ONLINE COURSE

Coding Music with pi-top [4]

Learn how to create new sounds and program your very own music Synth using a live coding environment!

pi-top
CERTIFIED TRAINER

pi-top

Learn how to program the Sonic Pi:
"*The Live Coding Music Synth for Everyone*".

You'll connect physical components such as buttons, sound and light sensors to the pi-top [4], which you can use to activate and control your code and extend your learning into the real world.
We learn by doing!

Learn the fundamentals of coding music as you write your own songs. Once you've mastered coding basics such as variables, if/then statements and constructors using coding blocks, you'll progress to writing your own code in Python.

This course includes:

- pi-top [4] Complete & Sensor Foundation Kit
  x1 pi-top [4] Computer, x1 Foundation Plate, x1 Sound Sensor, x1 Light Sensor, x2 Buttons, x1 Buzzer, x2 Potentiometers, x2 Red LEDs, x2 Green LEDs, x2 Yellow LEDs, x1 Ultrasonic Sensor, x8 LEGO® Connectors, lifetime access to Further project library

- 12 one hour sessions

- One-to-one tutoring (In English)

- For ages 11 to 17, beginner to intermediate level

- Tutors from top universities and with CR checks

Content aligns to CSTA Level 2 Standards:

2-CS-02; 2-CS-03; 2-DA-07; 2-AP-11; 2-AP-12;
2-AP-13; 2-AP-14; 2-AP-16; 2-AP-17; 2-AP-19

Course objectives:

Learn how to use computers to make and change things - not just to consume content. You will learn about how computer programs are made, how they work and how to program them.

Essential questions:

- What makes a good program/code?
- How can programs make the things I do *easier?*
- How can programs make the things I do *better?*

Students will understand/know:

- What makes a good program/code
- What programming and coding mean
- How programs are written and how they run
- How troubleshooting works
- How to diagram/flow-chart processes

Students will be able to:

- Build and prototype physical computing projects
- Write and run Python code

DAY 1:

Intro to pi-top, Sonic Pi

Overview
Complete an introduction to pi-top and Sonic Pi - a live coding environment for creating music. You will learn everything from setting up your pi-top[4] to the basics of coding music in Sonic Pi.

Activities
- Set up pi-top [4]
- Launch Sonic Pi
- Explore

DAY 2:

Sound of code

Review
In our previous session we set up your new pi-top [4] and learned about Sonic Pi. What were you able to do inside of Sonic Pi that you thought was interesting? What can we do with a tool like Sonic Pi?

Overview
Today we will go one step further by removing the Sonic Pi program from the equation, and programming the music in a more common programming language - Python. Python is a language that can do a lot more than just play music - it is used to build software applications, control robots, and much more.

Activities
- Play notes
- Use a while loop
- Create unique songs

DAY 3:

Light show

Review
In our previous session we learned to code music in Python and to execute tasks. We talked about how this was different from coding music in Sonic Pi.

Overview
Today we will learn how to incorporate another Python ability into our music making. We'll program physical buttons that we can use to make things happen with our music.

Activities
- Use components to play notes, hold notes, and change notes
- Code LEDs to provide visual cues in time with notes

DAY 4:

DJ loop

Review
In our previous session we learned how to use physical components, like LEDs and buttons to make things happen with our music.

Overview
Today's lesson covers using electrical components to control and interact with musical note code, and it also covers a practice called branching. Branching allows programmers to make their programs, or scripts more intricate.

Activities
- Use if and else conditions in combination with notes, and electrical components to make programs more complex
- Create a device loaded with your favorite songs that a DJ could use

DAY 5:

Turn the sound

Review
In our previous session we added more buttons, lights, and new code (loops) to our projects to make our most complex musical creations yet.

Overview
Today we will switch out our buttons for knobs and find out how that can change the way we interact with our music, and even change our music. We will also cover elif in branching to make the computer think harder!

Activities
- Introduce potentiometers
- Use them to change the pitch of a note and ignite visual indicators
- Use them to control one of two loops allows you to build a block of the given material.

DAY 6:

Echo

Review
In the previous session we learned how to use another component called a potentiometer. We also learned that sound can be manipulated based on the value that the potentiometer is dialed to.

Overview
Explore a new component found in the foundation kit, called an ultrasonic sensor. Today you will also learn how to manipulate sound with threshold values and a bit of mathematics.

Activities
- Experiment with an ultrasonic sensor
- Use thresholds to execute tasks
- Apply mathematics to change octaves

DAY 7:

Feel the noise

Review
In the previous session you learned how the ultrasonic sensor works and how it can be used to control sound.

Overview
This session builds on Lesson 6 and incorporates a new code concept called functions. This new concept will be used in combination with the foundation kit components to interact with notes and songs.

Activities
- Use a sensor to change the way songs sound
- Write functions to incorporate reusable code in a program and lessen the work load

DAY 8:

Select the noise

Review
The previous session you learned about functions and how to use them in code. Think of a situation in which it is beneficial to use functions in code.

Overview
Today we will experiment with a feature on the pi-top[4] that may have gone unnoticed. It is called the mini screen, or OLED (Organic Light Emitting Diode). We will also cover somethings that you can do with the buttons that surround the mini screen. The goal at the end of the lesson is to create an interactive device with the mini screen to play songs.

Activities
- Experiment with the OLED screen
- Use control buttons to play notes and initiate songs
- Create and use functions to execute tasks

DAY 9:

Playlist files

Review
In the previous session we learned how to use the mini screen or OLED screen to display messages and play songs using the control buttons. Can you think of any other things you can do with the OLED screen or some other functions that would improve a script?

Overview
Today we will use a program outside of Further called Mu. You will learn how to create modules in your very own library and select song clips using the control buttons.. like a playlist!

Activities
- Experience Mu
- Create and use modules for songs in a main program
- Write code for your favorite songs

DAY 10:

Jukebox

Review
 In the previous session you learned how to make and use modules from multiple files. Why is it more convenient to use modules when writing code?

Overview
Today we will learn how to use different synths in code to make our songs more interesting. The lesson also covers a new concept called multiprocessing so that we can create a light show at the same time that songs play.

Activities
- Use synths to change the sound of songs
- Create modules
- Apply multiprocessing with flashing LEDs

DAY 11:

Ambience

Review
In the previous session you learned how to make and use modules from multiple files. Why is it more convenient to use modules when writing code?

Overview
Learn how to use sounds and music to enhance media and apply sound effects to an interactive game.

Activities
- Transform a keyboard into a piano
- Enhance digital media with sounds
- Tinker with sound effects for an arcade game
- Learn what code flow charts are and create a sample
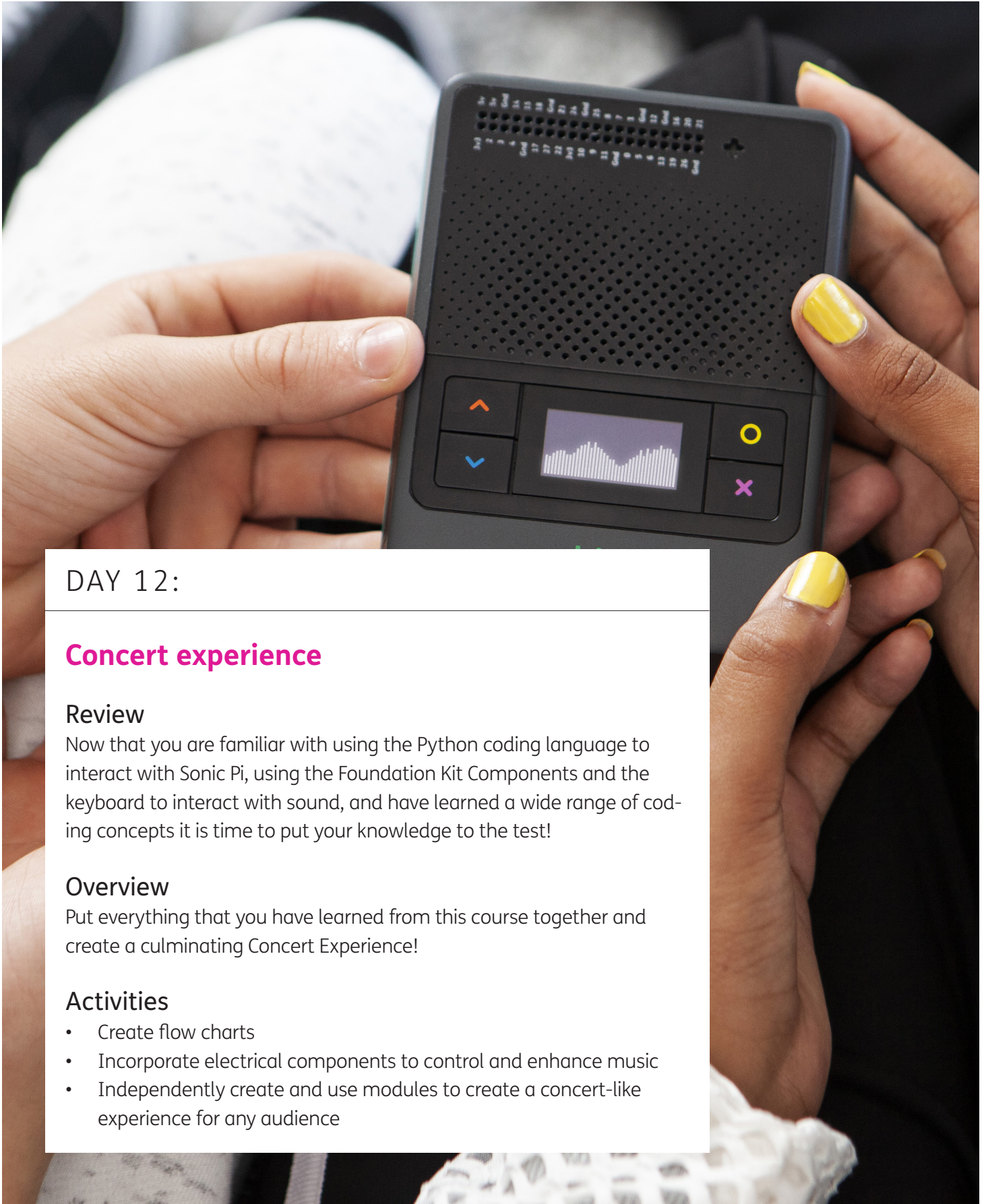
DAY 12:

Concert experience

Review
Now that you are familiar with using the Python coding language to interact with Sonic Pi, using the Foundation Kit Components and the keyboard to interact with sound, and have learned a wide range of coding concepts it is time to put your knowledge to the test!

Overview
Put everything that you have learned from this course together and create a culminating Concert Experience!

Activities
- Create flow charts
- Incorporate electrical components to control and enhance music
- Independently create and use modules to create a concert-like experience for any audience

pi-top

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