Chapter 6

Big Impact with littleBits

Stacy Brown*

A library of any type is a place to learn for all students. In most libraries, students originate from diverse cultures, have different educational needs and experiences, possess a range of social and emotional distinctions, and represent a variety of ages. The American Library Association's *Strategic Directions* notes equitable access as a key action area for libraries of the future.[1] Specifically, its strategic plan notes the need to accommodate individuals with language barriers, physical barriers, barriers to equal education, religious differences, and more. As a result, librarians are faced with the challenge of leveraging their resources to accommodate a variety of cognitive differences while accounting for physical differences. Discovering technology that is accessible to all and that can provide value to a diverse population can be challenging. In our school library, when we acquired littleBits, we also acquired a positive approach to integrating technology across a diverse set of needs.

LittleBits are small magnetic circuits that snap together to allow users to create simple inventions, such as providing a source of light, and more complex inventions, like creating a mobile underwater aquarium scene. LittleBits can be purchased as individual kits or within different types of specific kits. Some bits are more advanced than others. The blue bit represents the power source and connects to a 9-volt battery with a battery cable that is included. Pink bits represent input bits, allowing the creator to control the circuit. Examples include a dimmer switch, a button, or a pulse. Green bits represent output bits and accomplish a specific task. Examples of these include LEDs generating light, servos causing motion, or buzzers creating sound. Because littleBits can generate sound, light (flashing or continuous), and movement, they can accommodate individuals who are visually impaired or have hearing loss. Additionally, because input bits can control the intensity of the output components, students with sensory processing disorders can control the output of sound, light, or movement, making littleBits accessible for students with specific sensory needs. Finally, the orange bits are considered to be accessory bits that allow the user to extend the circuit with the use of branches as well as add levels of complexity to the circuits. With these bits, students with limitations in mobility range can still build with littleBits. With the inclusion of the wire bit, the circuits can extend to allow for a more expansive work area also allowing for a wider range of motion. The wireless transmitter and wireless receiver bits work together to allow the creation of a circuit that can be controlled remotely, which also extends the accessibility. The benefits of working with littleBits technology are extensive.

Instruction with littleBits can be differentiated to accommodate a variety of age groups and skill levels. Four- and five-year-olds can create simple inventions using only three bits. For example, our kindergarten students were learning about zoo animals. As a fun design challenge, we created design challenge cards related to the theme of zoo animals for the students to solve in small groups. With the students working in

* **Stacy Brown** is the 21st Century Learning Coordinator at the Davis Academy in Atlanta, Georgia, where she manages two media centers in a kindergarten prep through eighth grade academic environment. Recognized for facilitating the integration of technology into the curriculum, she leads #MakerMonday for pre–K through fifth grade, teaches a fourth grade programming and robotics class, developed a fifth grade entrepreneurship and technology course, coordinates a student technology leadership program known as Network Sherpas, and leads teachers' professional development in the area of technology integration.

teams of two and three, design challenges included creating a device that the zookeeper can use to alert the zoo animals that it is their feeding time. Using the blue power bit, the pink button input bit, and the green buzzer output bit, the team of kindergarteners were able to build a contraption out of construction paper, popsicle sticks, and pipe cleaners to house their "feeder alert." Other examples included designing a cooling system for the pandas, creating a zoo animal that can move, or building a lion cage that lights up when the door is opened. This last challenge used four bits, including a light sensor, allowing the teacher to designate this challenge for students who needed an additional layer of complexity to enhance their learning.

Older students can also create with littleBits in ways that will challenge them. Facilitating more complex design challenges tailored to meet the time constraints of the students can provide rewarding learning opportunities. Students learn to be self-managers as they break down tasks and set their own deadlines to accomplish a larger task within a specific time frame. In the book *Empower*, the authors write that this is a critical component of project management.[2] Students are cultivating skills that will serve them well in a professional setting. Merging the learning with littleBits with the core curriculum is another added advantage. For example, fifth graders learning about Jewish customs can create menorahs, dreidels, and mezuzahs out of littleBits. Integrating Lego pieces can also add to the design process with the incorporation of different building materials. Determining which lights work best, such as long LEDs or short bright LEDs, and which pink input, such as a dimmer or a button, will provide the most effective control for lighting the menorah each night is just as important to the design process. Additionally, as students consider the target audience for their designs, they can learn a variety of ways to accommodate a diverse user group. For example, if they are developing a menorah for the visually impaired, incorporating a sound trigger so that the LED candles light up with the trigger of sound can make menorah lighting accessible to individuals with sight limitations. LittleBits not only can be used by those with different abilities but also can be used to create objects for individuals with different abilities. The dual functionality of littleBits results in a lesson in empathy as users are encouraged to consider accessibility in their product development.

Oftentimes when our students are working with littleBits, we refer to them as little engineers. Engineers typically construct to solve a problem. As Amy Wilson-Lopez and Stacie Gregory state in their article "Integrating Literacy and Engineering Instruction for Young Learners," linking children's literature to engineering "can align with students' interests; resonate with their linguistic, cultural, or geographic backgrounds; or introduce them to problems that they have witnessed in their homes or communities."[3] They give the example of having fifth graders read excerpts from the young adult book *Candy Bomber: The Story of the Berlin Airlift's "Chocolate Pilot"*[4] and having the students design a device that would have allowed the candy bomber to safely deliver candy to the hungry children in Germany. Literary connections can help bring the engineering challenges to life, mimicking the solution of real-world problems by students.

Adults can learn with littleBits too. We have incorporated littleBits into our professional development for teachers and have modeled the learning that happens at school for our parents as well. For teachers, understanding this process improves their teaching abilities while helping them to discover new ways to implement different technologies in their curriculum. As stated in the article "The Philosophy of Educational Makerspaces," it is crucial that the process of making remain learner-driven as opposed to teacher-driven.[5] With exposure, parents can also understand the value of this approach to learning as part of their child's education and, in turn, can support these efforts. Constructing with littleBits represents a form of maker education. Maker education can be viewed as a grassroots effort in response to one-size-fits-all education in which instruction is designed for the masses.[6] The accessibility of littleBits allows the learning to be customized.

Acquisition

At the Davis Academy, we started small. We began our littleBits journey with the purchase of one Pro Workshop set, allowing eighteen individuals working in groups of two to create at one time. From the beginning, we used social media platforms, such as Twitter, to send our inventions to the creators of littleBits so that they could see the innovative projects that our students were making. In 2015, littleBits launched a school chapter program, in which schools that applied and were accepted would have a landing page on the littleBits website to upload their inventions, participate in monthly challenges, and receive discounts on additional littleBits. Our school was accepted into this program, which is now known as the littleBits Inventor Club. Being a part of the Chapter Program/Inventor Club has provided valuable learning opportunities for our school. For example, students in a variety of grades participated in several monthly challenges, including creating a project inspired by Harry Potter, inventing a birthday-themed invention in celebration of littleBits' fifth birthday (figure 5.1), and inventing something that glows with littleBits. As a winner of one of the challenges, our school received the Rule Your Room kit from littleBits as a reward. We have

been able to circulate this newest kit into our curriculum for fourth and fifth graders as part of their littleBits design challenge rotations.

Our school hosts Scholastic book fairs twice a year, and through the Scholastic dollars program, we are able to use a portion of the funds earned through our book fair to purchase items available in the Scholastic catalog. This catalog now offers littleBits, and as a result of successful book fairs, we were able to purchase two littleBits Synthesizer kits. With these acquisitions, the volume of projects that we create and their level of sophistication grew. Internally, our school has seen the value of this tool and how it is has enriched our learning community. As a result, we were able to include the littleBits Pro Library as part of our 2016–17 capital campaign. In our first two years of working with littleBits, acquiring the Pro Library seemed like a dream. Through consistent usage and demonstrated value of building this tool into our curriculum, we were able to gain the financial support to make this dream a reality.

Figure 5.1
Middle school students creating a birthday-inspired invention in honor of littleBits' fifth birthday.

Benefits of Bits

With the acquisition of an expanded library of littleBits, we have had the pleasure of strengthening collaboration, creativity, and the application of higher-order thinking skills. Students become problem solvers who persevere through the unknown. They become designers as they begin to understand the value of planning a well-organized blueprint for their creations. They become editors as they go back to alter their design plans to meet an unforeseen need. They become team players as they rely on each other's varying strengths and areas of expertise to complete a project on time. They become partners working toward a common goal that fuels their passions and interests.

Our school uses littleBits as part of a fourth grade exploratory class that meets three times a week for fifty minutes for nine weeks. Students have to meet their deadlines and ensure they have fulfilled the project goals. They have to work as part of a successful design team to meet their clients' needs. They are simulating the experience of real-world professionals working toward a common goal to earn a profit or, in their case, earn a respectable grade for their efforts. Students study characteristics that make engineers, designers, builders, architects, and artists desirable in the work force. With a clear understanding of these characteristics, they formulate interview questions for their classmates to help craft a successful design team. Once the interview process is complete, students are ready to form their teams and begin the brainstorming process to create their inventions with littleBits. Some inventions solve problems, and some are created for entertainment value. Through teamwork and collaboration, the design teams decide upon their goals and work together to successfully implement the design, create the prototype, and carry out the building process. In doing so, they are making social connections while learning to work with teammates who have strengths different from their own. Additionally, they are given a creative outlet to pursue their unique ideas and designs. Students are exposed to a new form of learning with their hands and, in turn, become experts in an area they had not previously explored.

Programming Possibilities

In collaborating with core subject teachers and other special teachers in the school community, students can leverage their knowledge of littleBits to show what they know in an array of subject areas. The programming possibilities are plentiful for all ages. Some activities can be very structured, whereas others can be intentionally more abstract. The time constraints can help dictate the facilitator's approach.

Setting up the time and the space for self-guided exploration and experimentation is rewarding as students can go at their own pace and pursue their own path. At the Davis Academy, we hosted a Bits Bar during our Maker Monday program in which littleBits were set out on a long counter or on top of a low book shelf, and students could come to the bar to put the bits together to make a variety of contraptions and explore how they work. This is a great activity for those without prior experience using littleBits. Selecting a broad theme, such as "Pick a Force," gives students a loose framework to work within but encourages creativity. With this theme, students design a contraption that generates energy to create physical movement. The theme is broad but has a clear objective. The opposite approach can also be taken, in which students are given a "Bucket of Bits" and with the littleBits provided are charged with creating something uniquely their own. Within the confines of the littleBits they are allotted, they can work in small groups to make an invention of their choosing.

In contrast, littleBits challenges can allow for more structured activities. For early morning brain

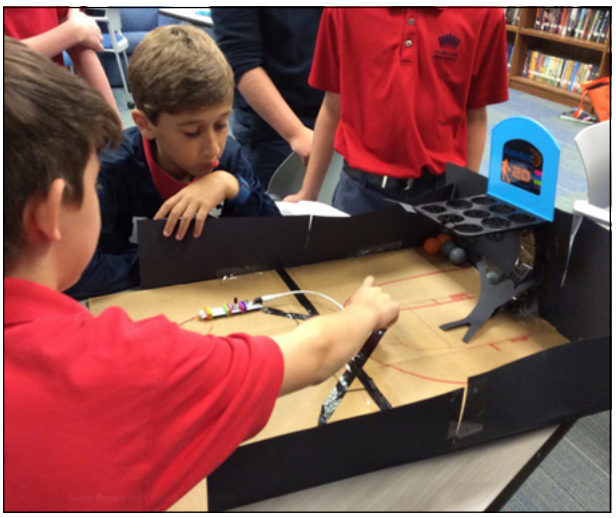

Figure 5.2
Middle school students creating a basketball game out of littleBits for the media center arcade.

warm-ups, fifth graders participated in littleBits challenges in which they were given an objective, the littleBits to accomplish the objective, and the craft supplies to go with it in one big bag. Challenges included the following: "New York City is known as the city that never sleeps. Design a skyscraper that includes a power button to light up the building so the light always shines." Another challenge was to invent a security device for a backpack. Using a battery as the power source, a light sensor, and a buzzer, students were able to create a device that was hidden inside a backpack and buzzed when exposed to light (or when a culprit was mysteriously attempting to take something out of the backpack). Our sixth graders participated in the Inventor Club's challenge to create a birthday-themed invention with littleBits in honor of the company's fifth birthday. One creation included a birthday cake that moved in a circular motion with lit candles on top made of LED lights. Third graders do an invention unit as part of their core curriculum and, as a result, we had students create their own inventions using littleBits to bring the learning to life. Seventh and eighth graders were tasked with turning the media center into an arcade for other students and faculty to enjoy. Using littleBits, students built a variety of games, such as a one entitled Goal Score Light, in which a light flashed when a goal was scored. This can be created using the motion trigger, an LED light bit, and the power source. The students can use cardboard to build the chute to work in conjunction with a small plastic ball. Another group created a basketball game with a launcher to launch the miniature basketball into the holes to earn points (figure 5.2).

Students of all ages can participate in rotational circuits using premade littleBits challenges in which specific littleBits are provided, the challenges are explained, and instructions are offered. The littleBits website, the Pinterest app or website, and the Teachers Pay Teachers website are all sources for premade littleBits challenge cards, or you can create your own challenge cards. With first graders, I set up a series of challenge cards and the littleBits required at different tables. Working in groups of three to four students, each team would use the magnetic littleBits to create simple circuits and then rotate to the next table to complete a different littleBits challenge within their group. This rotational setup allowed them exposure to a variety of littleBits, providing them with a broader understanding of how the different littleBits worked.

Conclusion

LittleBits makes it easy to reach learners at every level and at every age. There are a multitude of ways that littleBits can be integrated into the school library independent of other curriculum or as a catalyst to deepen the learning in a specified subject area. The vast number of littleBits available allows for significant differentiation across the population. Their ease of use, their compact size, and the flexibility of integrating other tangible items—such as Legos, cardboard, craft supplies, and more—allow users to differentiate the complexity of their creations. Since adopting littleBits in our school, we have witnessed the growth of student interest in exploring with educational technology. As we continue to infuse learning with littleBits into our school community, we continue to see the rewards for all students.

Notes

1. *American Library Association Strategic Directions* (Chicago: American Library Association, 2017), http://www.ala.org/aboutala/sites/ala.org.aboutala/files/content/governance/StrategicPlan/Strategic%20Directions%202017_Update.pdf.
2. John Spencer and A. J. Juliani, *Empower: What Happens When Students Own Their Learning* (IMPress, 2017), 84.
3. Amy Wilson-Lopez and Stacie Gregory, "Integrating Literacy and Engineering Instruction for Young Learners," *Reading Teacher* 69, no. 1 (July/August 2015): 27.
4. M. O. Tunnell, *Candy Bomber: The Story of the Berlin Airlift's "Chocolate Pilot"* (Watertown, MA: Charlesbridge, 2010).
5. R. Steven Kurti, Debby L. Kurti, and Laura Fleming, "The Philosophy of Educational Makerspaces: Part 1 of Making an Educational Makerspace," *Teacher Librarian* 41, no. 5 (June 2014): 8–11, Professional Development Collection, EBSCOhost.
6. Kurti, Kurti, and Fleming, "The Philosophy of Educational Makerspaces."