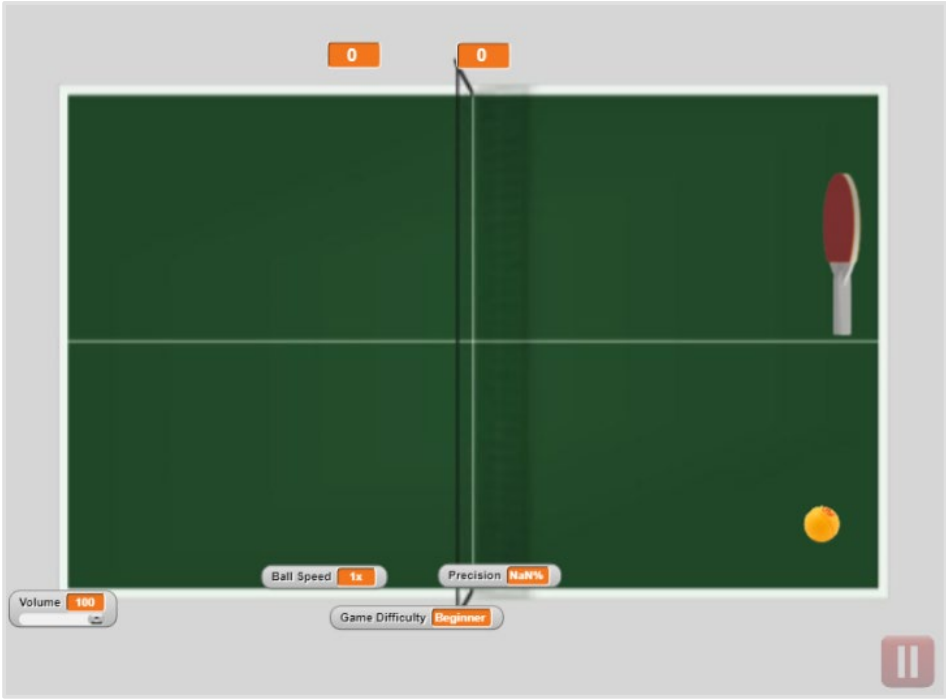


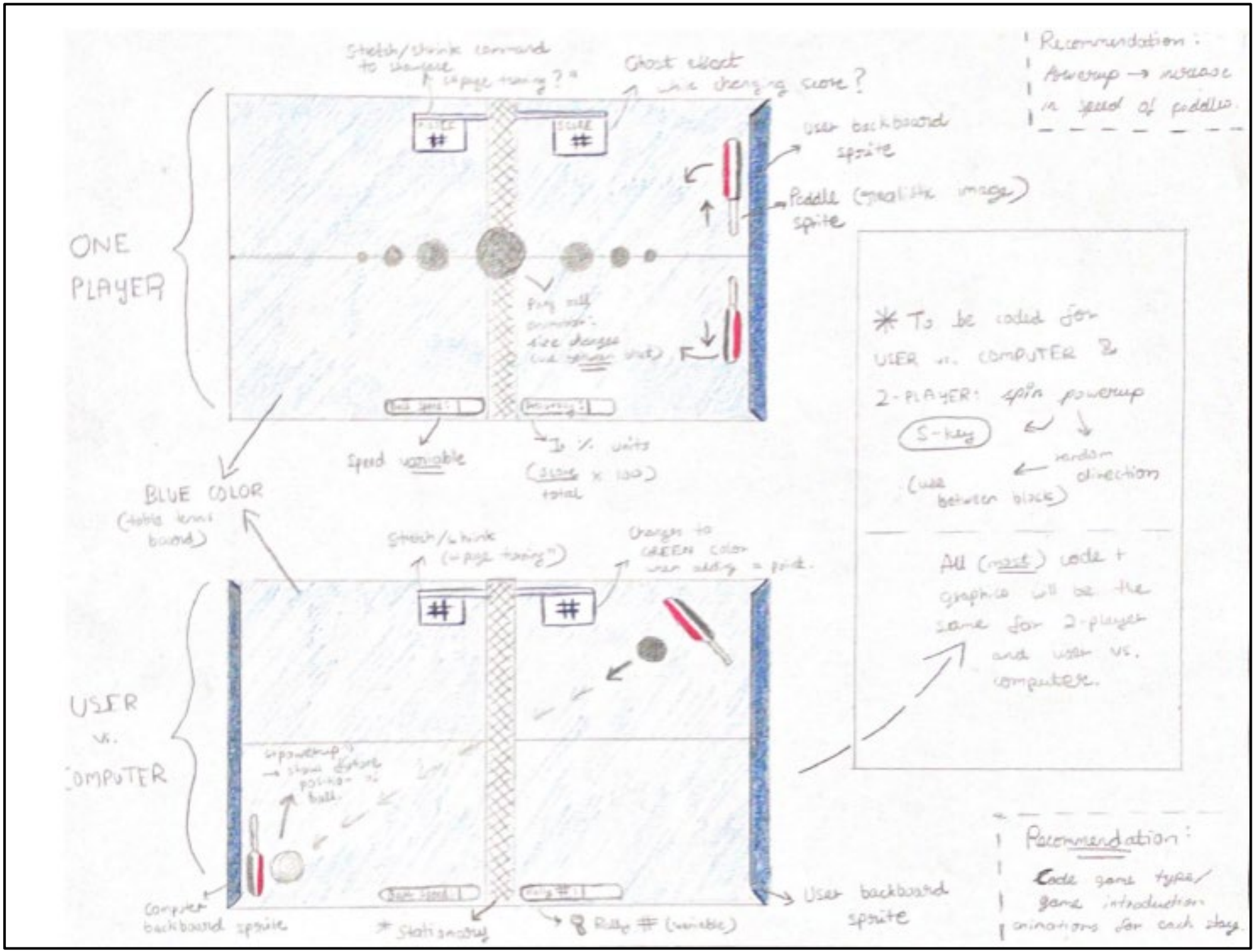
Classic Pong Game with a Twist!

Overview:

- Design Process
  - Identify parameters and brainstorm ideas around a theme
  - Sketch Ideas: Backgrounds, characters, ball types etc.
  - Create Prototype code: flow charts & decision tree, sample code
  - Test, collect feedback, revise based on feedback
  - Re-test, collect feedback, revise again
  - Finish/package code & branding
- Competitive Component
  - Voting based on user functionality and aesthetics



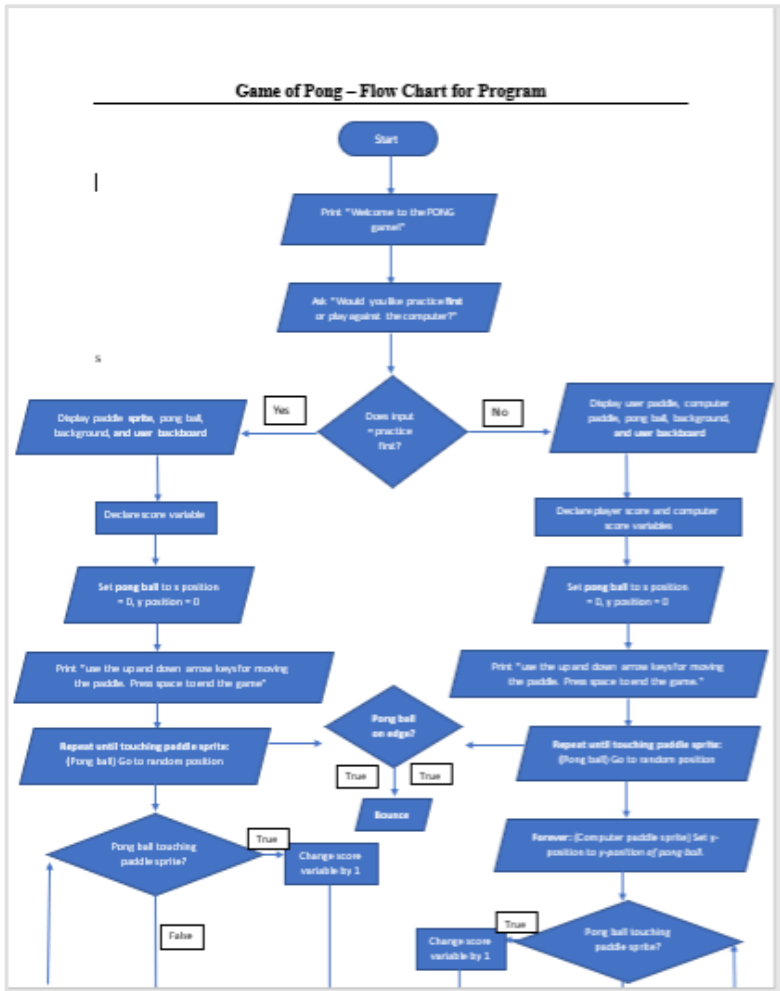


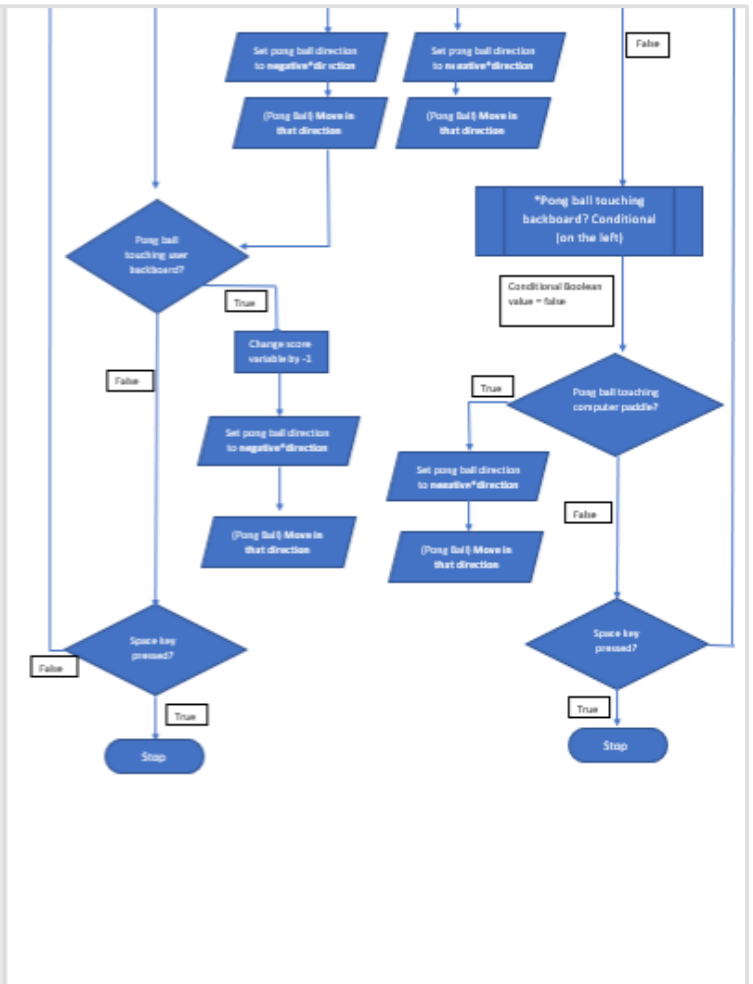


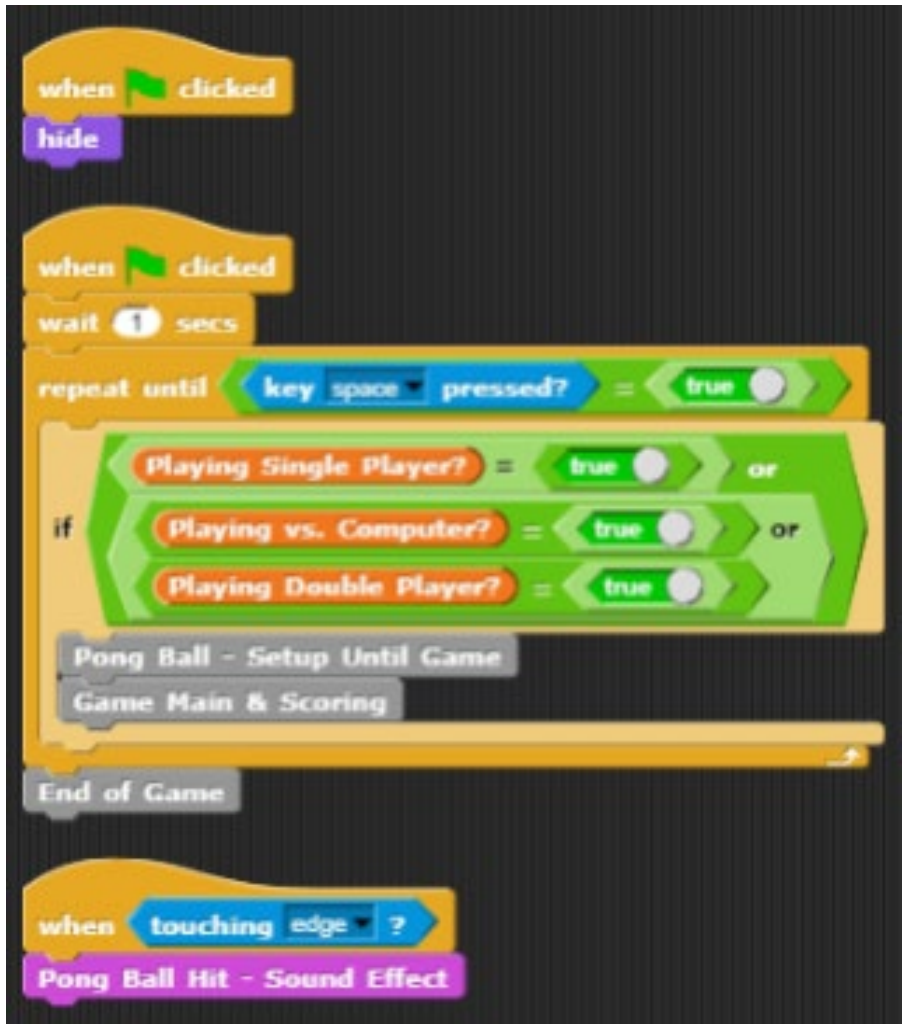
Classic Pong Game with a Twist!

Example of student conceptualization.

Classic Pong Game with a Twist!







EMS Station/Traffic Light activity is broken down into five main sections.

1. The Design Challenge
2. Programming the Traffic Light
3. The Call Comes In
4. Opening the Garage Door
5. Getting back to Normal

Design Challenge

An EMS Station is located on a busy highway, and when the EMS staff need to respond to an emergency call, they need to stop the traffic in both directions so they can exit the station safely.

There is a traffic light outside of the station that will assure that the EMS staff will be able to exit the station quickly. During normal operation, the light flashes yellow (or white), alerting drivers that the EMS station is nearby.

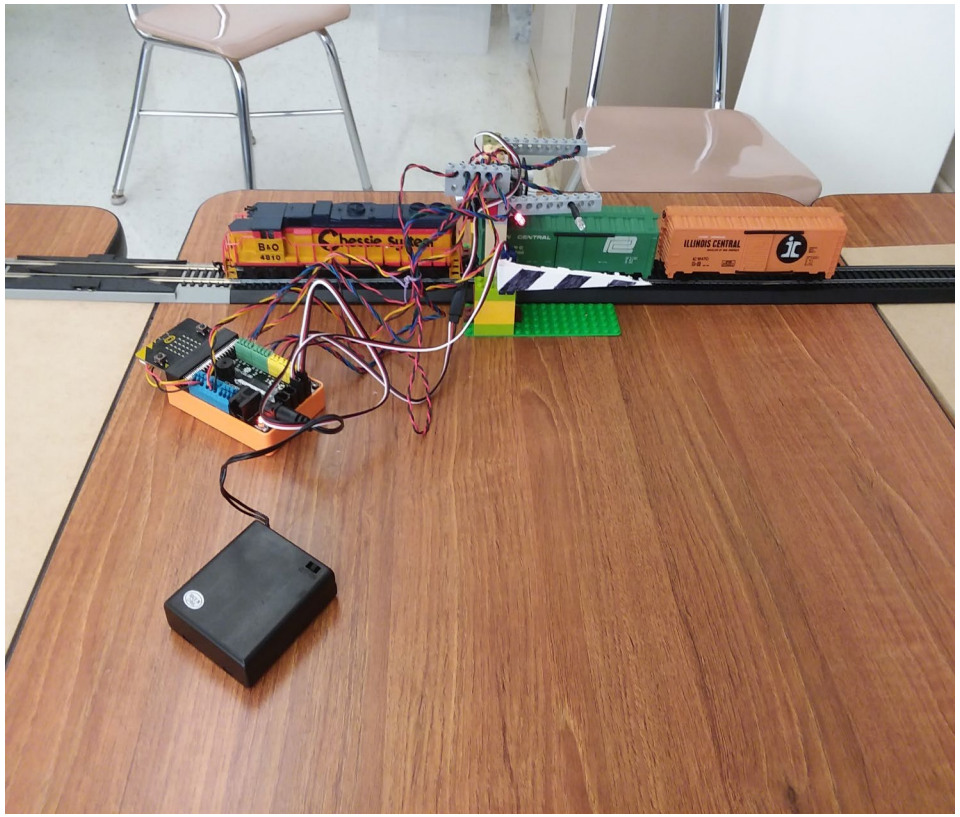
During an emergency, the light changes to a full-fledged traffic light, stopping traffic in both directions, thus allowing the EMS vehicles to enter traffic safely and expeditiously.

Students are tasked to design and build a Metro Access turnstile to verify Metro Cards and allow riders to enter the train area.

- The system will use light sensors to “read” a barcode off the rider’s Metro Card and generate a binary ID.
- The rider’s contact information and Metro Card validation are pulled from an already generated list.
- If the card is valid, the servo motors are activated, and the turnstile gate opens.

Railroad Crossing:

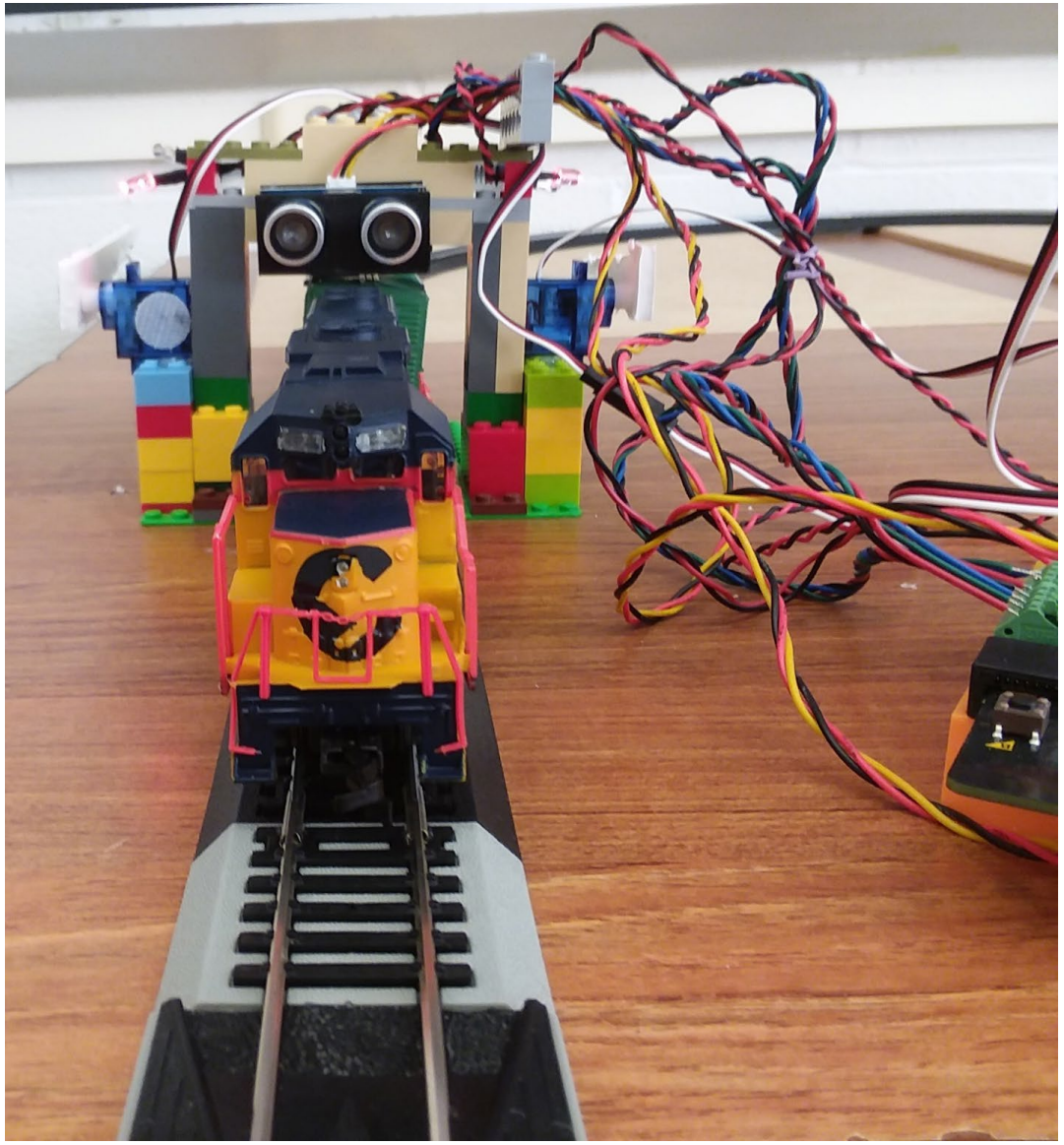
Students will learn how inputs from a sensor can be used by conditionals to control outputs and generate lists.



Railroad Crossing Project

Overview:

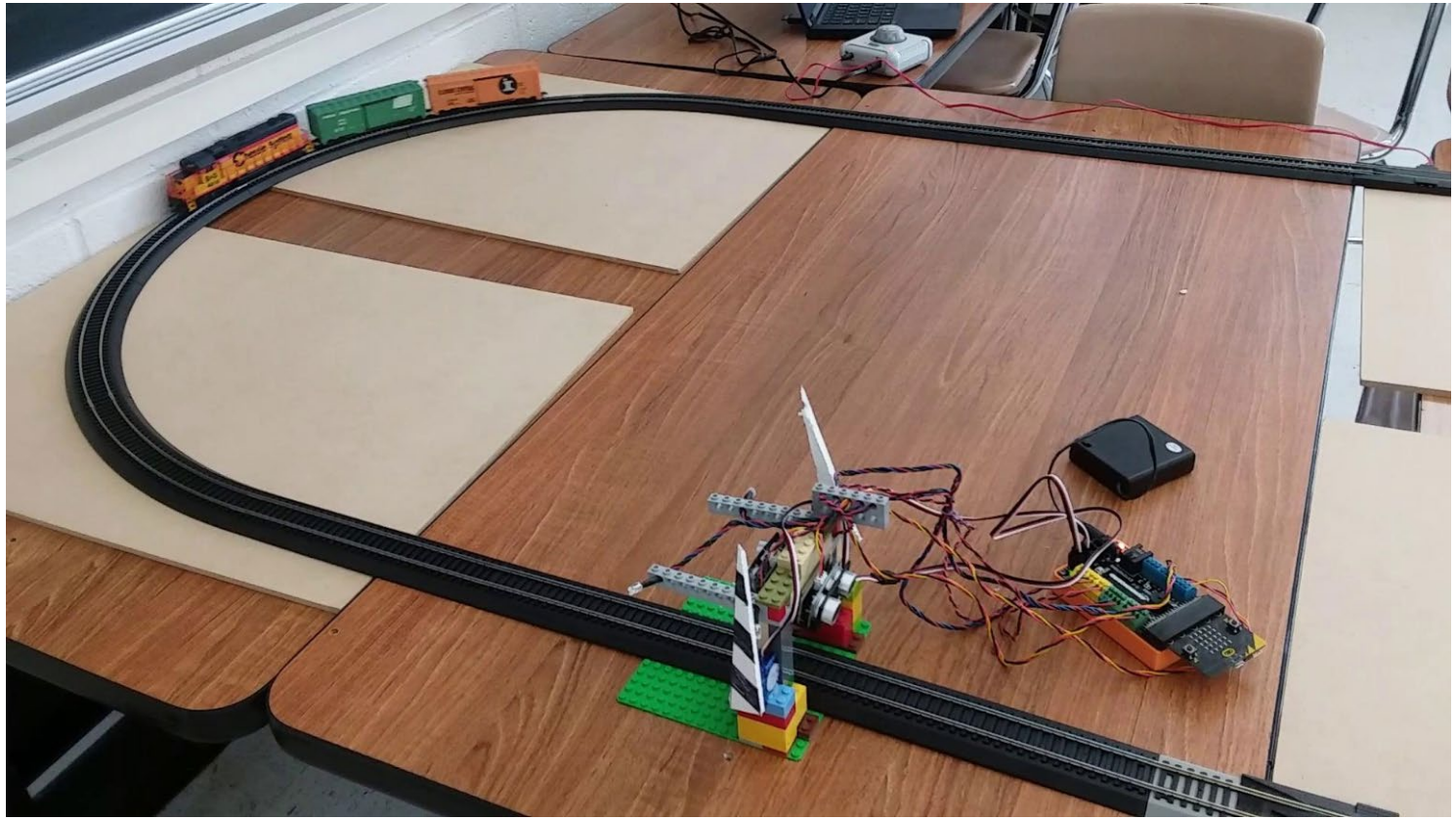
- Use of sensors, lights, servos and speakers to simulate a railroad crossing.
- Students learn to generate a ‘list’ that tracks date, time, and direction of travel.
- Make use of a train kit that can physically move, or use 3D printed trains to hand move to simulate. As authentic as you can make it!



Railroad Crossing Project

time table

12	A	B	C
1	3 4, 2020	14:38	Eastbound
2	3 4, 2020	14:38	Eastbound
3	3 4, 2020	14:38	Eastbound
4	3 4, 2020	14:39	Eastbound
5	3 4, 2020	14:39	Eastbound
6	3 4, 2020	14:41	Eastbound
7	3 4, 2020	14:41	Eastbound
8	3 4, 2020	14:41	Westbound
9	3 4, 2020	14:44	Westbound
10	3 4, 2020	14:44	Westbound
11	3 4, 2020	14:45	Westbound
12	3 4, 2020	14:45	Westbound



‘List’ that shows date, time, and direction.

“Flipped” Panel Discussions Breakout Rooms

Breakout Group Discussions

Each breakout group will discuss one of five questions.

1. Impact of real-world, hands-on content.
2. Systems and structures to support traditionally underrepresented students in first AP course.
3. Starting and growing a computer science program.
4. Engaging families and students in programming courses.
5. Fostering inclusiveness and belonging in computer science and/or AP courses.

When we return to large groups,

- One representative from each breakout group will speak
- Share a 2-3 sentence summary of the group's discussion
- Moderator and panelists' conversation

Breakout Group Discussions - Debrief

1. How do real-world scenarios serve to motivate students and support their understanding of coding, math, science, and engineering principles? What might be the benefits of a hands-on computer science instruction versus a more traditional model?
2. What systems and structures should be in place for educators to support traditionally underrepresented students in their first AP course experience?
3. What successes have you had when starting or growing a computer science program of study? What support do teachers and/or schools need in this work?
4. What strategies do you utilize when working with families and students to encourage participation in computer science/programming courses?
5. What strategies do you employ to encourage and recruit students to take more computer science and/or AP courses? How do you foster inclusiveness and belonging among your students once they are enrolled in these courses?

TI Education Technology is transforming the way teachers teach and students learn STEM (science, technology, engineering and mathematics) subjects.

Vince O'Connell

Director of School Partnerships | Texas Instruments

TI STEM Exchange

Texas Instruments

TI STEM Exchange

It Takes a Village:

State, Regional, and Community Support for STEM Learning

November 3, 2021 7:00 – 8:30 pm ET

Registration available soon at
https://education.ti.com/en/resources/ti-stem-exchange

TI STEM Exchange

Thank you!

Texas Instruments