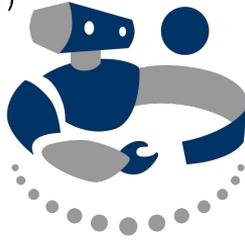




This research is supported by Award #1542465:
RET Site: Cyber Security Initiative for Nevada Teachers (CSINT)



S · A · R · G

SOCIALLY ASSISTIVE ROBOTICS GROUP

CORE COMPUTING PRINCIPLES

OR, HOW TO CODE...

CORE COMPUTING CONCEPTS TO DISCUSS

- Sequencing
- Decisions
- Loops
- Multi-Threading
- Subroutines



scratch

scratch.mit.edu



scratch: howto

ok, scratch is pretty easy...
let's just talk about how to code



scratch.mit.edu



what do you want to do?

CORE COMPUTING CONCEPTS TO DISCUSS

- **Sequencing**
- Decisions
- Loops
- Multi-Threading
- Subroutines



I want to make a cat that meows
when the mouse moves over it



pseudocode



pseudo = false

code = a series of letters, numbers, or symbols assigned to something for the purposes of classification or identification



pseudo = false
code = code



I want to make a cat that meows
when the mouse moves over it



pseudocode

try to frame program in terms of tools that
are available



make a cat



pseudocode

```
if (mouse is over cat)  
then meow
```

this is called a decision

CORE COMPUTING CONCEPTS TO DISCUSS

- Sequencing
- **Decisions**
- Loops
- Multi-Threading
- Subroutines



decision



This



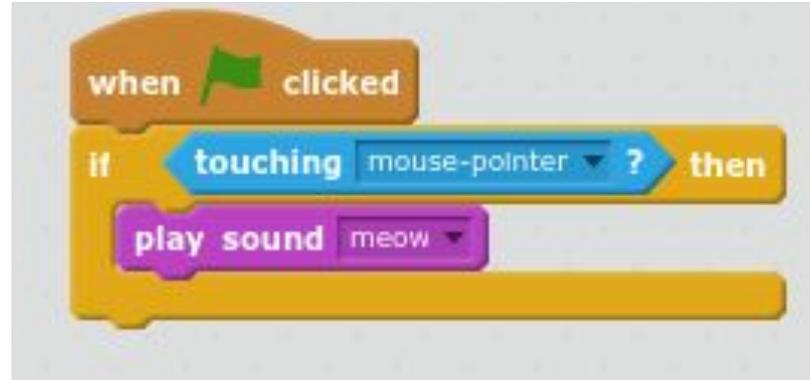
not this 



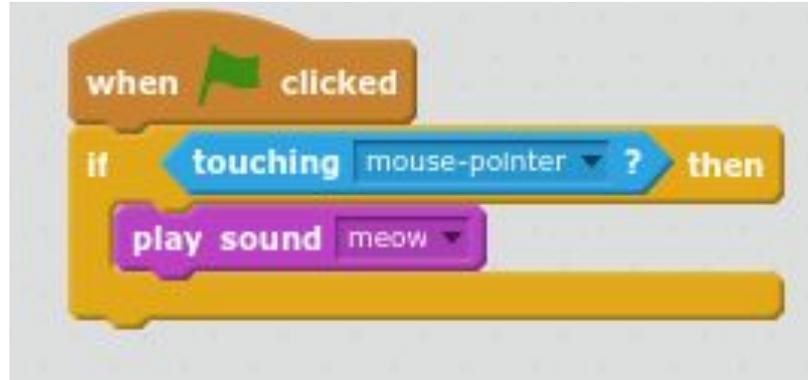


```
when clicked
  if touching mouse-pointer ? then
    play sound meow
```

why didn't this work?



why didn't this work?



...this code only runs once



there was a problem with our plan

we need to do the same thing
again and again

CORE COMPUTING CONCEPTS TO DISCUSS

- Sequencing
- Decisions
- **Loops**
- Multi-Threading
- Subroutines



loop



pseudocode

repeat forever

 if (mouse is over cat)

 meow



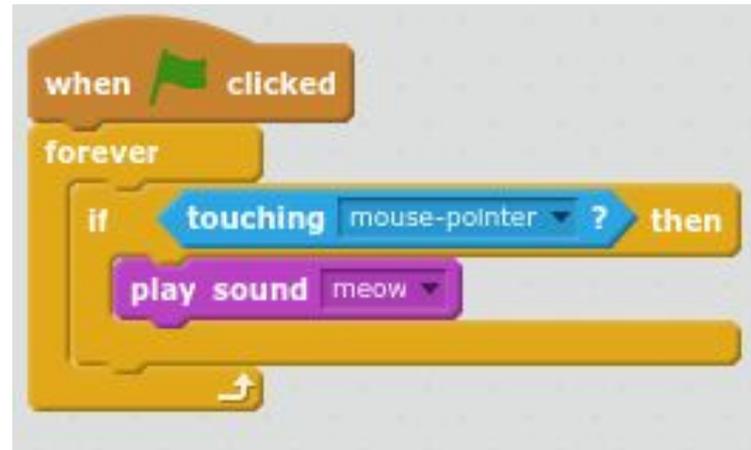


pseudocode

repeat forever

if (mouse is over cat)

meow





What did you do to the poor cat!?

Perhaps a pause between meows?



how long a pause?



pseudocode

repeat forever

 if (mouse is over cat)

 meow

 wait 2 seconds



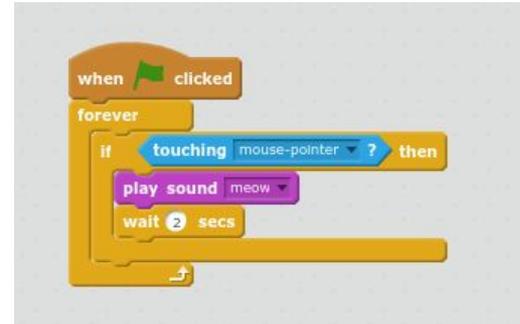
pseudocode

repeat forever

if (mouse is over cat)

meow

wait 2 seconds





let's see what happens



ok... new idea

CORE COMPUTING CONCEPTS TO DISCUSS

- Sequencing
- Decisions
- Loops
- **Multi-Threading**
- Subroutines



I want to see a woman playing with a dinosaur and do a cartwheel



more specific: anna says something
to a dinosaur, then the dinosaur runs
away, then anna runs after the dino



there are no cats in this program,
how do we do this?

this program needs two sprites

one for Anna

one for a dinosaur



sprite



is a two-dimensional image or animation that is integrated into a larger scene

for scratch, each character is a sprite

sprites can each do things at the same time
can also interact with each other



how to solve a problem like this?

break the problem into smaller parts

 solve each part individually

 integrate each part together

let's break up this problem



breaking up the problem

1. anna says something to a dinosaur
2. the dinosaur runs away
3. then anna runs after the dino

new pseudocode



ANNA

anna says: I'm a dinosaur

DINO

new pseudocode



ANNA

anna says: I'm a dinosaur

DINO

dino says: oh no
dino runs away



what went wrong?



what went wrong?

dino didn't wait for Anna

better pseudocode



ANNA

anna says: I'm a dinosaur

DINO

dino waits for anna to speak

dino says: oh no

dino runs away



what have we done?

1. anna says something to a dinosaur
2. the dinosaur runs away
3. then anna runs after the dino



what have we done?

1. *anna says something to a dinosaur*
2. *the dinosaur runs away*
3. then anna runs after the dino

better pseudocode



ANNA

anna says: I'm a dinosaur

anna waits for dino to run away

anna does cartwheel toward dino

DINO

dino waits for anna to speak

dino says: oh no

dino runs away

do a cartwheel

moves in one direction
at same time rotates



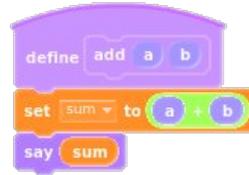
CORE COMPUTING CONCEPTS TO DISCUSS

- Sequencing
- Decisions
- Loops
- Multi-Threading
- **Subroutines**

this is a complex idea



use a subroutine



do a cartwheel



repeat a few times

moves a little to the right

rotates a bit clockwise

Final Code



Anna

```
when green flag clicked
  say I'm a dinosaur for 2 secs
  broadcast I'm a dino

when I receive dino runs away
  cartwheel

define cartwheel
  repeat 36
    turn 10 degrees
    change x by 10
```

Dino

```
when I receive I'm a dino
  say oh no! for 2 secs
  repeat 20
    move 10 steps
  broadcast dino runs away
```

why use a subroutine?



easier to read code later

might want to do same thing again and again

repeated actions



ANNA

anna says: I'm a dinosaur

anna waits for dino to run away

anna does cartwheel

anna does cartwheel

anna does cartwheel

DINO

dino waits for anna to speak

dino says: oh no

dino runs away

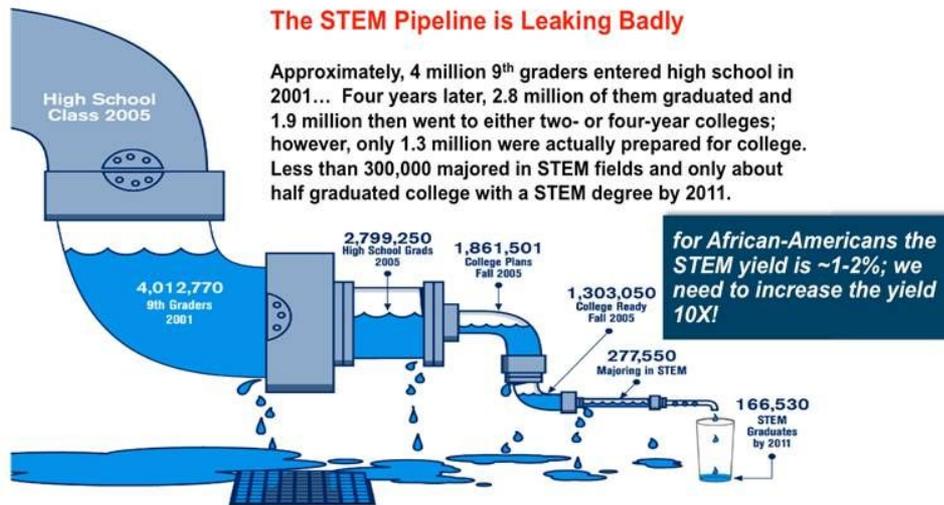


Why put programming in K-12 classrooms?



The STEM Pipeline is Leaking Badly

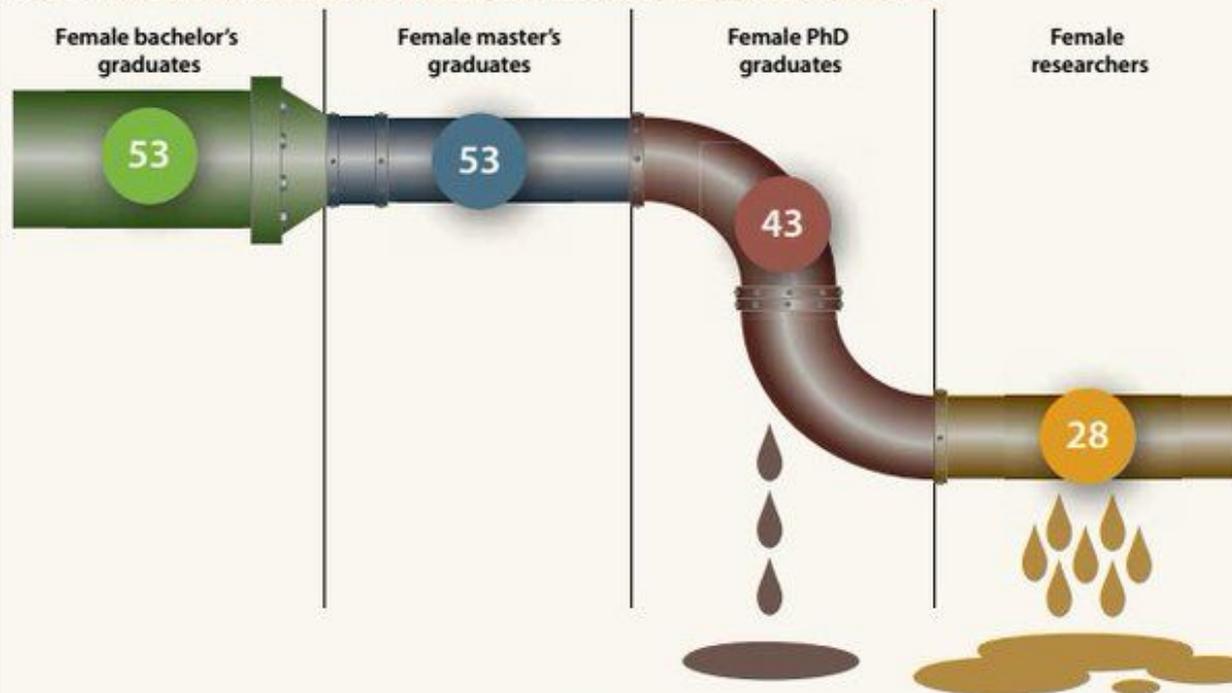
Approximately, 4 million 9th graders entered high school in 2001... Four years later, 2.8 million of them graduated and 1.9 million then went to either two- or four-year colleges; however, only 1.3 million were actually prepared for college. Less than 300,000 majored in STEM fields and only about half graduated college with a STEM degree by 2011.



Source: NCES Digest of Education Statistics; Science & Engineering Indicators 2008



Figure 3.1: The leaky pipeline: share of women in higher education and research, 2013 (%)



Source: UNESCO Institute for Statistics estimates based on data from its database, July 2015

CS Taulbee Survey



Share of degrees in CS/CSE awarded to women

Graduate with BS: 15%

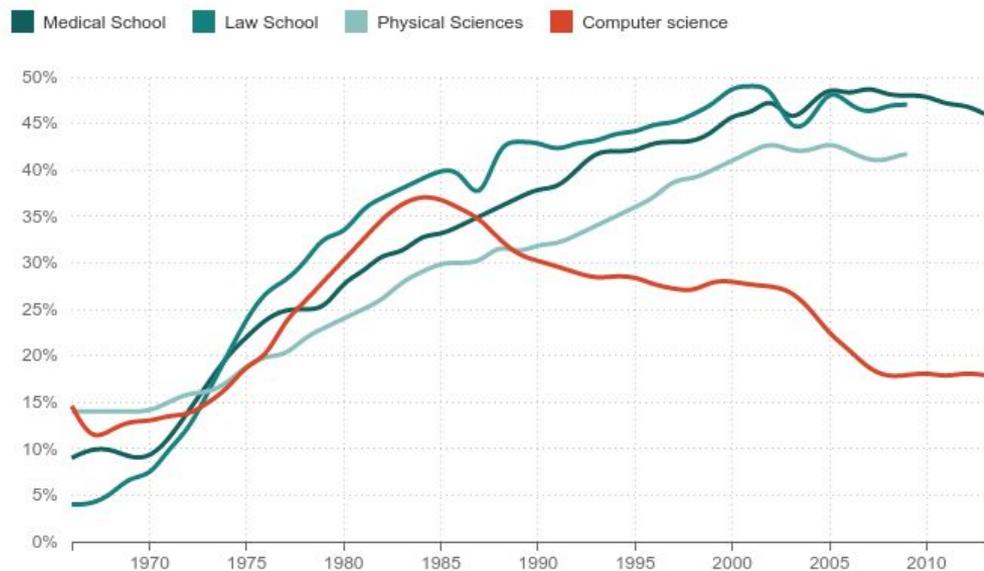
Graduate with MS: 18%

Graduate with PhD: 20%



What Happened To Women In Computer Science?

% Of Women Majors, By Field



Source: National Science Foundation, American Bar Association, American Association of Medical Colleges

Credit: Quoc Trung Bui/NPR



First Programmer?

Ada Lovelace (1815-1862)



Rear

- W
- E
- M
- C

9/9

0800 Antcom started
1000 " stopped - antcom ✓

13 ⁰⁰ (033) MP-MC	1.98247000	1.2700	9.037 847 025
(033) PRO 2	2.130476415		9.037 846 995 conch
conch	2.130476415		4.615925059(-2)
	2.130676415		

Relays 6-2 in 033 failed special speed test
in relay " 10.00 test.

Relays changed

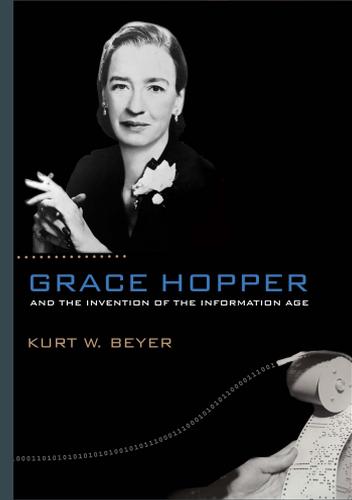
1100 Started Cosine Tape (Sine check)
1525 Started Multi Adder Test.

1545  Relay #70 Panel F
(moth) in relay.

First actual case of bug being found.

1630 Antcom started.
1700 closed down.

Relay 2145
Relay 3370



The m
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... they don't forget to take chances

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n up.
r 'em up

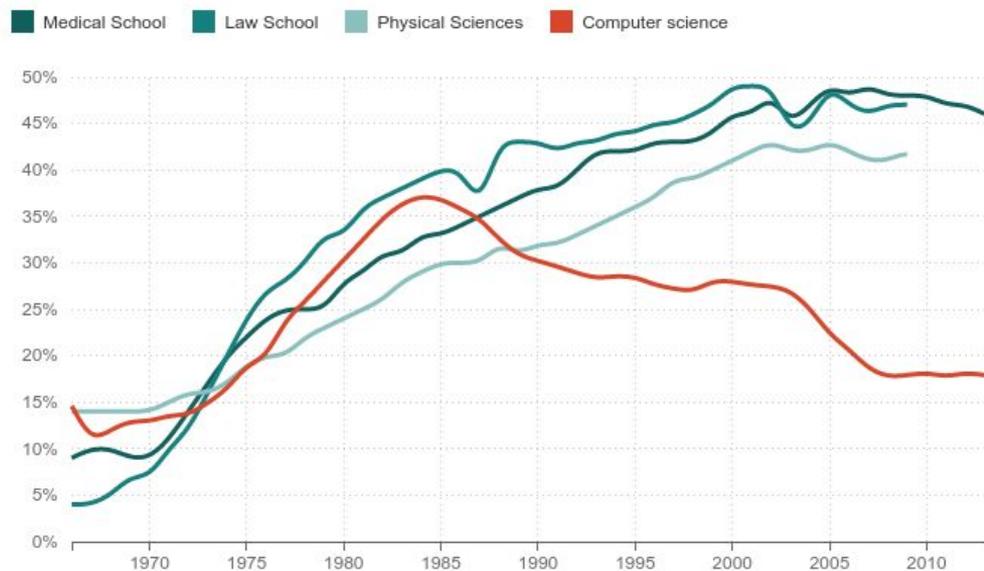


So What Happened?



What Happened To Women In Computer Science?

% Of Women Majors, By Field



Source: National Science Foundation, American Bar Association, American Association of Medical Colleges

Credit: Quoc Trung Bui/NPR

advertising



COBRA FOR A



I Remember When He Couldn't Keep His Hands Off Me!

'S PLAY.



**JACK WHEATON
STUDENT BY DAY
SPIDER-MAN BY NIGHT**

**PARKER BROTHERS
VIDEO GAME CARTRIDGES
The Ones To Beat**

Choosing one of these titles to play compared to what Jack Wheaton does when school's out. That's when he starts his crime fighting gear and starts pursuing justice against the evil DR. DOOM™. There's no game from Parker Brothers that's so fun as this one. Jack is the only one who can save the world from the villainous GREEN COBLER™ and his gang of evildoers. You can bring justice upon evildoers in your webbing to defeat deadly time bombs before they can blow up the world. This is a challenge like AMARCO™ where you guide gophers and giant aliens through a maze of squares with weapons and traps in hot pursuit. Then there's "Tomb Raider™" where it's up to you to search King Tut's tomb for hidden treasures being guarded by evil spirits. These, and other Parker Brothers home video games, are based on popular arcade games, leading movie franchises and comic book adventures. Every game combines brilliant graphics and amazing sound effects that'll get you so involved you'll feel like a part of the action. Just take it home with you.

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VIDEO GAME CARTRIDGES
The Ones To Beat**

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Computers in movies



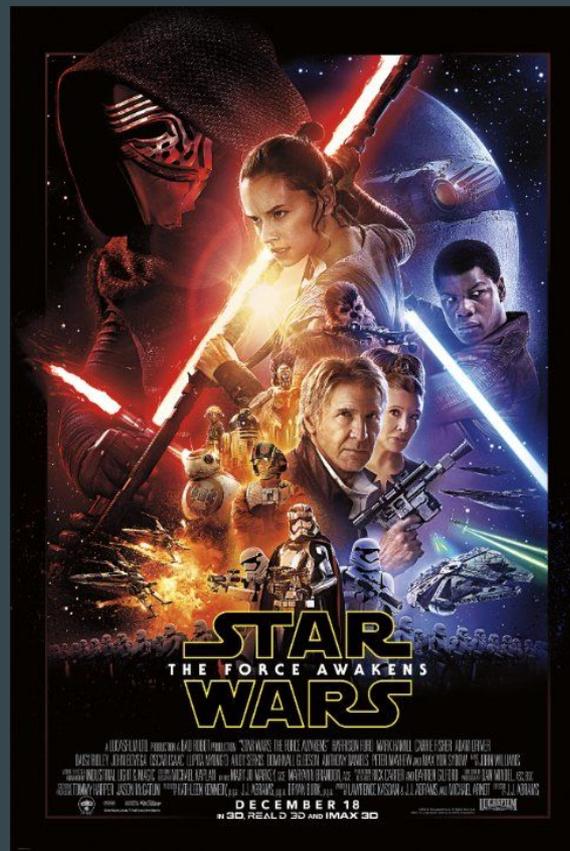
All Fixed Today, Right?



Hasbro: *“The Star Wars: Monopoly game was released in September, months before the movie’s release, and Rey was not included to avoid revealing a key plot line that she takes on Kylo Ren and joins the Rebel Alliance”*

Spoiler Alert

Hasbro: “*The Star Wars: Monopoly* game was released in September, months before the movie’s release, and Rey was not included to avoid revealing a key plot line that she takes on Kylo Ren and joins the Rebel Alliance”

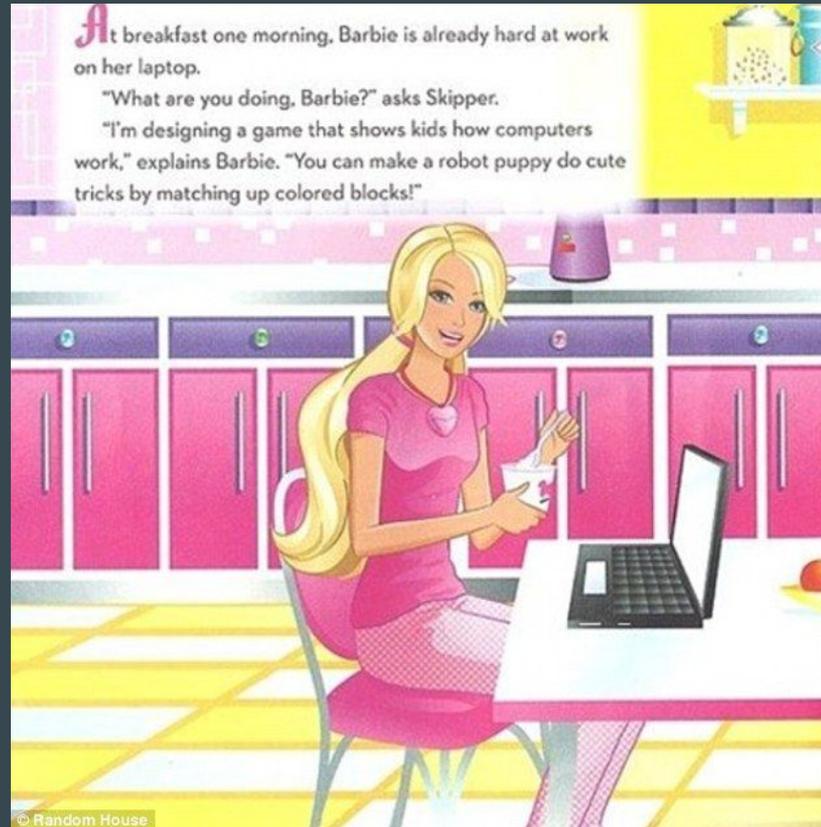
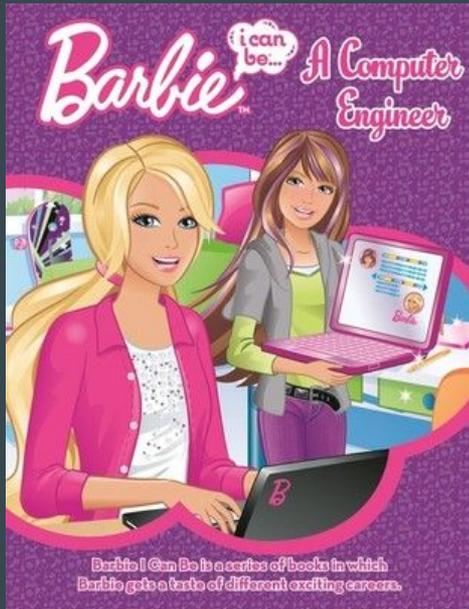




OK, let's fix it...

... girls like pink, right??

Computer Engineer Barbie: starts off fine



Computer Engineer Barbie: uh-oh



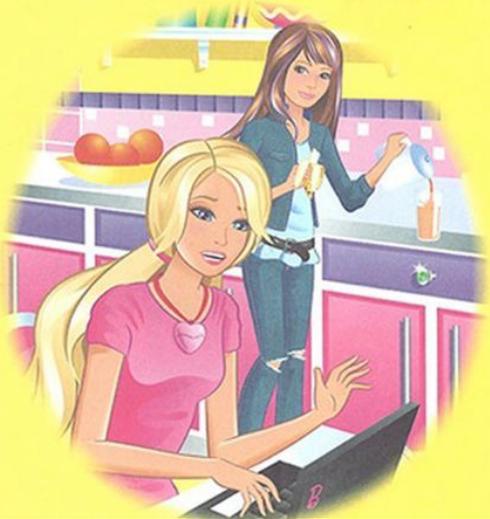
Barbie tries to email her design to Steven, but suddenly her screen starts blinking.

"That's weird!" says Barbie.

Barbie and Skipper try to reboot the computer, but nothing happens.

"Looks like you've got a virus, big sister," says Skipper.

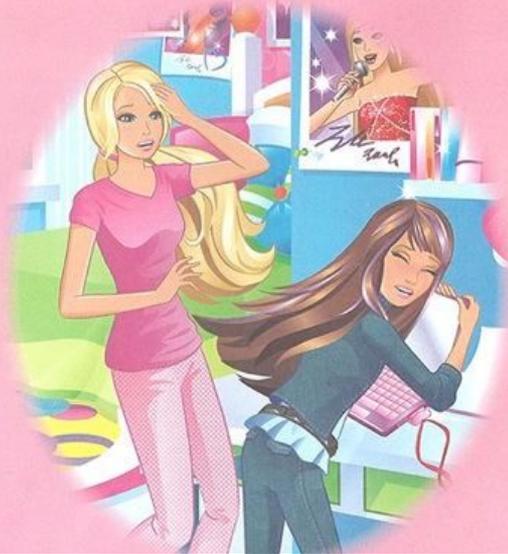
"Luckily, I wear my flash drive on a necklace so that I'll always remember to back up my work," replies Barbie.



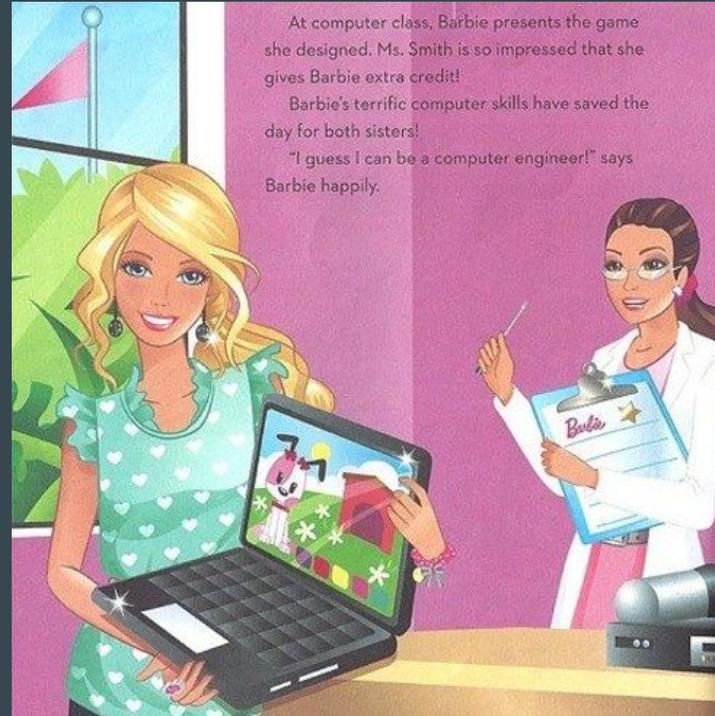
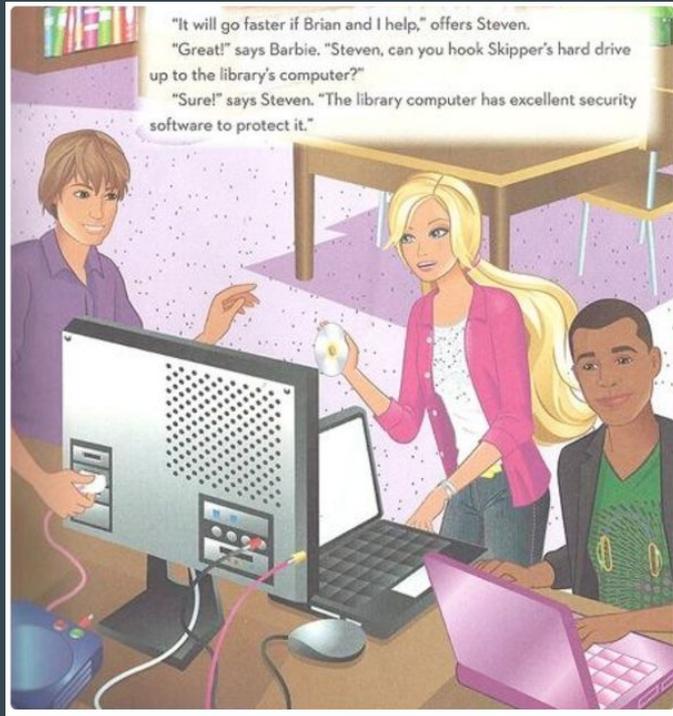
When Barbie puts her flash drive into Skipper's laptop, the screen starts blinking.

"Oh, no!" says Barbie. "The virus must be on the flash drive!"

"I forgot to back up my homework assignment!" cries Skipper. "And all my music files are lost, too!"



Computer Engineer Barbie: calling in the men



for the record...



... nice, though it took until last year



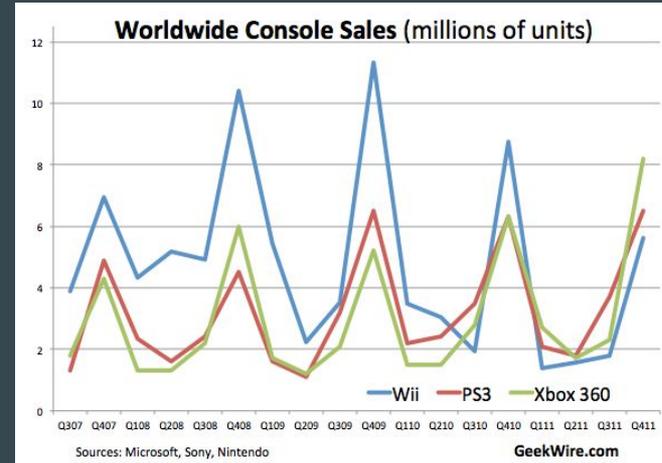
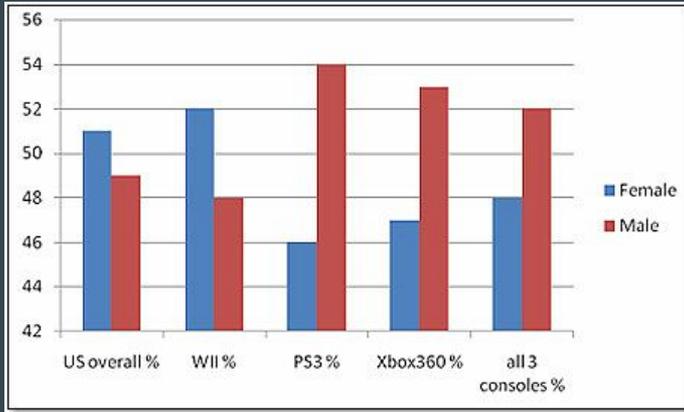
Inclusive Over Pink

Wii ads



The results?

Creating a blue ocean





Hour Of Code



Hour of Code (learn.code.org)



1. Youtube videos of celebrities and prominent programmers talking about computing
2. 1-hour lesson on computing and programming concepts
 - a. Variables
 - b. Loops
 - c. Decisions
 - d. Subroutines
3. 20-hour follow-up course that covers much of the fundamentals of programming

... FREE



Takeaways

1. Yes, there are bias/leaky pipeline problems in CS programs nationwide
2. But, there are also ingrained bias problems **before** students get to college
3. Inclusive interventions can help increase interest in STEM
4. Computing presents unique opportunities for pre-University exposure to a STEM discipline