Build Your Own Power Bank Workshop Design

Target Audience
Beginners and hobbyists interested in electronics and hardware (ages 16+)
Workshop Goal
The goal of the workshop is to build a functional power bank by following a set of steps/procedures presented by the workshop lead.
Workshop Objectives
1. Given a full power bank kit that includes 18650 lithium-ion batteries, a power bank module board, and a 3D-printed enclosure. The participants will be able to weld the four battery cells in parallel using a spot welding machine properly, with no connection problems. 2. Using the previously soldered battery cells, a power bank module, and a soldering iron, participants will be able to solder and connect the batteries to the power bank module using proper connectors with no errors in the polarity connection. 3. Using an AVO meter, participants will be able to test the battery connections and measure the output voltage with no errors in measurements.

Detailed Workshop Design (5Es Framework)	
Engage [20 Minutes]	Goal: Spark curiosity, connect to prior knowledge, introduce today's project, and show relevance through a live demo. Activity #01: Introduce the participants to today's build & outline the learning journey. ● Covered Slides: ○ From 02 to 05. ● Instructor Role: ○ Start the workshop by telling the participants that we are going to build a power bank. Like this one [Demo the power bank, connect it to your mobile phone and show it off in action] ○ **Prompt a question:** A power bank! What is actually a power bank?! ■ The aim of prompting this general question is to activate the prior knowledge of all the participants and let them dig deeper into their brains to grab what a power bank is and what its core components are. ■ Leave a space for the participants to answer freely without any pressure. ○ **Say to the participants:** A power bank is a device that can store energy through battery cells. But there are many aspects that we need to look at: ■ There are many battery types. Which type is ideal for power banks? ■ Are all power banks the same? They have different capacities, there are fast charging features, normal charging, wireless charging, etc. So, not all of the power banks are the same. ■ How can the power bank device distinguish between if I'm connecting my mobile phone to charge or I'm connecting a charger to charge the power bank itself? ■ How does the power bank manage the power distribution between the internal battery cells without overloading anyone of them? ○ **Say to the participants:** So, throughout this workshop, we are going to answer all these questions by building our own power bank device! You've all used a power bank. But today, you'll understand and build one from the inside out. Let's see what makes it come alive. ○ **Say to the participants:** Today, we are going to learn batteries assembly and how to use spot welding machine to connect multiple

	batteries, we are going to know more about the 18650 Lithium-ion batteries and their capabilities, lastly, we are going to learn how to use the power bank module and how to connect the battery cells to it.
Explore [30 Minutes]	Goal: Investigate how a power bank works and what the core components are that make a power bank through guided discovery. Activity #02: Explore the core components of the power bank device through a Hands-on experience. ● Covered Slides: ○ From 06 to 12. ● Instructor Role: ○ Distribute to each participant a full power bank kit + one shared spot welding machine. ○ **Ask them to identify** each component inside the power bank kit: Lithium-ion batteries, nickel strips, power bank module board, AVO meter, spot welding machine, and 3D-printed enclosure. Encourage all the participants to participate and guess if they don't know the name of each component. Encourage them to fail, don't judge anyone, and keep it cool! ○ After identifying all the components that make a power bank, wrap up what they said and quickly explain each component's function and how it works. And, they all integrate to make a power bank device. ○ Discuss battery types and why lithium-ion is the most used, and show the different applications that use this battery type. Electric cars, scooters, RC toys, etc. Activity #03: Explore Series and Parallel Battery Connections through a hands-on experience. The goal of this activity is to explore the differences between the series and parallel connections. And, what are the connection types we are going to use in today's power bank device? Also, become familiar with the tools that participants are going to use to assemble the batteries. For example, the spot welding machine, nickel strips, etc. ○ First, introduce the participants to the activity. Now, we are going to make two different types of battery connections. And, we are going to identify the differences between them. And, clarify which one is the proper one. ○ **Show them** how to connect two batteries in series. **Then ask them** to do the same with their batteries. Don't explain what a series and

	parallel connections are. We are going to explain those two concepts in the reflection section after they explore them by themselves first. ○ Now, let's use the AVO meter to measure the output voltage of the batteries series connection. ○ **Ask the participants** what they observe and what the conclusion of the series batteries connection. ○ After all the participants understand the series batteries connection, let's do the same process with the parallel batteries connection. **Show them** how to connect two batteries in parallel, **ask them to apply** the same steps, use the AVO meter to observe, and conclude. ○ Now wrap up the batteries series and parallel connections. Explain to them when to use the series and parallel connections, and what connection type we are going to use in the power bank that we are going to build in today's workshop.
Explain [50 Minutes]	Goal: The goal of this phase is to explain in a live demo how to use the spot welding machine to assemble the battery cells, connect them to the power bank module board, and assemble the 3D-printed enclosure. Activity #03: Onboard the participants on the power bank device build steps ● Covered Slides: ○ No slides. Pure hands-on. ● Instructor Role: ○ Show the participants how to assemble and solder the power bank device's four battery cells. A live demo ■ Assemble the battery cells in their 3D-printed brackets. Focus on the polarity direction, ■ Spot-weld the nickel strip on two battery cells as a demo. ○ After showing them how to assemble the battery cells, show them how we are going to assemble the welded battery cells on the 3D-printed enclosure and how to solder the battery cells to the power bank module board. A live demo
Elaborate [90 Minutes]	Goal: The goal of this phase is to give a space for the participants to put their understanding in action and build their own power bank devices. Activity #04: Let the participants practice applying the build steps by themselves under the instructor supervision and support. ● Covered Slides:

	○ From 13 to 16. ● Instructor Role: ○ *After onboarding all the participants on the steps of building a power bank device. (connect the four cells in parallel, using nickel strips and spot welding, and soldering the battery cells output terminals to the power bank module board),* Ask them to apply the same steps to their power bank kit. You will need to pass by them and observe how they work and provide any guidance they need during the building time.
Evaluate [20 Minutes]	Goal: Showcase outcomes, peer feedback, and final reflections. Activity #07: Showcasing time! ● Covered Slides: ○ No slide. Pure Discussion. ● Instructor Role: ○ Organize a “show and tell” session. Ask participants to demo their power bank devices. ○ Facilitate reflection on the learning process and challenges. ○ Prompt questions that will help you engage the participants: ■ What is the capacity of the power bank device we built? ■ What was the biggest challenge, and how did you solve it?