



PROGRESS OUTCOME 6

Designing a speaker box

Context

The school's integrated course encourages specialist students to combine their expertise to develop multi-disciplinary outcomes. An end-of-year occasion attended by whānau, local business, and council members celebrates these outcomes.

Jarrold and Krish have been working across two specialist technological contexts: digital and resistant materials, and construction. During the early scoping aspect of their project, they surveyed the school's three senior year groups. The most popular request was for a small Bluetooth® speaker and amplifier for linking with students' phones.

Jarrold explored the idea further with some of the students and decided that the device could include an audio-reactive LED matrix. The matrix would run a number of visualisation modes to react to the music via a microphone inside the speaker box.



Insight 1: Design and construction decisions

As the digital expert, I began to design and model a suitable electronic system. I met regularly with Krish, my construction partner, to ensure that we both understood the specifications and requirements. For example, we clarified the speaker-box measurements to make sure that the box could house an audio Bluetooth® amplifier board, an open source microcontroller (to control the LED matrix), a power supply and speakers, and a small, single-supply electret microphone circuit. We knew that to be fit-for-purpose, the outcome needed to look good and work well.

For the amplifier board, I sketched some circuit diagrams to show how I planned to build and control the amplifier, and I researched the components I might need and which would be suitable.



Insight 2: Trialling components and construction

Firstly, I had to gather electronic components – the Bluetooth® module, LCD Bluetooth® module, and lithium polymer battery speaker. The amplifier components included left- and right-channel amp modules, a transformer, a switch and hardware materials.

Getting the correct speakers for the amp was a challenge. We learned that the load handled by an amp (expressed in Ohms) has to match the load of the speaker, so, for example, you need to use an 8 Ohm speaker with an amp rated at 8 Ohms.

I worked closely with Krish as he measured and cut out the various parts of the speaker box, such as the top panel for the push-button controls. As we added components, we tested all parts to make sure they were still functional (so that we didn't fry anything and everything was put together correctly before being powered up). We also investigated the potential draw on the battery.



Insight 3: Configuring the network components

Potential challenges centred on aesthetic and functional factors. For example, the LED display was an important part of the complete unit and needed to look good. But I had to make sure it was earthed properly, as otherwise it might malfunction.

I sketched out a step-by-step plan as I worked through the best way to lay out the components inside the speaker. I also found I had to shuffle the components around to insert the LED baffle in the enclosure.

Once I had determined the layout, I had to connect the components from the JST PCB connectors.



Insight 4: Testing the final outcome

Once we had installed everything, we tested the speaker with a range of phones. For our first test, we turned on the speaker and connected my phone to Bluetooth®. I wanted to test the sensitivity of the microphone because the LED panel responds to this sound source. I found I had to adjust the MIC_HIGH and MIC_LOW parameters in the code to improve how the panel would read and react to the sound.

We then tested the sound source with Krish's phone to make sure the settings worked on a different make of phone. Finally, some senior students tested the speaker box in a variety of settings. They reported that it worked well and looked great!

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