

# K-12



# laamcs

INSTITUTE FOR AFRICAN-AMERICAN  
MENTORING IN COMPUTING SCIENCES

# Overview: K-12 Goals

To work with K-12 African American Students and women who have limited awareness and exposure to computer science

To provide

- Multiple opportunities to engage in computing & computational thinking
- Exposure to a broad range of computing sub-disciplines

To facilitate a process through which Students see themselves as

- being skilled and comfortable with programming
- enjoying the challenge of programming
- pursuing computing degrees & careers





Woven through these Outreach Programs



Opportunities for Graduate & Undergraduate Student to engage in  
Service Learning, Leadership, & Mentoring



# K-12 Programs

Extended  
Engagement



Hour of Code



Code IT Day



TECH EDGE



CyberBytes:  
GenCyber

a w a r e n e s s



# Hour of Code @ Eastside

**All Day Event**  
*over 68 Volunteer Hours*

## **Eastside High School:**

- 1,315 students in grades 9-12
- 70% of the student body (majority Black) – Note: State average of 58%

## Reichert House for Boys

- 40 Extremely At-Risk African

## American Youth

Coverage in The Gainesville Sun

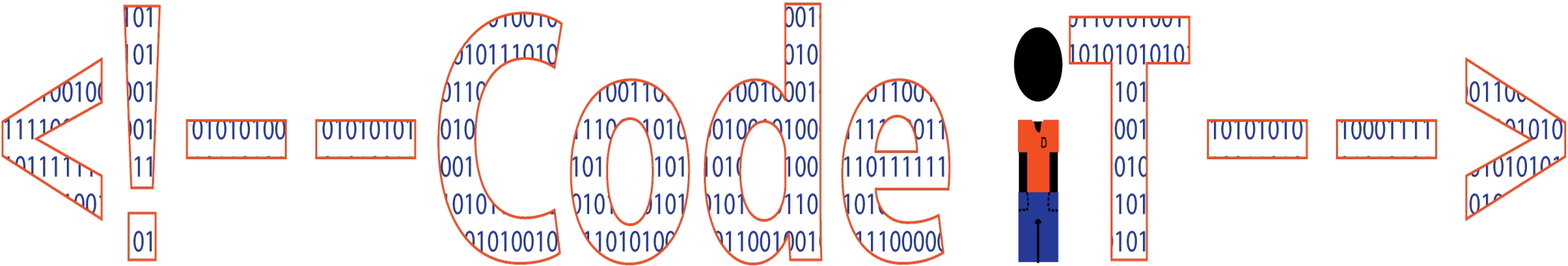
<http://www.gainesville.com/article/20141211/ARTICLES/141219897/1002/news01?Title=Students-get-early-glimpse-at-the-joy-of-computer-coding>

## **During School Day**

- 900 Students (1+ Hour of Code)
- 19 UF Computing & Engineering UGs & Grads

## **After School Day – Awareness Event**

- UF & Santa Fe College
- Start-up Tech Companies in Gainesville, FL
- HCC Research – Virtual Spatial Audio, BCI
- Robotics Teams & Research Demos





# CodeIT Day

- An 8 hour workshop where students come to campus to interact with graduate & undergraduate students and learn about computing.
- Goals:
  - ✧ To introduce computing in a fun and hands on way
  - ✧ To break stereotypes about what/who a Computer Scientist is

# CodeIT Day



❖ Program Coordinators:  
Jessica N. Jones and Naja  
Mack, Ph.D. Students

❖ Instructors/Staff:  
Graduate and  
undergraduate students





# CodeIT Day Student Population

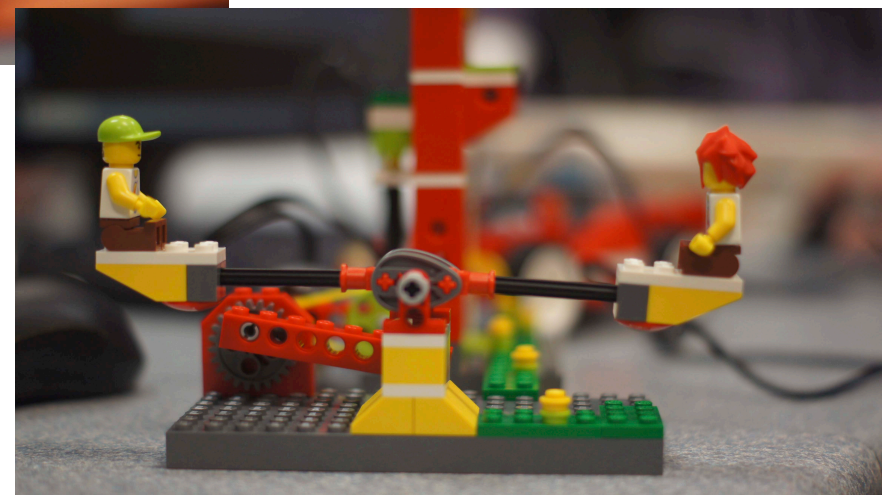
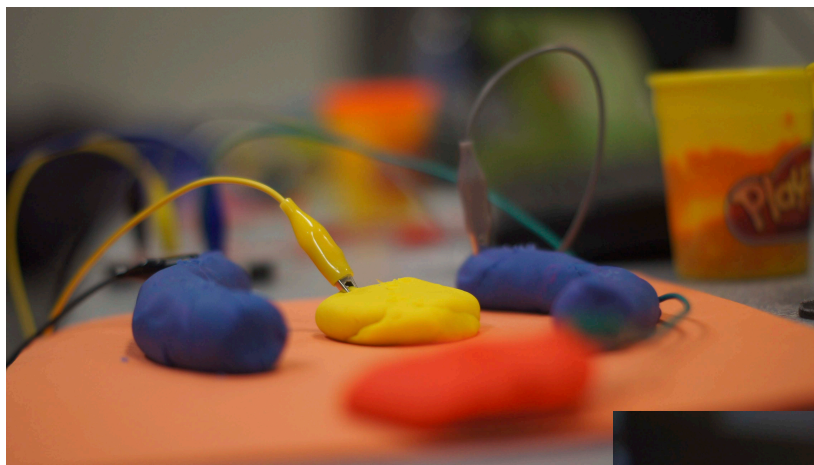
✧ Grades 6-8 & 9-12

- Students reached:
  - ~120 students since 2013
  - ~40% underrepresented groups
  - Low to high income families
  - Students with disabilities



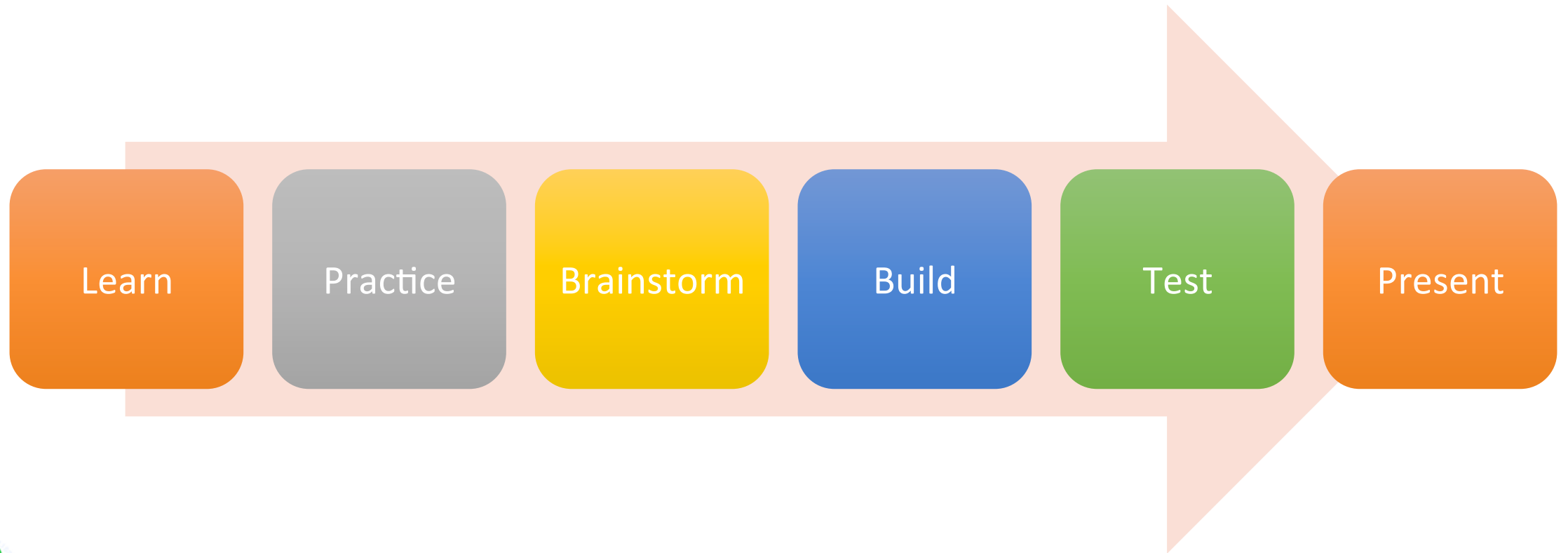
# CodeIT Day Curriculum & Activities

- ✧ Makey Makey
- ✧ Scratch
- ✧ Lego WeDo
- ✧ Lego Mindstorms
- ✧ Arduino
- ✧ Nao Robots





# CodeIT Day Curriculum & Activities



# CodeIT Day 2015 Coming This Fall!



# TECH EDGE:

## After-School Program



Funded by: laamcs NSF: Supplement #2  
Sponsored by: National Security Agency



# Tech Edge: Overview

**Goal:** To provide an opportunity for African American elementary and middle school students to become creators and not just users of technology

## To learn

- Basic Programming Concepts
- To Use programming concepts to solve problems
- To Apply programming concepts through creative expression
- To design user interfaces

## To become Computational Thinkers

- Engaged in Problem Solving & Algorithmic thinking
- Tolerate ambiguity
- Persist through challenges

## To see computing as a broad range of skills that are useful for

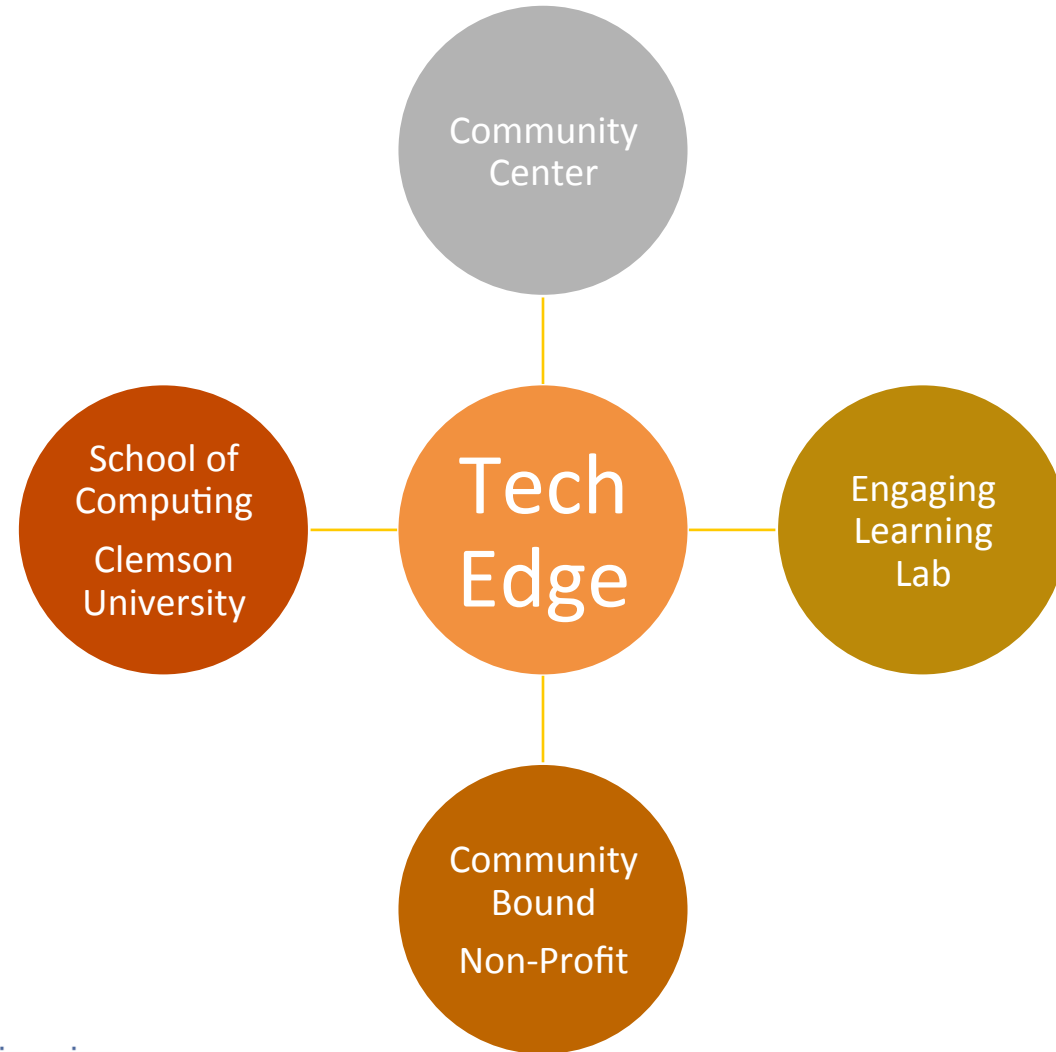
- Personal Expression & Creativity
- Problem solving
- Design

## To engage with Undergraduate & Graduate Computing Students

- To Learn about college
- To Learn about computing work on multiple levels
- To see a pathway for themselves in Computing

# Program Staff

- Dr. Gardner-McCune
- Sanethia Thomas
- Darryl McCune
- SOC ED Tech II Students
- Ms. Judy





# Program Details

- 14 Week After-school Program
- 4 Days per week
- 2.5 Hours a day

*Total 140 Contact Hours*



# Curriculum & Activities



Learning to  
Program

Weeks 3-14



Learning to  
be Designers

Weeks 1-2



Participatory  
Design

Weeks 5, 7-8, 11-13

## Learning to Program & Use Programming to Create

### Structured: Puzzles Basic Programming Concepts

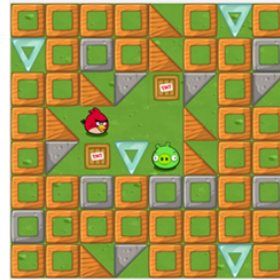
- Statements
- Algorithms
- Loops (sequencing, iteration, selection)

### Computational Thinking

- Problem Solving
- Persistence

### Structured: Projects

Apply CS Knowledge & Computational Thinking to create fun interactive programs



Hour of Code  
& Beyond

Scratch



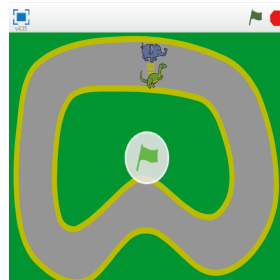
### Semi-Structured: Artistic Projects

### Creative Expression & Programming

- Reinforce & apply programming concepts

### Computational Thinking

- Tolerance for Ambiguity
- Problem Solving
- Persistence



Google CS  
First



# Impact

## 12 Students

- 7 - Elementary School (2<sup>nd</sup>-5<sup>th</sup> Graders)
- 4 - Middle School (6<sup>th</sup> & 8<sup>th</sup> Grade)
- 1- High School (9<sup>th</sup> Grade)

9 Girls; 3 Boys

- 9 - African American
- 2 - Multi-racial
- 1 - White

**Prior to Tech Edge - 9 out of 12 Never Programmed before**





**AFTER**  
**84**  
**CONTACT HOURS**  
**PER STUDENT**



**STUDENTS COMPLETED**  
**200**  
**BEYOND HOUR OF CODE CHALLENGES**

**60**  
**SCRATCH PROJECTS**  
**(AVG 5 PER STUDENT)**

# ENGAGEMENT

**6**  
**EDUCATIONAL TECHNOLOGY DESIGN**  
**REFINEMENTS & EVALUATIONS PROJECTS**

Untitled-2 by moviestarr (unshared)

Share See



x: -125 y: 144

Scripts Costumes Sounds

- Motion
- Looks
- Sound
- Pen
- Data
- Events
- Control
- Sensing
- Operators
- More Blocks

```

move 10 steps
turn 15 degrees
turn 15 degrees
point in direction 90
point towards
go to x: -27 y: -10
go to mouse-pointer
glide 1 secs to x: -27 y: -10
change x by 10
set x to 0
change y by 10
set y to 0
  
```

```

when clicked
forever
  move 2 steps
  if on edge, bounce
  if touching Cassy ? then
    play sound meow until done
    stop all
  
```

```

when clicked
point in direction 0
forever
  move 1 steps
  
```

```
point in direction 90
```

Sprites New sprite: [Icons]

Stage 3 backdrops

New backdrop: [Icons]

Sprite1, Cassy, Boy4

Backpack

# What students liked most about Tech Edge?

*“I got to learn how to program!”*

*“That we learned new technologies.”*

*“The projects. When we shared our Scratch projects.”*

*“I got to learn how to program & use different tools for engineering and I got to stay here instead of going home.”*

*“Programming and coding. I also like [the] Scratch website and I liked the Lost in Space [Beyond Hour of Code Module] because it was cool because you could put in the blocks when you were coding to tell it what to do to get to the Space Ship like an adventure.”*

# Impact

## Students' Perception of their Computing Ability

- 50% liked the challenge of computing (n=6)
- 58% believed they can become good at computing (n=7)

## Increasing Student Perception of Computing as Creative

- 76% perceived computing as creative

## Increasing Student Interest in Computer Science

- 76% indicated the ability to design technology for themselves was an important skill to have
- 85% wanted to find out more about computing
- 77% would recommend the program to a friend
- 69% would attend the program again



# Community Impacts:

## **Building a Local Community of African American Programmers whose parents encourage them to learn to program**

- 50% of student reported that their parents do not encourage them to use the computer.

## **However, at the program showcase**

- Parents were surprised about how much their children learned and what they were able to program
- Parents wanted to know how to engage their students in other coding programs
- 100% of parents indicated on their surveys that the Tech Edge program met or exceeded their expectations.

# Cyber-BYTES @ UF

## Summer Camp & Teacher Professional Development

Director: Christina Gardner-McCune, PhD

*Assistant Professor, Computer Science Education Research*

*Engaging Learning Lab*

## Student-Centered Cyber Security

### Goal:

*Helping students see the impact of Cyber Threats, Vulnerabilities, & Security on their Everyday Lives and Empowering them to be a part of the Solution*

### Target Student Population

- 20-24 students
- Grade: Rising 7<sup>th</sup> – 12<sup>th</sup> Graders (Middle & High School)
- Ethnicity: 50% African Americans & Latina Students,
- Gender: 25% Female
- Socio-Economic Status: Low Income – Free & Reduced Lunch
- Little to no Exposure to CS



# Collaborative Team Approach

- Program Director - Me
- Expert Teachers – CS or Technology – Train Teachers
  - Middle school
  - High School
- Two Undergraduates – Work with Expert Teachers, novice teachers, k-12 students
  - Cyber Security
  - Programming
- Cyber Security Experts as Advisory Board & Guest Speakers
  - Security Researchers @ UF
- Schools & Community Center Liaisons and sites
  - Pre – Program
    - Recruitment
  - During Program
    - Sign-in & Sign-out
    - Meals & Snacks
    - Recreational Activities
- Districts
  - Teachers
    - Technology
    - CS Teachers
    - Math & Science



# Leveraging Multi-Domain Expertise

## Teacher Professional Development

- Expert CS Teachers
  - Run PD
    - Ensure content is taught is appropriate for middle and high school students
    - Ensure Alignment to curricular standards
- Security Experts
  - Input on Learning Goals & Camp Focus
  - Content Authenticity and Accuracy
  - Guest Speakers from our Security Center of Excellence SENSEI



# Tentative PD Schedule

L	U	N	C	H

# Cyber-BYTES: Dual Curriculum Approach

## Cyber Security Curriculum

- Focused on helping students understand core security concepts on a conceptual and practical level
  - Interactive /Kinesthetic Activities
    - Conceptual Understanding
  - Authentic Exploratory Labs

## CS Curriculum

- Focused on helping students understand the fundamentals of programming on a conceptual and programming level
  - Statements
  - Variables
  - Boolean Logic Conditionals
  - Loops (sequencing, iteration, & selection)
  - Functions
- Engaging Programming Activities

# Tentative Camp Schedule

L	U	N	C	H



# Security Programming Curriculum Materials

## Rubber Rooms

- RAVE Capture the Flag Activities
- Jones & Bartlett Environment
- Texas - Amazon Cloud Environment
- Nifty Assignment Materials –
  - Packet Sniffing (Army & Stanford) - <http://nifty.stanford.edu/2015/matthews-raymond-packet-sniffing/>
  - Encryption Chase - <http://nifty.stanford.edu/2010/sherriff-encryption-chase/>
  - Encryption Inigma - <http://nifty.stanford.edu/2009/reed-enigma/>
  - Neat JavaScript Projects - <http://dave-reed.com/Nifty/>

# Security Conceptual - Curriculum Materials CS Unplugged

- Cryptographic Protocols & Encryption
  - [http://csunplugged.org/videos/#Cryptographic\\_Protocols](http://csunplugged.org/videos/#Cryptographic_Protocols)
  - [http://csunplugged.org/videos/#Public\\_Key\\_Encryption](http://csunplugged.org/videos/#Public_Key_Encryption)
- Networks & Error Detection
  - [http://csunplugged.org/videos/#Routing\\_and\\_Deadlock](http://csunplugged.org/videos/#Routing_and_Deadlock)
  - [http://csunplugged.org/videos/#Error\\_Detection](http://csunplugged.org/videos/#Error_Detection)
- Searching Algorithm -  
[http://csunplugged.org/videos/#Searching\\_Algorithms](http://csunplugged.org/videos/#Searching_Algorithms)

# Tools

## Middle School

- Scratch
- Blockly

## High School

- Python
- HTML & JavaScript

Example Middle School Programming & Security Activity:  
Scratch - Creating a Network

## Middle School Students



## Broadcast Feature

- Allows messages to be passed between sprites
- Have students use the Broadcast feature to model a network with several computers that pass messages back and forth and devise ways to keep unwanted people from reading the messages.