Lesson: Introduction to Computer Science and the micro:bit

Big Picture
This lesson will prepare students with a quick overview of basic computer science terminology and concepts then introduce the BBC micro:bit microcontroller hardware and Makecode *Blocks Editor* software tool.

Objectives
Students will be able to:

- List the 4 basic functions of a computer
- List the 3 fundamental building blocks of programs
- Define hardware, software, algorithms, and program
- Create a simple micro:bit program and install it on the device

Alabama Standards Alignment

29: Create an artifact to solve a problem using ideation and iteration in the problem-solving process.

- Examples: Create a public service announcement or design a computer program, game, or application.

Links to Resources
micro:bit quickstart http://microbit.org/guide/quick/
micro:bit safety guide http://microbit.org/guide/safety-advice/
What is a microcontroller https://en.wikipedia.org/wiki/Microcontroller

Preparation
The following files will be needed:

- lesson-3_video.mp4: Introduction to micro:bit video on lesson page (7:56)
- lesson-3_student_handout: Tutorial handout found on lesson page

The following file is optional:

- lesson-3_video_optional.mp4: Optional hello world program demo (9:57)

Choose a presentation method:

- A video (lesson-3_video_optional.mp4) that demonstrates the process may be viewed (and paused where needed)
- Instructor can walk the students through using the student tutorial handout
- Students can work at their own pace using the tutorial handout. You may also post the video and tutorial locally and allow students to choose.

Materials Required

Each student (or pair of students) requires:

- Tutorial handout
- micro:bit kit
- USB cable
- Internet connected computer with modern browser

  **Note: Browsers known to work with micro:bit software includes Firefox, Chrome, Safari, and Microsoft Edge*
  For a complete list, visit this page: https://makecode.microbit.org/browsers

Vocabulary and Concepts

- Hardware - the physical parts of a computing device
  - The stuff you can actually touch
- Software - the instructions that tell the hardware what to do
  - Ex: Any programs found on a computer or phone; Google, Facebook, etc.
- Algorithm - a step-by-step set of instructions to accomplish a task on a computer that always works.
  - A technique for solving a problem. Ex: The algorithm for cooking brownies
- Program - a computer implementation of one or more algorithms
  - A piece of software that performs a certain task. Ex: Powerpoint
- 4 basic functions of a computer: Input, Process, Output, and Storage
  - Input Example: entering words or numbers into a program using your keyboard or clicking an icon with your mouse.
  - Process Example: the program processes your input. It is taking in the instruction you gave it to see what it needs to do with it.
  - Storage Example: the input entered may need to be saved in memory so you can access it later in time--like pulling up a Word Document saved on your Desktop
  - Output Example: displaying what you type on the keyboard to the screen. Also, clicking the internet icon on your desktop will output an internet browser.
- 3 essential building blocks of programs: Sequence, Selections, Loops
  - Sequence: a series of actions completed in a specific order. Ex: having a daily routine--wake up, get dressed, brush teeth, eat breakfast, etc.
  - Selections: asks a question to figure out which path to take next. Ex: is it cold outside? If so, grab a jacket. If not, leave it at home.
  - Loops: asks the same question over and over until a certain task is complete. Ex: eating breakfast--while there is still cereal in the bowl, take another bite! If there's no more cereal, the "task" is complete. You finished your breakfast.
- Microcontroller - a small computer on a single circuit board
  - Programmed to do one thing, simpler and smaller than a desktop computer.
- Circuit - a set of electronic components connected together by wire designed to accomplish a specific function

- Analog circuit - a circuit where the signal varies continuously

    - Ex: A digital song (Stored as 1's and 0's) outputted directly would sound like static. An analog circuit must be used in your phone to convert those 1's and 0's into an audio signal that varies continuously, aka music.
- Digital circuit - a circuit where the signal is one of two or more discrete values
    - Ex: A digital circuit in a cell phone may download a song as two discrete values; a bunch of 1's and 0's.

Teaching Guide

Getting started (10 mins)

Tell the class that they will create their first micro:bit program today. Before they start programming, everyone needs to learn a few new vocabulary words and concepts that are important for makers of digital artifacts. The terms and ideas are explained in a short video (Introduction to microbit.mp4) that ends with an overview of the micro:bit hardware.

Activity (40 mins)

The class is now ready to create their first micro:bit program. Use your chosen method to demonstrate how to complete the activity. After students get "Hello World" working, allow them time to experiment with the software and micro:bit. Variations include changing the text in the "show string" instruction and picking different symbols to be displayed using the "show icon" instruction. Encourage students who create variations of the program to share with the class. It is important to build a sense of accomplishment early in CS Making so that students will be engaged quickly and are more likely to persevere when projects become more challenging.

Wrap Up (5 mins)

Review the 3 essential building blocks of all computer programs in the "Hello World" program; sequence, loop, and decision. Ask students which of the three building blocks were used in this program and how they were used:

- ✓ Sequence - the order of instructions matters. If the "show string: Hello!" instruction is placed after the loop, the string will never display.
- ✓ Loop - The loop instruction allows the message to display repeatedly instead of only once.
- X Decision - The program did not make any decisions, all instructions simply told the micro:bit exactly what to do.

Emphasize that every program in the world can be constructed using just these three building blocks (note: two other building blocks will be added later, but these three are sufficient).

If time permits, ask the students how the micro:bit is different from a desktop computer, tablet, or smartphone. The micro:bit is a microcontroller and all microcontrollers are complete computers (i.e. they implement all 4 basic functions of a computer). However, microcontrollers do not typically have full color graphical displays, keyboards, or require large amounts of power (they can usually be powered by batteries for days, weeks, or even months).