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# Computer Science Education Resource Guide

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# Why computer science?

## Why Now?



We continue to be confronted with a public health crisis, social injustices, economic crisis, and the devastating impact of climate change. Rapid advances in technology are drastically reshaping how people live, work, and learn in a short period of time.

While there is great potential for technology to help address society's biggest issues, the pace of this change is also raising new challenges and intensifying existing inequities in our communities. It's critical that we apply technology and innovations to address these challenges without sacrificing core values like education and inclusion. See more about Microsoft's efforts to build inclusive economies at [Corporate Social Responsibility](#).

## Partnering for collective impact



We are proud to work with experienced non-profit partners, companies, education institutions, public agencies, and governments internationally to:

- Increase the number of students who have equitable access to inclusive computer science (CS) education and are exposed to pathways to future economic opportunity.

- Increase the number of educational institutions that have teachers with the capacity to offer CS courses and pathways independently.

- Increase the number of students in CS courses who are from groups historically excluded from learning CS and demonstrate interest and excitement in CS opportunities.

Microsoft supports computer science education efforts which encompass the study of computers, including their theoretical and algorithmic foundations, hardware, software, and their uses for processing information. A high-quality CS education equips learners to use computational thinking and creativity to build computing solutions. Computational thinking is a way of thinking about problems that leverages the power of technology, including concepts such as decomposition, pattern recognition, and abstraction.

This Resource Guide is a summary of Microsoft supported CS education initiatives that can assist school leaders, teachers, students, and nonprofits around the world, separated into the categories seen below.



Establish CS program



Set up classroom



Support students



Extend student learning

# Contents

## Establish CS program



### TEALS Program support

Key initiatives driven by Microsoft Philanthropies to build and grow CS programs

[Page 4](#)

### CS research

Microsoft supported research to help establish the importance and impact of CS education programs

[Page 5](#)

## Set up classroom



### Learning tools for CS students

Platforms that set the stage for meaningful learning

[Page 6](#)

### Learning tools for all students

Tools that help personalize learning to meet the needs of today's diverse learners, including students with learning challenges

[Page 7](#)

### Curriculum

Overview of CS course options and Microsoft curricula for primary and secondary learners

[Page 8](#)

## Support students



### Student success

Programming that can inspire and motivate learners to participate in CS related classes

[Page 10](#)

### Inclusion

Guides and activities to develop diverse, inclusive CS classrooms

[Page 11](#)

## Extend student learning



### Skills for Jobs

Certifications and courses that support post-secondary education

[Page 12](#)

### Partner organizations

Partnering organizations and their efforts to strengthen CS education

[Page 13](#)

# TEALS Program support



Establish CS program

Since 2009, the Technology Education and Learning Support (TEALS) Program has helped high schools build equitable, inclusive computer science programs in schools. TEALS helps classroom teachers learn to teach computer science on their own by pairing them with industry volunteers and proven curricula.

## Microsoft Philanthropies TEALS Program

### TEALS US Impact

The TEALS Program in the US supports over 500 schools and 650 classes in 29 states and in the District of Columbia. Since 2009, TEALS has connected more than 95,000 students to high quality CS education.

### Increasing access worldwide

Microsoft works with corporate and nonprofit partners to deliver the TEALS Program in new countries and regions. These partnerships so far have helped TEALS expand in 8 countries and will support 60 teachers at over 40 schools to teach 2000 students computer science in 2023!

### TEALS in community college

TEALS support for community colleges is piloting instructor and program capacity development for cybersecurity pathways across US community colleges.



*Exposing students to CS gives visibility to careers they might not have considered. It can also get them into a higher salary bracket, which helps their families and the entire community."*

– Kirk Thomas,  
New Orleans TEALS partner teacher



*The impact that the TEALS Program has brought in my life is learning new things about myself that I never thought I would know, and it has allowed me to be even more creative."*

– Imani Brock,  
New Orleans TEALS student



**Watch video** to see how CS education is impacting student trajectories in New Orleans, LA.



**Click here** to discover how TEALS partnerships in Ciudad Juárez, Mexico are increasing access to CS.



# CS research



Establish CS program

Data can raise awareness around the need for CS education advancements. It can also provide school leaders, teachers, policy makers, and advocates with information for implementation and policy strategies. This is a compilation of research supported by Microsoft that is available for all to access.

## US



### [Digital Equity Scorecard](#)

This scorecard shows the extent to which individual states are addressing the need for digital equity.

### [Code.org State of CS](#)

This annual report on K-12 computer science provides information on national and state-level computer science education policy, including policy trends, maps, state summaries, and implementation data.

### [National Governors Association Compact](#)

50 governors signed this compact to expand access to computer science education.

### [National Center for Women & Information Technology](#)

NCWIT provides research and statistics around women's involvement in IT and IT related subjects.



## Worldwide



### [Brookings Institute CS Research](#)

This research examines how to scale up and improve computer science education around the world. It features case studies of education systems from diverse regions and circumstances that have implemented CS education programs.

### [The Power of Digital Technologies and Skills](#)

The Organization for Economic Co-operation and Development (OECD) research is a synthesis of evidence generated through its surveys and analytical work that identifies the best policies and practices to foster technology-based innovation.

### [Microsoft and the United Nations \(UN\) Sustainable Development Goals \(SDG\)](#)

This report summarizes how Microsoft partners with organizations by contributing creativity, expertise, and know how to unleash the power of digital technology across the UN's 17 SDGs.

### [LinkedIn's Economic Graph](#)

LinkedIn partners with world leaders to analyze labor markets and recommend policy solutions to prepare the global workforce for the jobs of the future.

### [Microsoft Computer Science Curriculum Whitepaper](#)

This curriculum framework is a holistic and effective guide for education leaders to navigate the complexity of transformation, envision what's possible, and develop a strategy to achieve it.

# Learning tools for CS students



Set up classroom

Microsoft provides a variety of learning tools for primary, secondary, and post-secondary classrooms. These programs are optimized to support learners as they develop their CS skill set from beginning stages as they explore the field to more advanced coding platforms.

## Primary and secondary students



### Microsoft MakeCode

MakeCode is an online educational platform for students to learn computer science with Blocks, JavaScript or Python through building arcade games, doing physical computing with the [micro:bit](#), and modding Minecraft.

### Minecraft Education

Minecraft is a game-based learning platform that promotes creativity, collaboration, and problem-solving in an immersive digital environment.

### Flip

Flip is a video discussion and sharing app where curious minds connect to share their creations, build community, and learn together. Sign in to view the [Coding and Computer Science Collection](#).

## Secondary and post-secondary students



### GitHub

GitHub is a developer platform to build software. [Github Copilot](#) uses the OpenAI Codex to suggest code and entire functions in real-time. GitHub [Teachers](#) includes training options and access to GitHub [Classroom](#), a teaching tool that can help manage assignments. GitHub [Students](#) enables learners to build their skills and network.

### Visual Studio Code

This lightweight, but powerful source code editor supports multiple programming languages and a rich ecosystem of extensions.

### Azure for Students Starter

This starter code provides access to Azure products to develop in the cloud.

### Assignments in Teams for Education

Educators can assign, view, edit, and run Python files (.py) and Python Notebooks (.ipynb) directly in Teams.



In partnership with Microsoft, Connect 313 is helping to bridge Detroit's digital divide by providing CS training in high schools and ensuring that all Detroit residents have access to quality devices, internet access and tech support to improve learning, employment and well-being.



[Click here](#) to learn more about Connect 313's work in Detroit, MI.

# Learning tools for all students



Set up classroom

Microsoft's goal is to empower students with tools that help personalize learning to meet the needs of today's diverse learners and help them build life skills, including students with learning challenges.

## Literacy supports



### Immersive Reader

This inclusive reading tool includes features such as a read aloud function to help increase student comprehension. It began as a winning employee [hackathon](#) project.

### Reading Progress

Reading Progress builds a personalized reading experiences into assignments within Microsoft Teams. [Reading Coach](#) focuses question on the five words each student struggles with the most.

### Microsoft Translator

Translator services provide real-time translation for 100+ languages to support learners, families and members of the community.

### Dyslexia Training

In partnership with Made By Dyslexia, this program features tools to empower every person with dyslexia to reach their potential, including training for teachers.

## Infrastructure and classroom supports



### Accessibility

Accessibility related products and services expand access to technology, workforce, and the workplace at large.

### Adaptive Resources

Accessible accessories enable people to create inclusive systems.

### Digital Literacy

These modules teach learners how to use technology to find, evaluate, and communicate information.

### Microsoft Showcase Schools

This program supports schools in developing student-centered, immersive, and inclusive experiences by implementing the [K-12 Education Transformation Framework](#).

### Microsoft Teams for Education

Teams allows students, faculty, educators, and staff meet, work together, create content, and share resources.

The power of Office 365 to support student learning



## Microsoft Teams for Education

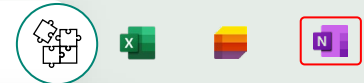
### Assess Skills and Knowledge:

Microsoft Forms, Interactive PowerPoint, Flipgrid, Coaching tools, [Reading Progress](#)



### Record/Share/Evaluate Data:

Power Automate, SharePoint List, Excel, Power BI, [Coaching tools](#), [Insights](#)



### Instruction/Intervention:

OneNote Notebook, [Class Notebook](#), SharePoint pages, Office 365, [Coaching tools](#), Recorded lessons



### Progress Monitoring/Evaluation:

Microsoft Forms, SharePoint Lists, Power BI, Insights data, [Reading Progress & Coach](#)



# Curriculum: Programming



Set up classroom

Microsoft provides framework and guidance as school leaders and educators select curricula. Below is a summary of curricular options for students exploring introductory computer science and computer programming.

## General resources



### [Microsoft Computer Science Curriculum Toolkit](#)

A set of information and recommendations for the development of computer science education standards for primary and secondary schooling.

### [Microsoft Learn Educator Center](#)

A center where educators can acquire certifications, find programs, and view lesson plans.

### [TEALS partner curricula](#)

A description of TEALS curriculum partners for a variety of CS related topics.



Patrick Wilson, student at Kansas State School for the Blind, [created a digital tool](#) using the programming skills he learned in his TEALS class.

## Computer Science Progression *Building Learning Pathways for all*

### Coding

Develops programming skills to craft custom projects and programs

### Transition to Coding

Transitions from block-based programming to a programming language such as Python or Java

### Block Coding

Builds computational thinking and block-based programming skills

### Computational Thinking

Introduces computational thinking with block-based coding

Adapted from the [Microsoft Computer Science Curriculum Toolkit](#), page 20

## Introduction to Computer Science



A semester or full-year course that explores a variety of basic computational thinking and programming concepts.

### [CS Unplugged](#)

Curricula that explores CS via engaging games and puzzles.

### [Minecraft Educator Resources](#)

This site contains over 500 lesson plans across subjects to help educators teach using Minecraft.

### [Advanced Placement Computer Science Principles with MakeCode](#)

A block-based programming environment for coding beginners.

## Computer Programming



A full-year course focused on learning a programming language such as Java or Python focusing on concepts such as problem solving, abstraction, and data structures.

### [Minecraft Educator Resources](#)

Over 500 Minecraft lesson plans across a variety of subjects.

### [MakeCode Resources](#)

Curriculum and projects to help bring MakeCode into the classroom.



# Curriculum: AI, Cybersecurity, and Sustainability



Set up classroom

Setting up a CS program involves building a pathway of courses to advance student learning. Below is a summary of curricular options for secondary students in cybersecurity, sustainability, data science, machine learning, and artificial intelligence.

## Cybersecurity



A full-year course that explores the fundamental concepts or applied skills of cybersecurity and may involve project-based labs in a secure environment or virtual range.

### CloudCraft

CloudCraft is a world within Minecraft that explores the important role data centers play. Learners can explore how data is managed and protected across the globe. CloudCraft is modeled after the [We Live in the Cloud](#) datacenter virtual tour.



*The CS Fair was an eye-opening experience for me. I have always wanted to go into CS, but I didn't have a clue as to what I wanted to do or achieve in the field."*

– Walla Walla High School Senior



[Click here](#) to learn more about the 2022 Eastern Washington CS Fair.

## Sustainability



A semester or full year course that teaches environmental awareness and action.



### MakeCode Arcade

Activities that encourage exploration of sustainability concepts such as [Save the Forest](#)



### Climate and Sustainability Kit

A kit of more than 20 Minecraft lessons and pre-built worlds including [Sustainability City](#) and [Biodiversity](#)



### Hacking for STEM

Inquiry and project-based activities to visualize data such as [Day of Data: Orcas](#)

## Data Science/Machine Learning (ML)/Artificial Intelligence (AI)



A semester or full-year course that explores the fundamental concepts or applied skills of data science, ML, and/or AI.



**GitHub Curriculum for beginners including:**

### Data science

A 10-week, 20-lesson project-based curriculum.

### Machine learning

A 12-week, 26-lesson curriculum focused on classic machine learning.

### Artificial intelligence

A 12-week, 24-lesson curriculum focused on knowledge representation, neural networks, deep learning, and more.

# Student success



Support students

Even when CS classes are available in schools, there is a divide in who participates in those courses. Introducing events that build interest can inspire primary and secondary students to get involved with CS. Challenges and scholarships can help motivate secondary students to continue and extend their efforts over time.

## Challenges



### [The Microsoft Garage](#)

The Garage has locations worldwide that often host hackathons and activities for students, educators, and STEM/CS-related topics.

### [Imagine Cup Junior](#)

Students aged 16 plus can learn about technology and how it can be used to solve some of the world's biggest challenges, while participating in a global student challenge.

### [Minecraft Build Challenge](#)

Build challenges are easy to implement activities to engage students' creativity and 21<sup>st</sup> century skills.

## Scholarships



The following scholarships are for seniors in high school pursuing a post-secondary education opportunity in the United States.

- [Blacks at Microsoft Scholarship](#)
- [HOLA at Microsoft Scholarship](#)
- [Microsoft Disability Scholarship](#)
- [Microsoft Data Academy Scholarship](#)
- [Women at Microsoft Scholarship](#)
- [LinkedIn Possibilities in Tech Scholarship](#)

## Building interest



### [Computer Science Education Week](#)

Every December, CS Ed Week promotes a call to action to inspire primary and secondary education students to learn CS, advocate for equity, and celebrate the contributions of students, teachers, and partners to the field.

### [DigiGirlz](#)

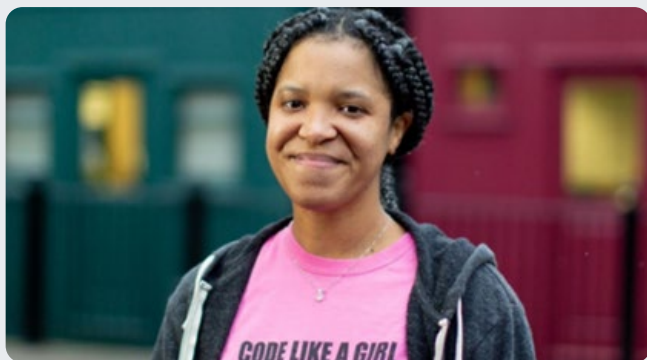
Microsoft offers DigiGirlz for girls in secondary school to learn about careers in tech, connect with Microsoft employees, and participate in hands-on workshops.

### [Minecraft Student Ambassador Program](#)

This Minecraft learning path helps students and educators understand how to create, sponsor, and implement a student leadership program.

### [CS Student Opportunities](#)

TEALS Program curates CS related student opportunities.



*The more lives I touch, the more ripples I make in the pond. I'm passionate about investing in particularly underserved and underrepresented kids in the tech industry, to show them they have opportunities."*

— Brandy Foster, CS classroom volunteer, Detroit MI



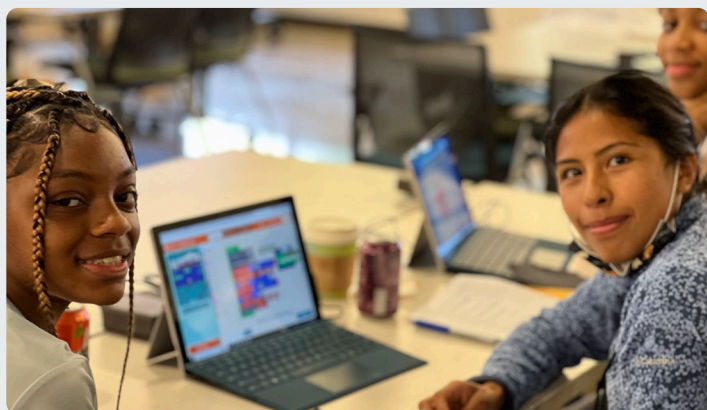
[Click here](#) to learn more about Brandy's volunteer work in CS classrooms.

# Inclusion



Support students

Knowledge of computer science is fundamental to students' future careers. Microsoft delivers and supports programs worldwide that address the changing economy and digital divide with focus on those historically excluded from opportunity due to race, gender, or geography.



High school students participate in Redmond, WA DigiGirlz summer camp.

## Guides and Toolkits



### [Guide to Inclusive CS Education](#)

This guide provides school leaders and educators with context and concrete steps to build and expand inclusivity in CS education.

### [Closing the STEM Gap](#)

This report analyzes why STEM classes and careers still lack girls and what we can do about it.

### [CS Student Recruitment Toolkit](#)

This toolkit features a large variety of resources to increase diversity in secondary classrooms.

### [Microsoft Inclusion Journey](#)

This content library includes videos on allyship, bias, covering, empathy, growth mindset, identity, inclusion opportunity, intersectionality, and privilege.

## Access



The right and opportunity for all students to learn and experience computer science.

## Diversity



Ensuring CS courses and programs have student enrollment rates that reflect the demographics of the larger school or community population.

## Inclusion



Creating learning environments that are accessible and welcoming of students' identities, backgrounds, differences, and perspectives without barriers or judgment. This means actively attending to race, gender, or geography.

### Access

Availability of CS to all students

### Diversity

Students' participation reflects school demographics

### Inclusion

All students are engaged and learning

Culturally responsive teaching and learning

Engaging curriculum

Universal design and accessibility

# Skills for Jobs



Extend student learning

CS offers the opportunity to constantly learn and improve. The resources below offer extended learning options for secondary and post-secondary students.

## Internships



### Microsoft Explore

Microsoft Explore is a 12-week summer internship program for first- and second-year college students. The program is rotational and allows students from the US, Canada, and Mexico to gain experience in different software engineering roles.

### University Internship

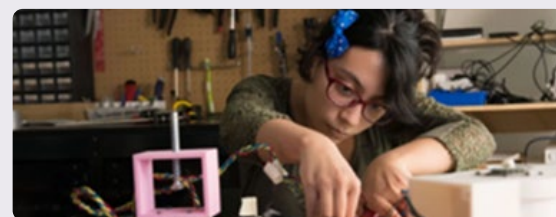
The University Internship provides opportunities for current students in Bachelor's, Master's, MBA, PhD programs in the US and Canada.

### GitHub Internship

The GitHub internship provides work experience by pairing students with GitHub employees on real projects in the US.

### Microsoft Internships

Search here for internship opportunities across Microsoft worldwide.



*You can't build a more equitable and sustainable future without making sure that learners have access to resources and an environment where they can thrive."*

– Cathy Chen,  
Director of the El Paso Fab Lab



**Click here** to learn how students such as Wendy Sandoval created a prosthetic robotic arm for her friend in the Fab Lab.

## Skills for Jobs



### Skills for Jobs

Helps people excluded from the digital economy gain foundational, role-based, and technical skills by offering learning pathways on [LinkedIn](#), certifications, and connections to jobs. Note that LinkedIn has an age requirement of 16 years old.

### Microsoft TechSpark

A program that fosters economic opportunity and job creation in partnership with communities across the US. View the [playbook](#) for details on TechSpark resources, framework, and case studies.

### Microsoft Leap

A program that recruits, develops, and upskills employees in technology related roles. This paid program offers 4 weeks of structured learning and 12 weeks of on-the-job training.

## Certifications



### Microsoft Learning Paths

Provide students with modules associated with each of the [certifications](#) listed below.

- [Introduction to Azure Fundamentals](#)
- [Microsoft Azure Data Fundamentals](#)
- [Microsoft Azure Artificial Intelligence Fundamentals](#)
- [Microsoft Security, Compliance, and Identity Fundamentals](#)

### Minecraft Certification

Prodigy provides Minecraft certifications in introduction, intermediate, and advanced levels.



# Partner organizations



Extend student learning

Microsoft partners with nonprofits to create long lasting impact in the computer science education space.

## Resources for educators and school leaders



### Computer Science Teacher Association

CSTA creates an environment of support for CS teachers. The [CSTA Equity Fellowship](#) is a year-long program that develops leadership in equitable teaching practices and advocacy.

### CSforAll



The CSforAll [SCRIPT](#) (Strategic CS for All Resource & Implementation Planning Tool) guides teams through exercises to create or expand a CS education implementation plan. CSforAll partners with [JROTC](#) (Junior Reserve Officer Training Corps) cadets to advance cybersecurity education.

### Kapor Center



Kapor Center seeks to level the playing field in tech. The Culturally Responsive-Sustaining CS Education Framework guides CS program development.

### Junior Achievement



JA delivers hands on, immersive learning in work readiness, financial health, entrepreneurship, sustainability, STEM, economics, and more.

### Generation Unlimited



The world's first Public-Private-Youth Partnership (PPYP), Generation Unlimited brings together the best of each sector to create and unlock opportunities for young people.

### 4H



4H empowers young people to lead for a lifetime and has developed coding activities for young coders.

## Resources for students



### Code.org

Code.org provides Hour of Code activities, curriculum, and advocacy for policies to expand and sustain access to K-12 computer science.



### Girls Who Code

Girls Who Code supports clubs, summer programs, and college and career programs for girls.



### Last Mile Education Fund

The Last Mile Education Fund provides grants to support students within four semesters of graduation.



### Reboot Representation

This coalition of tech companies seeks to build diverse teams in the tech sector.



### NCWIT

The National Center for Women & Information Technology provides a toolkit to design engaging and inclusive CS experiences, a Computing for Counselors initiative, Aspirations Award, and posters for the classroom.



### FFA

The FarmBeats program combines an affordable hardware kit with curriculum and activities designed to give students hands-on experience in applying precision agriculture techniques to food production.

# Computer Science Education Resource Guide



Earn a badge by completing the Learn Module: [aka.ms/Microsoft-CS-Module](https://aka.ms/Microsoft-CS-Module)

