GET TO KNOW THE ARDUINO STUDENT KIT

Interview with Aaron Locke, Robotics Curriculum Specialist, Pitsco Education, U.S.A.

We recently had a chat with Aaron Locke, robotics curriculum specialist with Pitsco Education, one of our partners in the U.S. Aaron has been with Pitsco for 14 years and writes lessons and activities about building and programming robots.

He also used his expertise to write the curriculum material for the Arduino Student Kit.

Arduino Education: Hi Aaron, great to chat! Firstly, tell us how you went about the development of the curriculum material for the Arduino Student Kit?
Aaren Locke: Our goal was to create the *Arduino Student Kit* as the place to start if you are a student new to Arduino. So, first we looked at academic standards associated with coding, electronics, engineering, and even science and asked ourselves a few key questions. What are the expectations that are out there when it comes to courses? What concepts do students need to learn? What skills do students need to develop? Then we analyzed other Arduino Education curriculum products such as *CTC GO!* so we could in a sense, work backward to develop a first experience that would set students up for success with these and other Arduino products.

Working with a team from Arduino, we developed a curriculum map that outlined project ideas, programming and electronics concepts to be covered, and skills to be developed. We also wanted to focus on the history of invention and highlight inventions that have helped to shape our technical world. For each lesson we mapped

out inventions and inventors that relate to what students would be learning and doing.

Once the map was created, lessons went through a development process where they were written, reviewed by the Arduino team, revised, student tested, revised, edited, revised, tested for quality assurance, revised, and finally turned over to Arduino for deployment to the online platform.

AE: How did you come up with the project ideas?
AL: This took a lot of collaboration with David Cuartielles from Arduino. David came to Pittsburg, Kansas, to meet with me and we spent the better part of a day working together, brainstorming ideas for projects, and making adjustments to the curriculum map so that the concepts students would learn could be applied through hands-on projects.

AE: Did you have any core elements that were really important to include?
AL: To me, the most important thing to include were answers to the questions of how and why. Especially when it comes down to fundamentals of electronics and coding. For example, how is electricity flowing through the circuit to make it work? For this specific question, we included a multimeter in the kit so students can measure and see for themselves what is going on in different components of the circuit. We put a lot of effort into explaining and physically showing how different electronic components work.

But the how and why also extends to coding concepts. First, we didn't want to just give students the code they needed. This is different from the *Starter Kit* where you can get the code from the Example menu in the IDE (the *Arduino software*). We wanted students to have to manually type it in to create their own sketch. Furthermore, we didn't want to tell students to just "type this line of code" without telling them what that command or function does and why it's useful. A lot of thought was put into explaining down to bits and bytes how the sketches they create work to control their circuits.

This kit differs from other Arduino kits in that lessons aren't over once the project is built and coded. Students then perform experiments with their projects to get a deeper understanding of how they work. For this, it was important to include a place for students to take notes, record data, draw conclusions, and answer reflection questions. A student logbook that accompanies the curriculum can be downloaded and printed from the digital content.

Another thing that was important to include was lots of teacher support. We didn't want teachers to have to feel like they have to be Arduino experts to use this kit in their classroom. They can be learners just like their students. So, to help teachers we

provide teacher notes throughout the curriculum so they know what to look for, where students might struggle, and how to help them persevere to success. There are suggestions for how to check student understanding along the way and provide correction when needed. We provide assessment rubrics that teachers can use to assess each lesson as well as a teacher logbook that provides answers or explanations of what to look for when assessing the student logbook.

AE: What did you want the overall learning outcomes to be?
AL: I'd say in general a deeper understanding of the basic fundamentals of coding and electronics. There are two projects (lessons 5 and 10) that are open-ended challenges where students need to apply the concepts they've learned in previous lessons to complete the challenge. While these two challenges do have criteria and constraints to be met and specific objectives to be accomplished, students have a lot of freedom in how they go about building their circuit and programming their sketch.

But to me it goes beyond coding and electronics fundamentals. The curriculum also has an intentional focus on helping students develop work-place readiness skills such as creativity, collaboration, critical thinking, and communication. For example, the open-ended challenges culminate with students developing and delivering presentations on their projects to show off what they've created. These work-place readiness (also known as 21st century) skills are just as important and perhaps even more important than the fundamental concepts.

AE: Which is your favourite project and why?
AL: My favorite project is the Musical Keyboard. I've always loved music and this lesson does a deep dive into how sound is produced, transmitted, and heard by the human ear. There is some great science presented in this lesson. But more than that, students put the science of sound to use to do something creative. They create a full octave keyboard where they can play and write music. I think it is so cool when technology and the arts come together. (Check out *this video* to see Aaron play his Arduino keyboard!)

AE: We love that project, too! What would you say to students, parents, and educators who are now using this kit remotely?
AL: One of my favorite things about this kit is how flexible it is. Content and activities are broken up into sections that are easy to navigate. There is a lot of bonus material that can be explored through direct links to different resources to enhance learning about specific concepts. There are suggestions for extension activities and discussions. All that to say that there is no right or wrong way to implement this curriculum. You can just focus on doing the fun and engaging activities or you can dive deep into the concepts that make the circuits work. I think the kit and curriculum work in just about any remote learning situation.

AE: Do you have any tips for using this kit remotely?
AL: If they can, students should get parents or siblings involved in what they're doing. While they can certainly complete the lessons by themselves, it can be a lot of fun to work together and collaborate on projects like this. Plus, there are some places where having an extra set of hands might be beneficial. For example, one person to press a button while you hold the multimeter test leads.

Remember that failure is always an option. We usually learn more from our failures than we do from our successes. The inventors that are highlighted in each lesson all had failures before they finally got their invention right. Failure gives us the opportunity to persevere and work through our struggles with grit and determination. So if you don't get it, keep at it. Take a short break if you need to but don't give up. If you do get stuck, reach out to the Arduino community for help. There are plenty of people out there willing to lend a hand.

Also, take your time. While there is guidance on pacing to move through each lesson, those are just suggestions. I'd say move at the pace you or your students feel comfortable with.

Finally, share your successes. Tell others about what you're learning and what you've created. Make videos of your projects and post them online so others can see what you're doing.

AE: We agree! Everyone can share their projects using the hashtag #arduinoathome .

To purchase the Arduino Student Kit, you can *find your country's distributor*, or *visit our online store*.