# Computer Science for Social Good

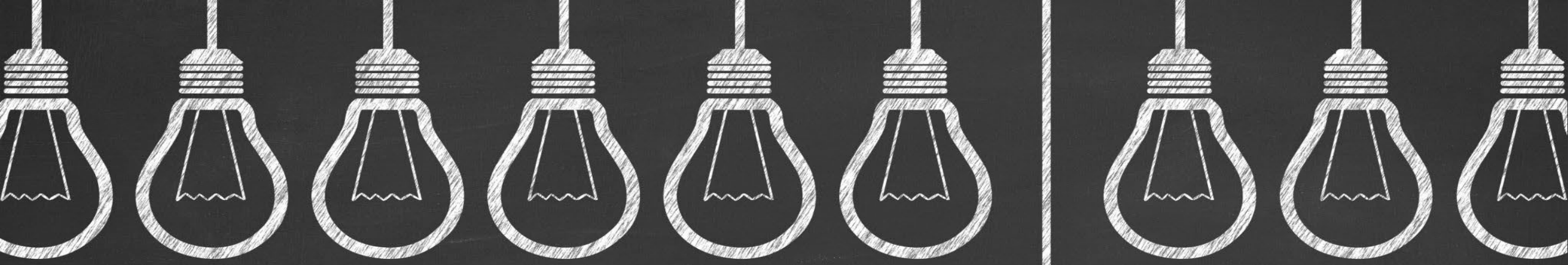**CSforSocialGood**

# Project Description

- Building Capacity for Indiana Preservice CS Education

- IN DOE grant

- PDs & Workshops

# What is Computer Science?

- Try to describe Computer Science without searching it online!

**"**

*Computer Science is "the study of computers and ALL the phenomena that arise around them."*

Herbert Simon

◎ Internet
◎ Artificial Intelligence
◎ Digital divide

◎ Human habits
◎ Economy
◎ Communication

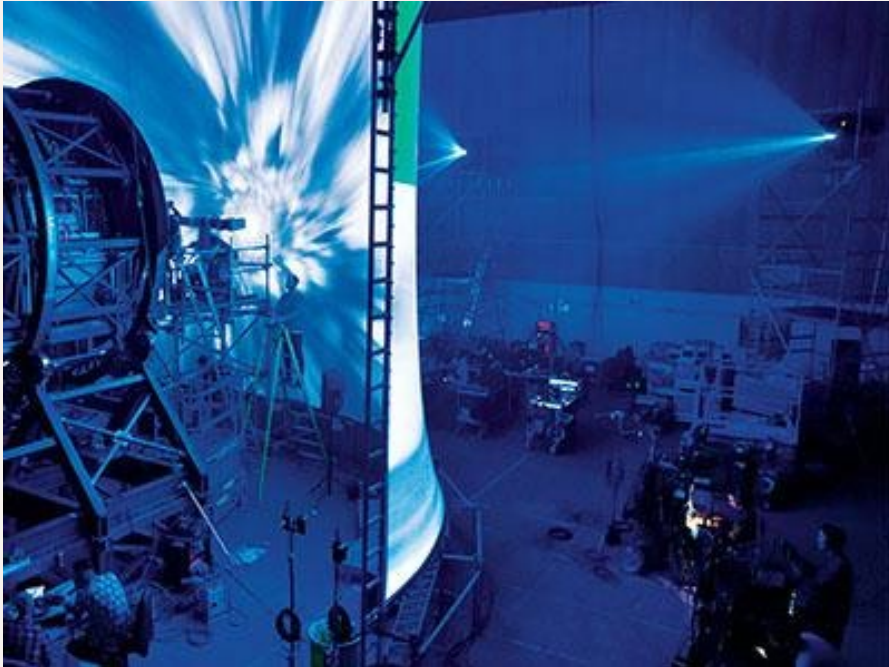…and many more

# INFORMATION TECHNOLOGY



Designing security software or developing mobile communication devices, networks and applications

# MANUFACTURING



Designing and using simulations to improve products

# ART



Designing new special effects for movies or composing digital music

# FINANCIAL SERVICES



Designing and overseeing automated trading services

## HEALTHCARE



Exploring the vast quantities of data produced by new DNA sequencing techniques, and more

## RETAIL



Analyzing data to predict trends and improve inventory management

## LAW ENFORCEMENT



Using CS and computer technologies in policing to detect, monitor and position.
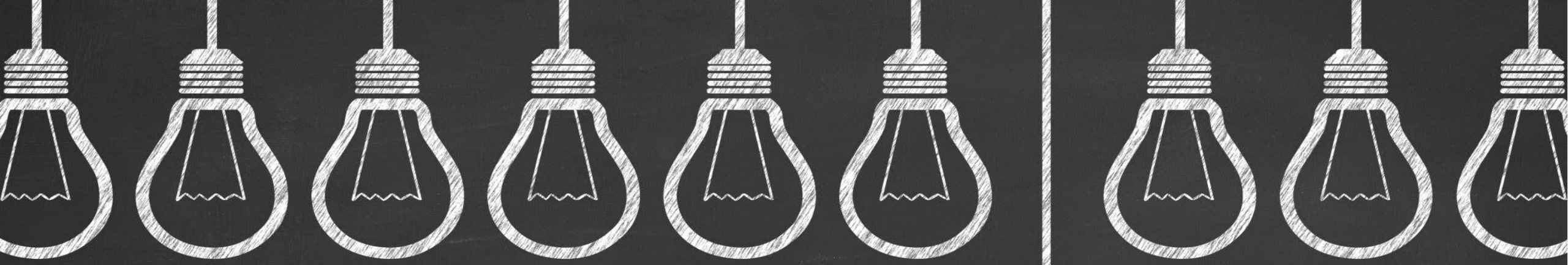
## ARCHEOLOGY/HISTORY



Analyzing data and patterns collected with latest technology to investigate history and people of the past.

"

*Computer science (CS) is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society.*

Tucker, 2003, p. 6

# What do we teach CS?

- Try to think of one or more possible reasons for us to teach CS.
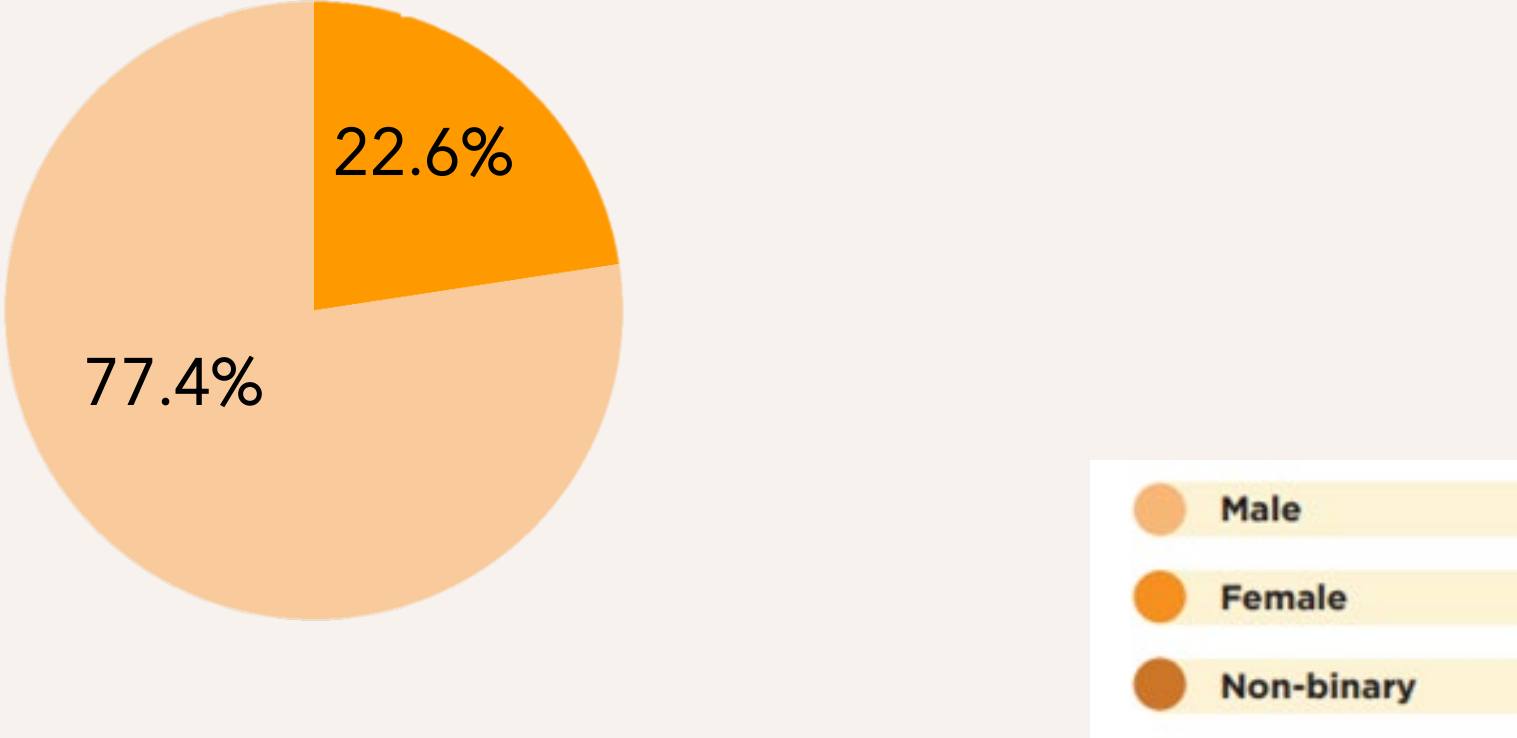
# CS is important in K−12 Education because…

Not all of today's K-12 students will need to develop their own machine learning algorithms…

…but most will need to be able to identify, understand, and resolve the critical issues around the use of tomorrow's technology.
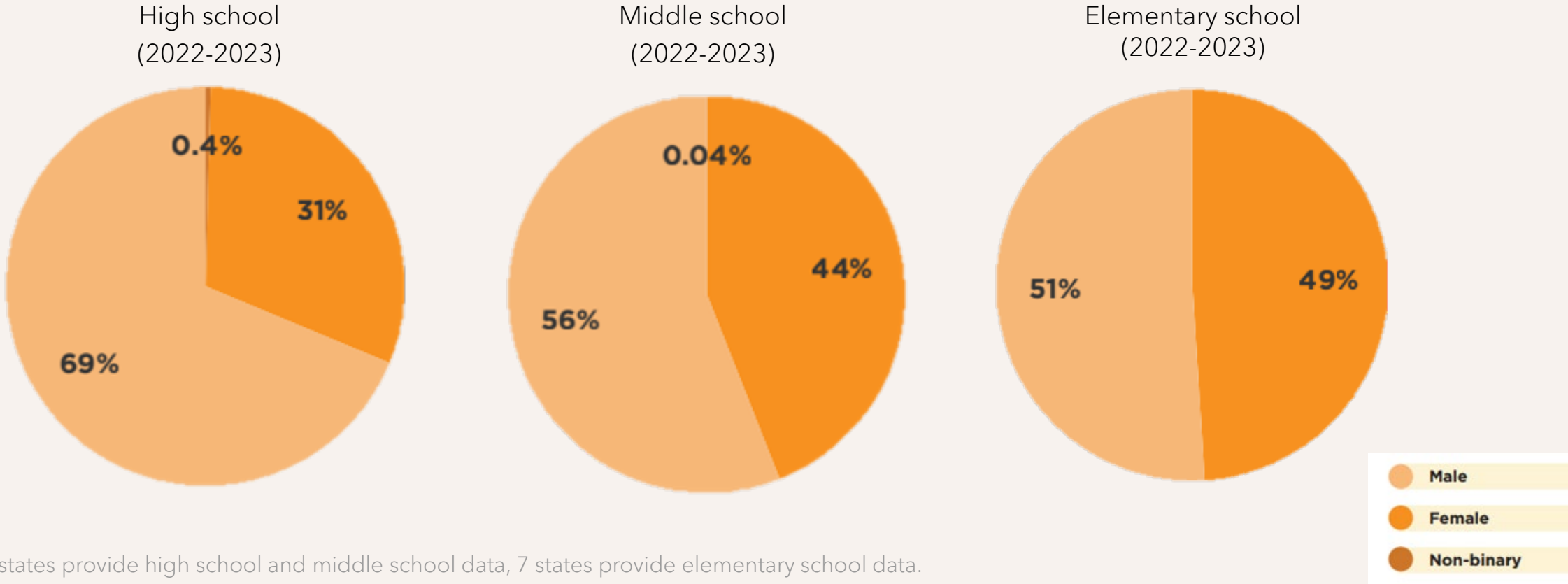
What is the percentage of women majoring in Computer Science at universities in the US?

# Gender gap in the field of CS
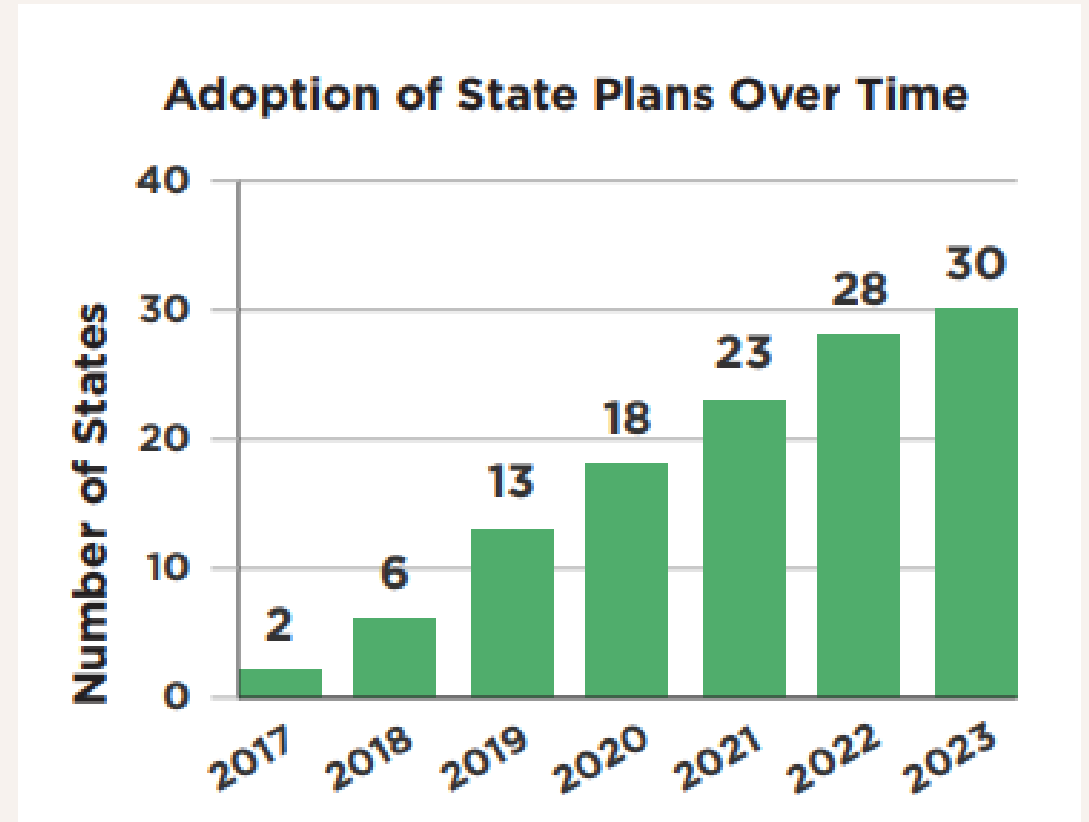
Higher education (2021-2022)



22.6%

77.4%

Male

Female

Non-binary

(National Center for Education Statistics, 2022; Code.org et al., 2023, p. 38)

# Gender gap in the field of CS



High school
(2022-2023)

0.4%

31%

69%

Middle school
(2022-2023)

0.04%

44%

56%

Elementary school
(2022-2023)

51%

49%

Male

Female

Non-binary

*31 states provide high school and middle school data, 7 states provide elementary school data.

(Code.org et al., 2023, p. 43, 45)

# US State Plans for K–12 CS education

The awareness of implementing CS education is growing in the US.



**Adoption of State Plans Over Time**

# CS Education in IN

**SEA 172**
Signed Into Law May 2018

"**After June 30, 2021**, each public school, including each charter school, shall include computer science in the public school's curriculum for students in kindergarten through grade 12."

CS Must incorporate K-8
Must offer *at least 1* high school CS course
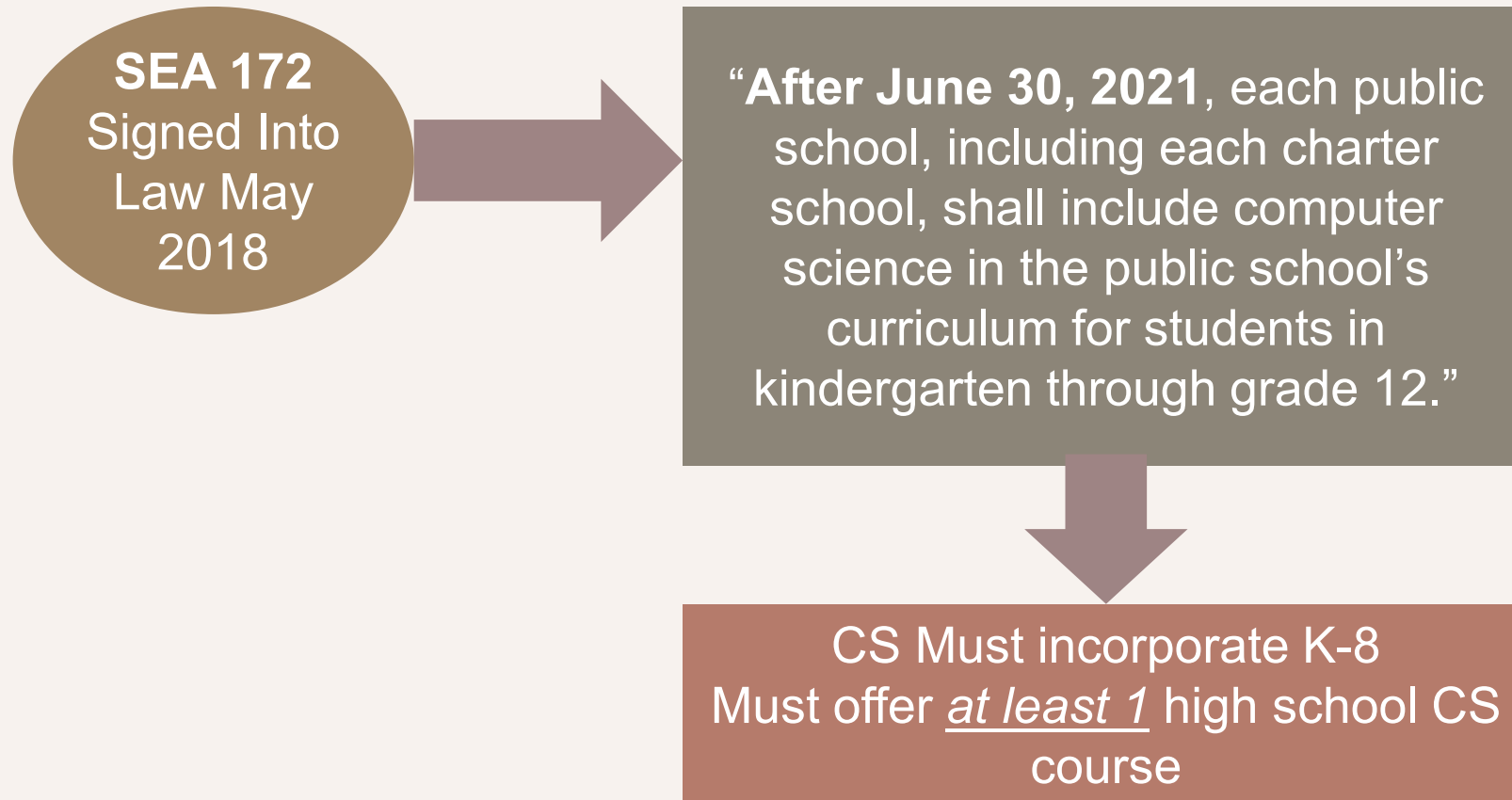
# Indiana – A recognized leader in CS education

### Kathleen Gallagher: Indiana is far ahead of other Midwest states in crucial computer science training

**By Kathleen Gallagher** Special to the Journal Sentinel
Published 2:48 p.m. CT Oct. 20, 2020 | Updated 8:22 a.m. CT Oct. 22, 2020

**View Comments**

When Pump-CS went virtual this summer, twice as many middle school teachers as expected signed up to learn how to teach computer science. So Marquette University professor Dennis Brylow, who runs Pump-CS, scrounged up two additional facilitators and all 50 teachers got trained.

It was no surprise the extra help came from Indiana.

### Indiana Once Again Identified as National Leader in Computer Science Education

Wednesday, October 14, 2020
Adam Baker
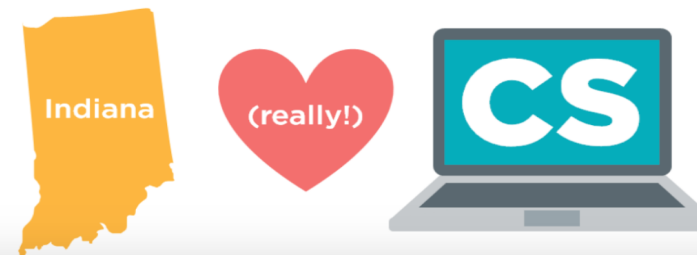Press Secretary
(317) 232-0550
abaker@doe.in.gov

INDIANAPOLIS – The Indiana Department of Education (IDOE) today shared a 2020 report highlighting Indiana a national leader in computer science education, for the second consecutive year. Created by Code.Org, the Computer Science Teachers Association, and the Expanding Computing Education Pathways Alliance, the 2020

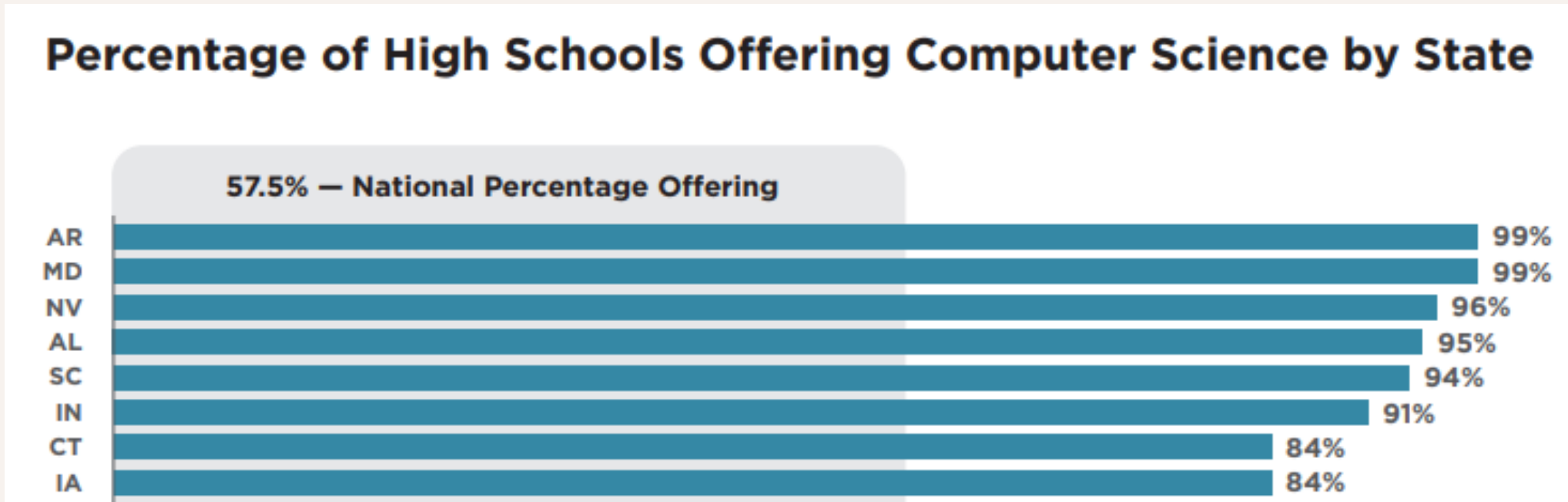### Indiana becomes third state in the country to adopt all 9 CS policies

Code.org · Jan 18, 2019 · 2 min read

The state of Indiana has joined Arkansas and Idaho as one of just 3 states across the country that have adopted all nine of the Code.org Advocacy Coalition's policies. These policies cement computer science as a fundamental element in the state's education curriculum!

# CS Access Report



**Percentage of High Schools Offering Computer Science by State**

57.5% — National Percentage Offering

| State | Percentage |
|-------|-----------|
| AR | 99% |
| MD | 99% |
| NV | 96% |
| AL | 95% |
| SC | 94% |
| IN | 91% |
| CT | 84% |
| IA | 84% |

Indiana is the 6th in the nation in high schools offering CS.

# CS Education in IN

In Indiana, only 6% of high school students took foundational CS in 2022-2023.

Within this 6%, 24% were female.

- 94% high school students didn't take foundational CS
- 6% high school students took foundational CS
- 1.44% female high school students took foundational CS

(Code.org et al., 2023, p. 43, 45)
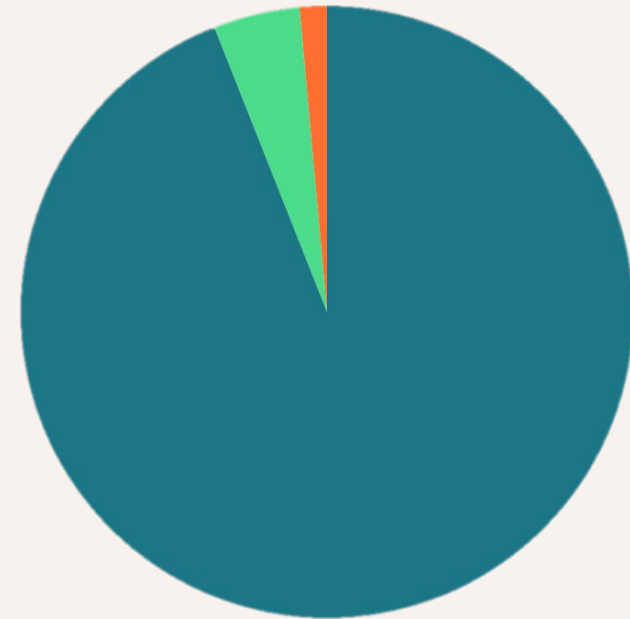
What are the possible reasons behind the underrepresentation of women in the field of Computer Science?

# Underrepresentation, so what?

# Harmful design bias examples

- **Seatbelts:** Designed for men, children and women injured more often (47% more likely to be injured)

- **Google Speech Recognition:** 70% more likely to recognize male speech

- **Smartphones:** Designed for larger hands

- **Soap Dispensers:** Designed for certain skin tones and locations

# Ways to include CS in education − CS Standards



K − 8 Science Standards C
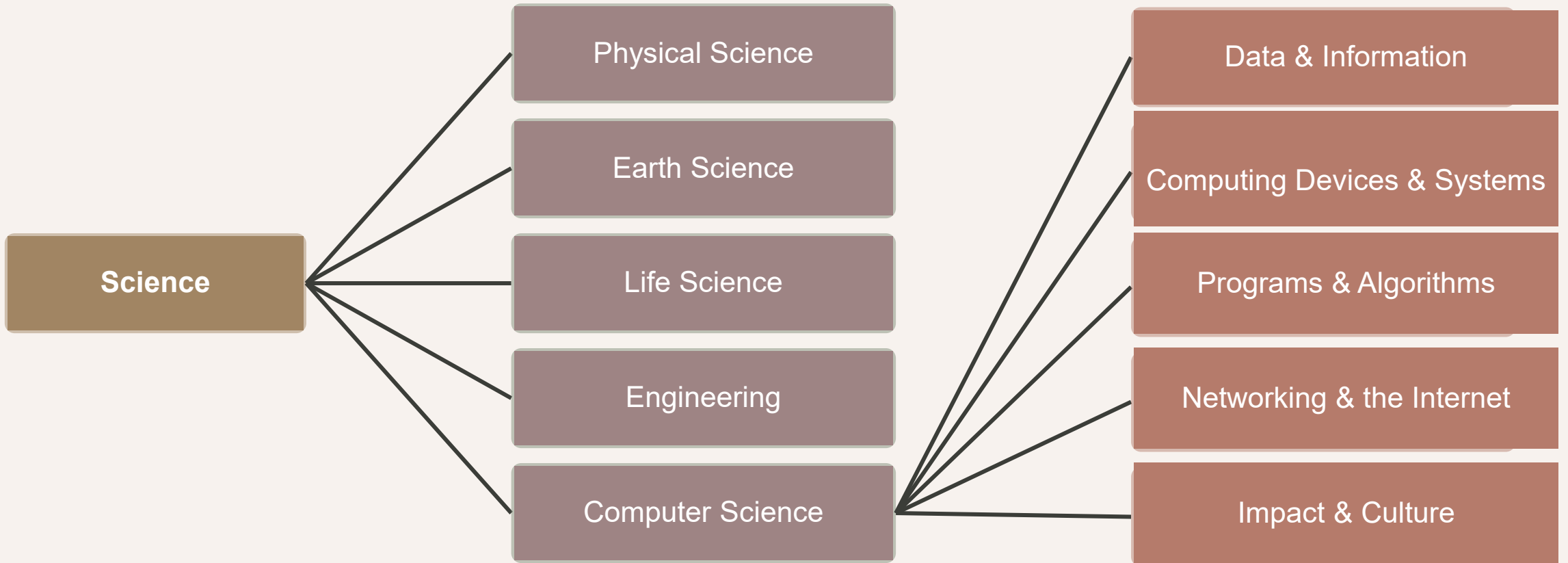
# CS for Social Good



CSforSocialGood

How can we use CS to promote social good?

# Introduction

- Developed by an IU research project.

- Targeting at 6$^{th}$ - middle school students.

- Project + problem-based learning

- Learning goals
  - Basic block coding skills (Scratch)
  - Computer Science, culture, and kindness
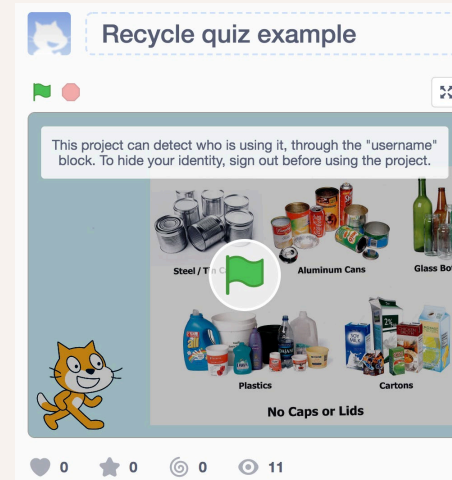
**CSforSocialGood**
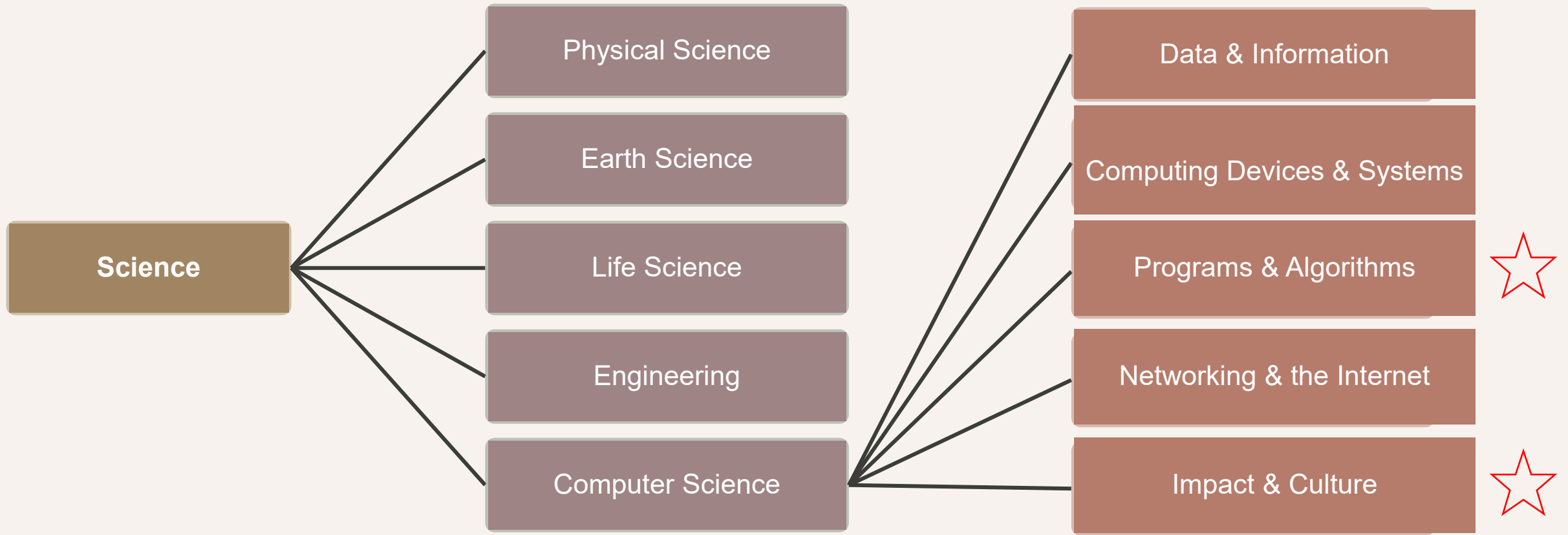
# CS for Social Good Curriculum

- What is CS

- Scratch Introduction

- Design a Scratch project

- Brainstorm kindness examples

- Explore social good Scratch projects

- Design a social good Scratch project

# CS Standards

```
                    ┌──────────────────────┐              ┌──────────────────────────────┐
                    │   Physical Science   │              │      Data & Information       │
                    └──────────────────────┘              └──────────────────────────────┘

                    ┌──────────────────────┐              ┌──────────────────────────────┐
                    │    Earth Science     │              │ Computing Devices & Systems  │
                    └──────────────────────┘              └──────────────────────────────┘

┌──────────────┐    ┌──────────────────────┐              ┌──────────────────────────────┐
│   Science    │    │     Life Science     │              │     Programs & Algorithms    │   ☆
└──────────────┘    └──────────────────────┘              └──────────────────────────────┘

                    ┌──────────────────────┐              ┌──────────────────────────────┐
                    │     Engineering      │              │    Networking & the Internet │
                    └──────────────────────┘              └──────────────────────────────┘

                    ┌──────────────────────┐              ┌──────────────────────────────┐
                    │   Computer Science   │              │       Impact & Culture       │   ☆
                    └──────────────────────┘              └──────────────────────────────┘
```

# What is Scratch

It is a **block-based programming application** where you can create your own interactive stories, games, and animations.

Created by the Lifelong Kindergarten Group at the MIT Media Lab.

Scratch helps young people learn to think creatively, reason systematically, and work collaboratively.
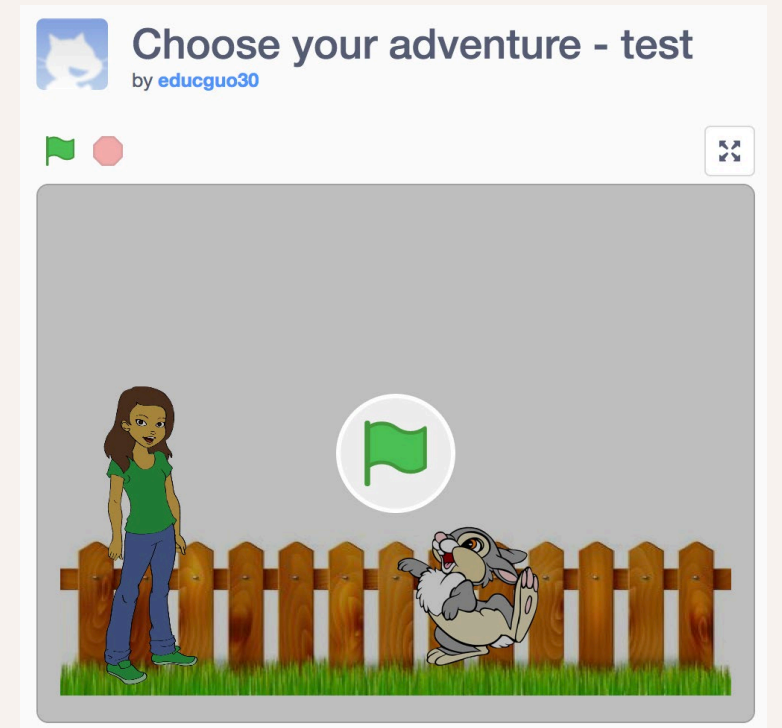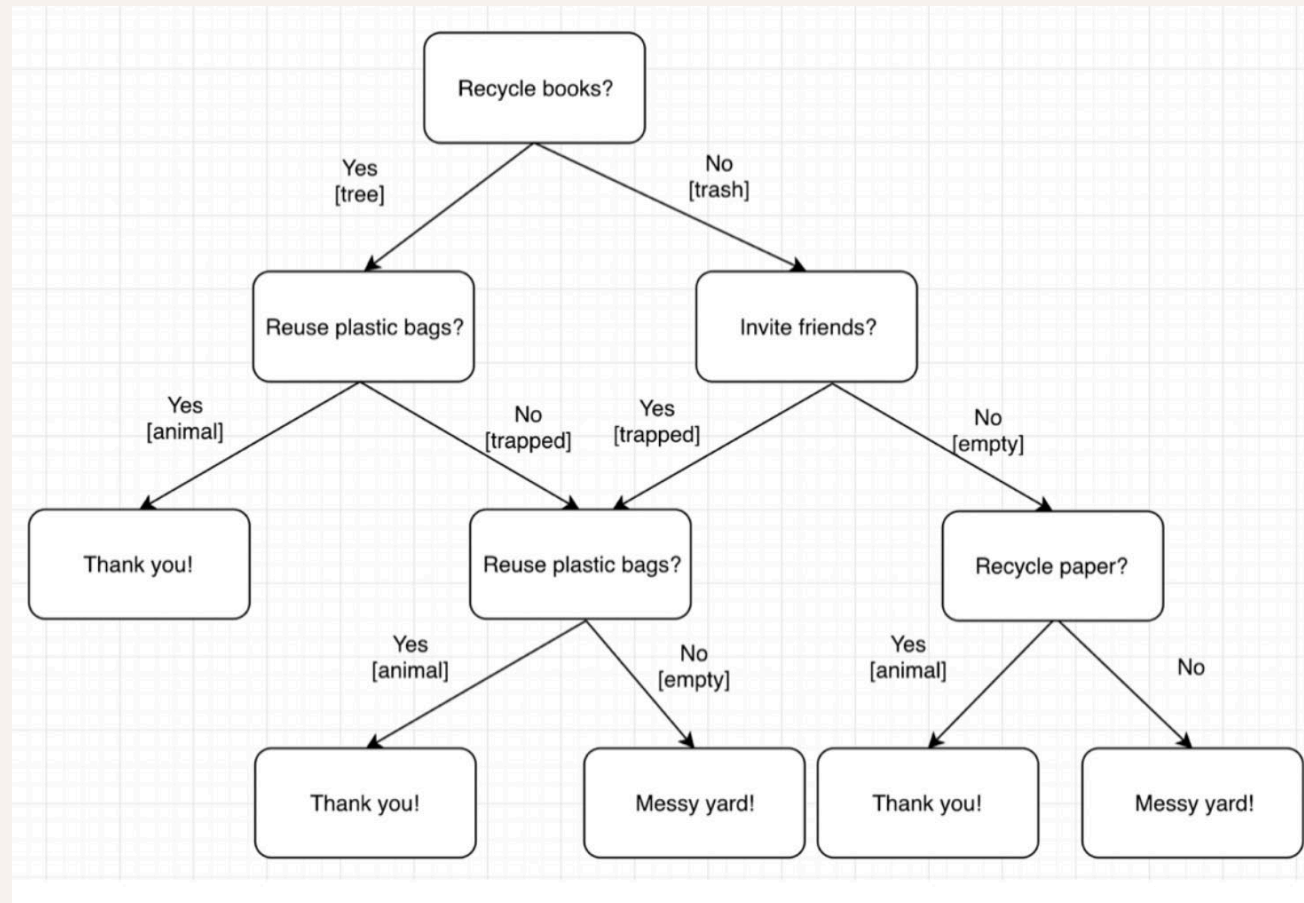
# Introducing Scratch

What can we do to support a culture of kindness in schools?

# Example activity

# Create a culture of recycling in schools



Choose your adventure - test
by educguo30

# Choose your own adventure
# Flowchart design

Let's design a flowchart for your culture of kindness adventure story!

# More examples

# CS for younger learners (K–2)

## Scratch Jr.

- Young children (ages 5-7)

- Program interactive stories & games

- Learn problem solving

- Design projects
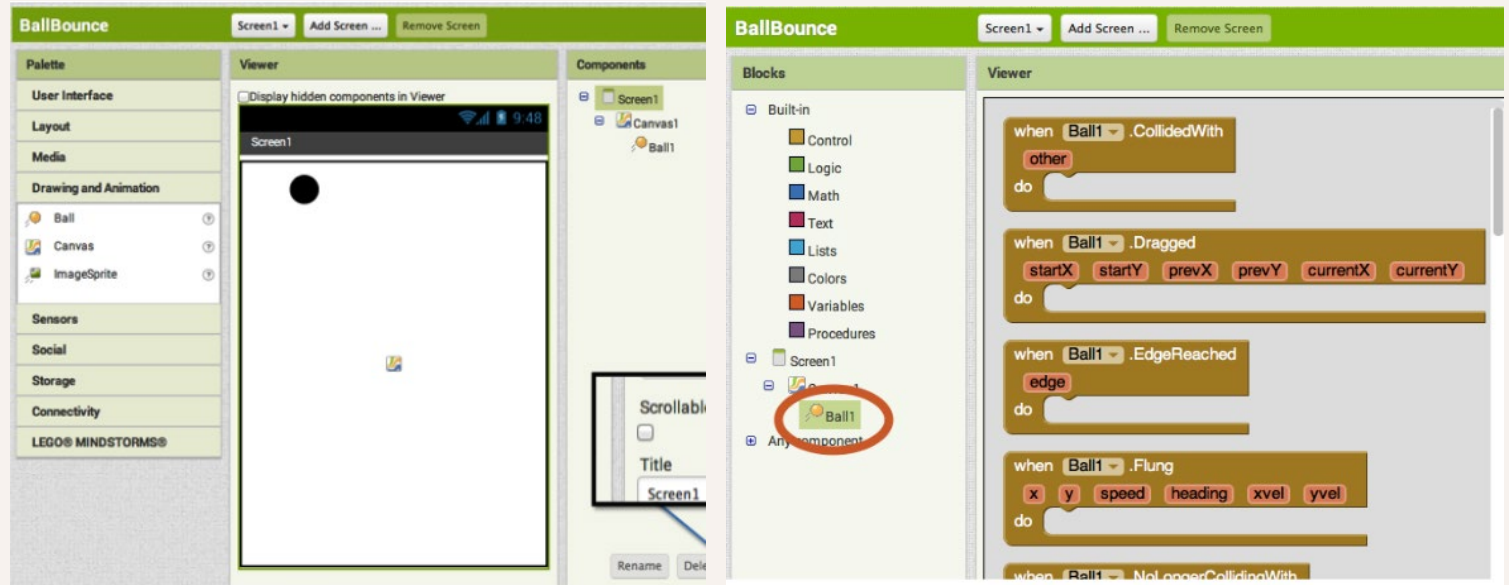
- Express themselves creatively

https://www.scratchjr.org/

# CS for higher grade levels (9th–12th)

## MIT App Inventor

- Creating apps using block coding

- Considering more advanced problems and solutions

https://appinventor.mit.edu/

# Congressional App Challenge

# CS Standards you practiced today

## Data & Information

- 6-8.DI.4: Create visuals such as flowcharts, diagrams, and pseudocode to represent complex problems as algorithms.

## Programming & Algorithms

- 6-8.PA.2: Systematically test and refine programs using a range of test cases

- 6-8.PA.4: Document programs in order to make them easier to follow, test, and debug.

## Impact & Culture

- 6-8.IC.5: Discuss how unequal distribution and participation in technology and computer science disadvantages marginalized populations.

# Takeaways

- Introducing CS in K-12 is a way to promote diversity, equity, and inclusion in our society.

- We are focusing more on the impact of CS rather than the technical parts.

- Believe in students that they can learn CS at younger ages.

- Scratch can use for practice coding, also for teacher productivity.

# Thank you!

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