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Raspberry Pi

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Learning in the library at Greenhills School (in Ann Arbor, Michigan) can get noisy. Students in grades 6–12 have come to the school library to fabricate a Klein bottle with the 3-D printer, run the sewing machine to embellish a hoodie with LEDs, and borrow EL (electroluminescent) wire for a photography shoot. Now students can also check out Raspberry Pi kits to create a number of inventive projects in the classrooms or at home.

What Is a Raspberry Pi?

Although it sounds like a delicious dessert, since 2012 over three million of these tiny computers about the size of a playing card have been sold to educators and tinkerers around the world. These circuit boards are available with multiple configurations. The differences are roughly in the number of USB ports and the amount of memory available on each of the boards. On its own, the Raspberry Pi won't do much out of the box. Users will need to install an operating system (usually Raspbian or Linux), which can be downloaded to an SD card from a number of websites, and set up the small computer with a power source and peripherals.

Once the operating system is loaded, and keyboard and monitor are attached, it's time to select a programming language. Many school librarians and students are familiar with Scratch, a graphic programming language supported by an active online programing community, and Python, another easy-to-learn, object-oriented programming language that has loads of online support. Both languages have a growing library of projects written for the Pi, so new users need to know just enough coding basics to modify projects or commands for their own use.

The simplicity and adaptability of the Pi allow students to construct and instruct a piece of hardware to do just about anything, from playing video games to taking pictures from near space. Although using a Raspberry Pi can present a fairly steep learning curve for many school librarians, being able to customize a technology to accomplish something useful or cool with students is a tremendous benefit.

What Have We Done in the Greenhills Library?

As a school librarian, I'm always on the lookout for ideas to integrate useful technologies and for new ways to broaden student interest in the subjects they are studying. Middle school students and teachers at our independent school are busy trying to cover a ton of content in their classes, so often I need to offer a club or a workshop for anything I want to introduce that is not traditionally taught. Sometimes these workshops are so successful that teachers will work with me to find a way to incorporate these ideas

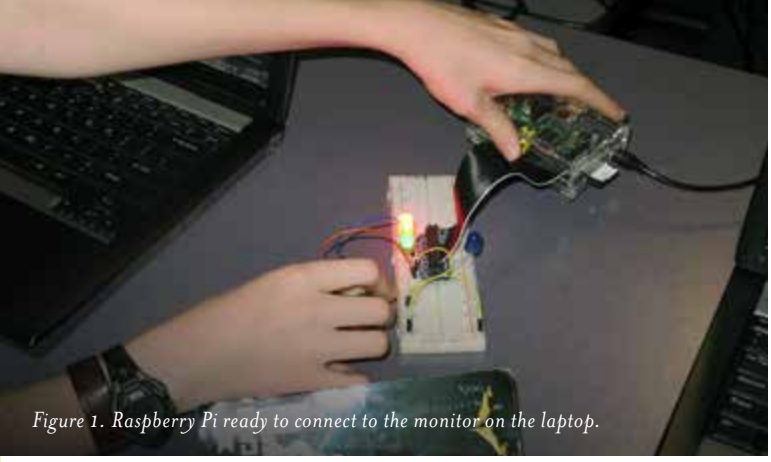

Figure 1. Raspberry Pi ready to connect to the monitor on the laptop.

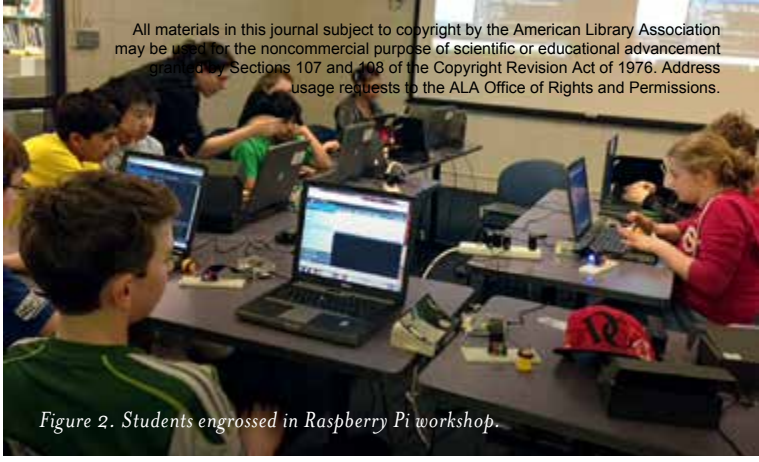

Figure 2. Students engrossed in Raspberry Pi workshop.

or technologies into their classes. That's what happened after a lively Raspberry Pi workshop.

I asked a couple of the students in the high school computer science class if they wanted to help put together an after-school workshop to build a motion detector that would trigger an e-mail when the door to the student's room was opened. We snagged some items from the science department and ordered a few things from Adafruit <www.adafruit.com>. Here's what we used for each pair of students (see figure 1):

- RASPBERRY-MODB-512M
- 4GB SD card
- Two-foot Ethernet cable
- 1A external plug-in Micro-USB
- Breakout kit for PI (see <http://adafruit.com/products/914>)
- Breadboarding wire
- Three 10mm diffused LEDs in different colors
- One pushbutton
- One PIR motion sensor with tails.

We didn't have any HDMI monitors available so we found an article that showed how to use a laptop as the display and keyboard for the Pi.[1]

I worried that we had way too much material to cover in two hours. After all, asking kids to install an operating system on a computer, learn a new programming language (Python), and combine it with some previous knowledge of electronics might be too complicated. Boy, was I wrong! A student quickly pointed out that our plan was flawed because the number of people in the lab would set off the motion detectors.

Students quickly put their (and my own) reasoning and research skills to the test in coming up with a new project. We decided we would use the LED lights to indicate temperature ranges by pulling the information from airport websites.

Students showed each other how to turn their queries into code and began posing all sorts of questions that I had never dreamed of asking. Before long, our lights were blinking and reporting temperatures from around the world (see figure 2).

Pi enthusiasm has caught the attention of the eighth-grade teaching team. Each year students in grade 8 showcase science work with circuits as well as writing skills from an English memoir project. What if we combined the projects into an integrated unit and created our version of a digital book—one that could light up? The science teachers decided to offer the option to use either the Raspberry Pi or an Arduino board (available at <www.arduino.cc>) to illuminate the homemade books. Students have jumped at the chance to extend their knowledge of circuits by working with the boards. In addition, we have decided to add an innovation rotation to the seventh-grade curriculum; this change allows students to select the option of using the library's Pi units to design a project.

What's next? This year, members of the middle school book club decided that they wanted to use a Raspberry Pi to build a Minecraft program based on a story they are writing. Maybe we will tackle building a machine to run the circulation system. To my great delight, it appears that the energy level in the school library will continue to be turned up as we support students' STEAM learning as they have fun.

1 "Raspberry Pi Remote Connections—Without a Network!" at <http://pihw.wordpress.com/guides/direct-network-connection>.

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