Southeast ada Center

Accessibility & Inclusion in K-12 Computer Science Education

Session Begins 1:00 pm CST

Periodic Audio Testing Occurring

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Useful Keyboard Shortcuts

- Full list - *Keyboard Shortcuts* from the *Help* menu on the Menu Bar.
- Chat: Move cursor to the Message text box

  Windows: Ctrl+M

  Mac: Command-M
- Speaker level Up:

  Windows: Ctrl+Alt+Up Arrow

  Mac: Command-Option-Up Arrow
- Speaker level Down:

  Windows: Ctrl+Alt+Down Arrow

  Mac: Command-Option-Down Arrow

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More keyboard shortcuts

- Open Closed-Captioning window

  Windows: Ctrl+F8

  Mac: Command-F8

- Close Closed-Captioning window

  Windows: Alt+F4 or Ctrl+W

  Mac: Command-W

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MOBILE Devices supported include iPhone, iPad, Android Devices, Kindle Fire HD)**

Individuals can download the free Blackboard Collaborate App from the Apple Store, Google Play or Amazon

**Closed Captioning is not visible via the Mobile App and there is limited access to the white board for individual's using voice over technology

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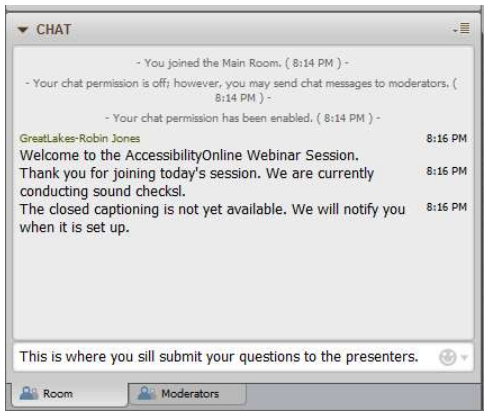

Please note: This webinar is being recorded and can be accessed on the website at http://www.ada-accessibletech.org within 24 hours after the conclusion of the session.

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Customize Your View

- Resize the Whiteboard where the Presentation slides are shown to make it smaller or larger by choosing from the drop down menu located above and to the left of the whiteboard. The default is “fit page”
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  - Select “Edit” from the tool bar at the top of your screen
  - From the drop down menu select “Preferences”
  - Scroll down to “General”
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      then Uncheck anything you don’t want to receive and “apply”
    - Select “Visual Notifications”
      then Uncheck anything you don’t want to receive and “apply”
  - For Screen Reader User – Set preferences through the setting options within the Activity Window (Ctrl+slash opens the activity window)

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  2. Call 877-232-1990 (V/TTY)

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Accessibility & Inclusion in K-12 Computer Science Education: Meeting the Needs of Students with Disabilities in the CS for All Movement

January 17, 2019

- **Maya Israel -** Associate Professor of Educational Technology, University of Florida
- **Todd Lash** - PhD Student, University of Illinois Urbana-Champaign

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Presenter: Maya Israel

- Associate Professor of Educational Technology, University of Florida
- Director of Creative Technology Research Lab (CTRL)
- Research: strategies for supporting students with disabilities meaningful engagement in science, technology, engineering, and mathematics (STEM)
  - Emphases on computational thinking and Universal Design for Learning (UDL).
- PI of National Science Foundation (NSF) project – Project TACTIC
  - Teaching All Computational Thinking through Inclusion and Collaboration, which focuses on accessible and inclusive computer science instruction.
- Works with multiple school districts on meaningfully including all learners in K-8 computer science education.

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Presenter: Todd Lash

- Doctoral student at the University of Illinois at Urbana Champaign.
- Elementary educator for 16 years who oversaw computer science instruction.
- Research interests: increasing equity in and access to high-quality computer science education for all students.
- Writer for both the K-12 CS Framework and on the 2016-2017 CSTA Standards revision working group.

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Roadmap

- Introductions
- What is CS for All?
- How who is accessibility being addressed in CS for All?
- Research and development focused on accessibility in K-12 CS education
- Next steps that should be taken

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Computer Science Education in K-12 involves

The broad range of of topics including the study of:

- Algorithmic processes/thinking
- Coding/programming
- Ethics of computing
- Collaborative computing
- Hardware
- Etc.

K12 COMPUTER SCIENCE

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What is CS for All in the U.S.?

- White House initiative in 2016
- Petition signed by 26 governors (bipartisan) and dozens of industry CEOs
- National Science Foundation investments
- State and district initiatives

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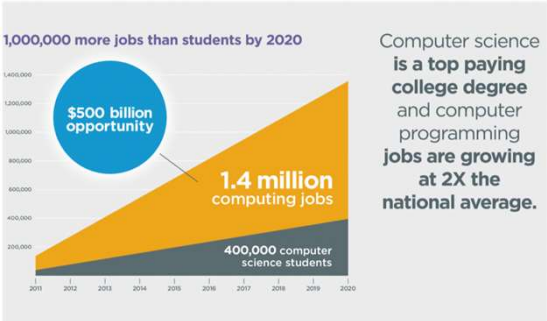
Why focus on CS for All?

- Jobs/career opportunities
- Equity/access
- Transferable skills including:
  - Persistence
  - Collaboration
  - Creative problem solving



Credit: Code.org

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What about accessibility & inclusion in K-12 CS Education?

- Most programming platforms for young learners:
  - Have limited access with screen readers
  - Do not focus on cognitive supports
  - Rely on visual representations
- Many activities are open-ended with ill-defined problems
- There is still a bias about who can/can't be successful in CS

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The good news….

- Students generally are motivated to engage in creative problem solving
- Teachers buy into CS for All and want to include all their learners in CS activities
- National momentum towards increasing access

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In K-12, two types of programming platforms

- **Block-based**

- **Text-based**

```
noStroke();
// the starting size for the sun
var sunSize = 30;
draw = function() {
    // all lines of code inside here will be run rep
    //position of the sun

    // the beautiful blue sky
    background(82, 222, 240);

     // The sun, a little circle on the horizon
   fill(255, 204, 0);
   ellipse(200, 298, sunSize, sunSize);

   // The land, blocking half of the sun
   fill(76, 168, 67);
   rect(0, 300, 400, 100);
  sunSize= sunSize+1;
};
```

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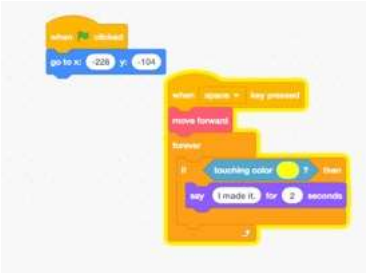
Advantages of Block-Based Programming Languages

- Easier “on ramp” for novice programmers since blocks are simplified code
- Less frustrating because students do not get “lost in the syntax”
- Visual reinforcement of structure



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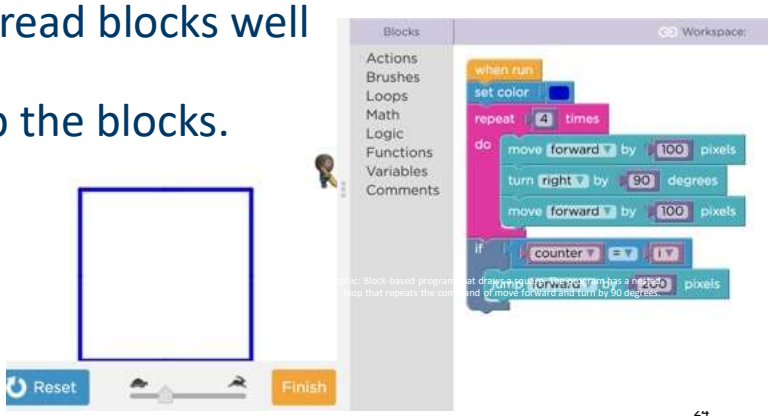
Accessibility issues in block-based programs:

- Visual avatars, games, and other outputs
- Screen reads do not read blocks well
- Must “Drag and drop the blocks.



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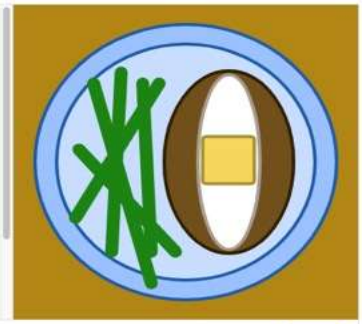
Advantages of text-based languages

- Generally easier to use with a text-reader
- Language more similar to professional coding languages

```
background(186, 145, 20); // wooden table
fill(166, 200, 255);

//plate
    stroke(34, 103, 181);
    strokeWeight(4);
    ellipse(200, 200, 350, 350);
    fill(207, 225, 255);
    ellipse(200, 200, 300, 300);
//potato
    stroke(54, 35, 1);
    fill(125, 91, 29);
    ellipse(250,200,150,232);
    stroke(176, 167, 157);
    fill(255, 255, 255);
    ellipse(250,200,72,222);
    stroke(176, 157, 60);
    fill(247, 220, 102);
    rect(219,167,60,60,5);
//green beans
    stroke(31, 143, 19);
```



Request Help | Spin-off | Save

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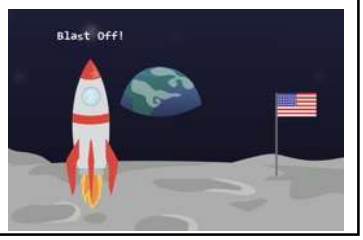
Accessibility issues in text-based programming

- Discoverability of features within the system
- Reading code line by line, including indentation levels (How can we read white spaces efficiency?)
- Reading code comments embedded in the code

*Pictures are of Codesters which proactively was designed with access in mind.

```
stage.set_background("moon")
sprite = codesters.Sprite("rocket")
sprite.go_to(-100, -150)
def click(sprite):
    sprite.say("Blast Off!")
    sprite.set_say_color("white")
    sprite.set_y_speed(5)
sprite event_click(click)
```



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What are we doing about this issue?

- CS for All Accessibility Pledge
- National Science Foundation focus on access and inclusion as part of it's broadening participation mission
- Work with school districts to educate about options

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CSforALL + AccessCSForAll

CSforALL Accessibility Pledge

- Aimed at engaging:
  - Content creators, Program providers, School districts/states, Researchers, & Investors
- Focus on "first steps" and "ongoing commitment" to accessibility in CS education

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Commitment from Content Creators (making tools & curricula)

- Assess content and tools for accessibility and usability for a broad range of users (including those with disabilities)
- Create an improvement plan to address targeted gaps and meet accessibility standards
- Include accessibility guidance along with tools and curricula for users
- Make accessibility a priority in developing future CS education content and tools

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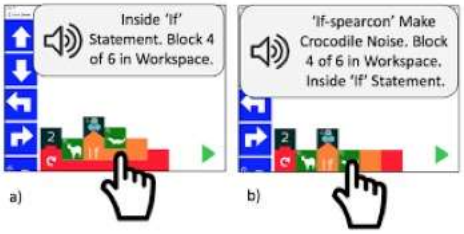
Example: Blocks4All

- High contrast image blocks that can be resized
- Audio and visual outputs
- Readable through text-reader
- Used with physical robot (Dash) that can be felt, seen, heard



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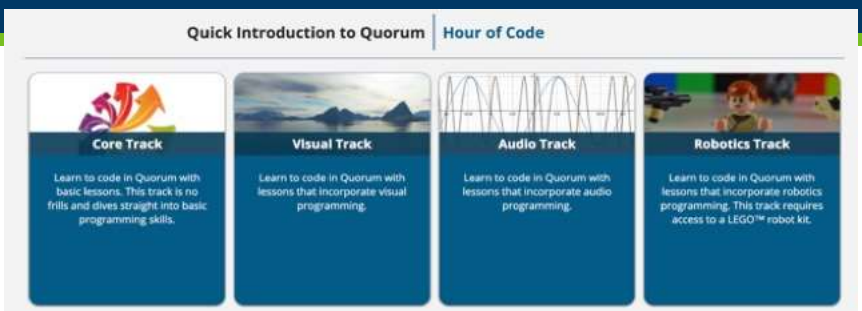
Example: Quorum Programming Language



- "Born accessible" text-based programming language based on universal design principles.
- Focus on users who utilize screen reader technologies.
- Use of visual, auditory, and tactile design elements including custom vibration library

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Example: Bootstrap

- Curriculum to teach algebra, physics, and data science through CS education
- Use of text-based programming language
- Accessibility features include:
  - ARIA labels: navigation of tool bar, interaction area, definition areas
  - Use of keyboard shortcuts & other navigation aids
  - Multiple means of representing data beyond graphical output

Bootstrap
+ computing creatively
thriving mathematically

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Commitment from Program Providers:

- Acquire materials, curricula and technology that is accessible.
- Review program content and tools for accessibility.
- Create an improvement plan and set target dates to fill identifiable gaps
- Include accessibility guidance for facilitators, teachers, and other content implementers

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Example: Deaf Kids Code

- CS and making workshops and school programs for students who are deaf and hard of hearing.
- Focus on hardware and robotics
- Support deaf education teachers and other school personnel that work with students who are deaf and hard of hearing

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Example: Tech Kids Unlimited

- Not-for-profit education organization that does after school, weekend, hackathons, and summer programs for students with a range of abilities and needs.
- Focus on students with autism spectrum disorders, social/emotional challenges, etc.
- Emphasis on job skills, cognitive access, problem solving, and social interactions.

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Commitment from School Districts and State/Regional Education Assoc.

- Acquire materials, curricula, and tech that is accessible for students with a range of needs
- Work with school personnel that have knowledge of assistive technologies, accessibility, and student needs (AT coordinators, special educators, occupational therapists, etc.)
- Identify systemic barriers to inclusion
- Offer professional development on Universal Design for Learning, accessibility, and inclusion

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Example: Broward County Public Schools

- Teacher professional development focused on including ALL learners in CS education opportunities.
- Investment in physical robotics as well as software

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Example: New York City Public Schools

NYC Department of Education Computer Science for All

- Development of a Blueprint for K-12 education based on Universal Design for Learning (UDL)
- Creation of model units that are accessible and built through UDL and differentiation
- Ongoing professional development for teachers

NYC Department of Education COMPUTER SCIENCE FOR ALL

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Commitment from CS Education Researchers

- When possible, gather demographic data on research participants including disability status
- Consider impact of research on a range of users
- In developing pedagogies and technologies for CS education, consider a range of instructional need
- When working in K-12 schools, advocate for the inclusion of a range of learners in CS education opportunities

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Example: Our work with the CTRL Research Lab

Creative Technology Research Lab (CTRL)

- NSF projects focused on inclusion of all learners with a focus on elementary and middle school
- Focus on Universal Design for Learning, accessibility, and inclusion
- Work with school districts and provide resources for inclusion of all learners, including those with a range of instructional needs

Creative Technology Research Lab

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Another Example:

AccessCSforAll Including Students with Disabilities in High School Computing Education

- Focus on increasing participation of students with disabilities in high school computing education.
- Provide professional development to teachers
- Work on software development (e.g., Quorum and Blocks4All)

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Next steps in Research:

- Continue studying accessibility, learning, and engagement to improve functionality and accessibility.
- For example, Bootstrap initial lessons learned:
  1. Students are not as familiar with screen readers as the researchers expected.
  2. For students with visual impairment, they overwhelmingly preferred text-based languages but there is a “threshold for maximum length of code”.
  3. Equity goes beyond the tool and extends to the curriculum

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Next steps in teacher professional development:

- Teachers want resources for supporting all their students. We must create additional resources to help teachers!
- For example, the CTRL lab is creating:
  - TACTICal teaching briefs that have strategies embedded in case studies
  - Universal Design for Learning examples in CS education
  - Face-to-face professional development for teachers

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TACTICal Teaching Briefs on the CTRL website

TACTICal Briefs

- Peer Collaboration during K-12 Computer Science Instruction
- Paraeducators during K-12 Computer Science Instruction
- Utilizing the Universal Design For Learning Framework in Computer Science Education
- Meeting the Needs of All Learners in K-12 Computer Science Through Co-Planning and Co-Teaching
- Scaffolded Project Planning During K-12 Computer Science Instruction

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Universal Design for Learning Examples in CTRL

Multiple Means of **Representation**	Multiple Means of **Action and Expression**	Multiple Means of **Engagement**
Provide options for perception · Model computing using physical representations as well as through an interactive whiteboard, videos · Give access to modeled code while students work independently · Provide access to video tutorials of computing tasks · Select coding apps and websites that allow the	*Provide options for physical action* · Provide teacher's codes as templates · Include CS Unplugged activities that show physical relationship of abstract computing concepts · Use assistive technology including larger/smaller mice, touch-screen devices · Select coding apps and websites that allow coding with keyboard shortcuts in addition to dragging & dropping with a mouse	*Provide options for recruiting interest* · Give students choices (choose project, software, topic) · Allow students to make projects relevant to culture and age · Minimize possible common "pitfalls" for both computing and content · Allow for differences in pacing and length of work sessions · Provide options to increase or decrease sensory stimulation (for example listening to music with

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Resources

K-12 CS Framework:
https://k12cs.org/

Bootstrap Accessibility information:
https://www.bootstrapworld.org/blog/accessibility/User-Interface-REPL.shtml;
https://www.bootstrapworld.org/blog/accessibility/User-Testing.shtml ;
https://www.bootstrapworld.org/blog/blocks/Block-Getting-Started.shtml

Blocks4All:
https://milnel2.github.io/;
http://stemforall2018.videohall.com/presentations/1078

Quorum programming language:
https://quorumlanguage.com/

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Additional Resources

Deaf Kids Code:
https://www.deafkidscode.org/

New York City CS4NYC:
https://blueprint.cs4all.nyc/resources/

Creative Technology Research Lab (CTRL):
https://ctrl.education.illinois.edu/;
https://docs.google.com/document/d/1bga4el8U5PTxWvJjh3NrQmCULKEYGw3R81weiZLhfpo/edit

AccessCSforAll:
https://www.washington.edu/accesscomputing/accesscsforall

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Thank You For Your Attention!

- **Maya Israel**

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QUESTIONS?

You May Type and Submit questions in the Chat Area Text Box
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