60
READY-TO-USE
CODING PROJECTS

EDITED BY
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Preface

Coding or computer programming is an integral part of digital literacy and has become of paramount importance for libraries committed to providing computational thinking skills to their patrons. These types of programs offered by libraries can provide patrons of all ages with valuable STEM skills as well as problem-solving, critical thinking, and computational thinking abilities and practical career-building proficiencies. For these reasons, the interest in providing such technical programs in libraries continues to grow. ALA's Libraries Ready to Code initiative, funded by Google, provided "more than $500,000 in grants for 28 libraries in 21 states . . . to design and implement coding programs for young people." This was the first time ALA dedicated funds for computer science-related programming in libraries. The introduction shares findings from the Libraries Ready to Code program and shows how your coding projects can contribute to the larger goal of developing computational thinking.

While the benefits of coding programs in libraries is clear, these types of events and workshops can be quite intimidating for librarians who don't have a computer science background. And that's where this book comes in. Each chapter in this book is a complete start-to-finish recipe for how to plan and run an effective coding program in your library, including learning outcomes and recommendations for future programs, even for librarians without any technical background or previous experience.

The programs and workshops in this book have been organized by age group and cover a variety of challenging and engaging topics that run the gamut from choreographing music videos with Ozobots to programming Mad Libs games with Python to animation with Scratch. All age ranges and skill levels are represented—from the youngest kids who can take part in storytime coding activities to tweens who can learn to program robots and develop video games to hacker clubs for young adults and physical computing for adults.

60 Ready-to-Use Coding Projects is an all-in-one guide book for creating innovative coding and computer-related programming that is chock-full of practical project ideas for libraries. It provides real-world programming ideas for public, school, and academic libraries. The programming projects herein have been contributed by librarians and library professionals, and each chapter is specifically geared toward how to implement these projects in libraries.

Introduction

From Coding to Computational Thinking Literacy: A Library Call to Action

LINDA BRAUN and MARIJKE VISSER

Taylor, a teen girl from a rural community, took part in her library's Ready to Code–sponsored activities. She got involved because the school librarian talked with her about her interests and learned that Taylor is very interested in fashion. The librarian then introduced Taylor to Ready to Code programming by working with her on learning how to code and produce e-textiles. Taylor may not pursue a career in fashion or become a coder, but through the exposure to coding through the library, she is more aware of how coding can enhance her interests and even open up opportunities for her.

We often hear that children entering school now will work in jobs or pursue careers not yet imagined. Statistics tell us in the United States today, more than 500,000 computing jobs are not being filled and yet are the fastest growing type of science, technology, engineering, and mathematics (STEM) job available. Along with that, the majority of these jobs are outside the tech sector. Moreover, technology infuses all aspects of learning and human interaction. This will continue to change the nature of how we communicate, how we work, and how we live. There is tremendous opportunity for innovative approaches to solving complex social and economic problems that challenge local communities and around the globe.

Today's workforce requires technical and digital skills. As technologies continue to advance and as emerging technologies are embedded across work sectors and in daily life, the demand for specific sets of cognitive skills will increase in order to integrate these technologies into a variety of areas related to work and life. In response, recent reports from McKinsey & Company and Harvard Business Review have called for more attention to developing social and emotional (SE) skills such as taking initiative and collaboration as well as creativity and problem-solving skills. Coding and computer science (CS) activities help youth develop SE skills, which are at the heart of the concepts in computational thinking (CT).

Libraries Ready to Code CT Definition

"Computational thinking (CT) refers to thought processes used to formulate problems and their solutions.* These include breaking down problems into smaller parts, looking for patterns, identifying principles that generate these patterns, and developing instructions that computers—machines and people—can understand. It is an approach to critical thinking that can be used to solve problems across all disciplines.† Along with leaders in education and industry, the Libraries Ready to Code initiative considers CT to be a critical literacy for all ages of learners."

*Wing, Jeannette. "Computational Thinking." Communications of the ACM. March 2006. https://www.cs.cmu.edu/~15110-s13/Wing06-ct.pdf.

†"Google for Education: Exploring Computational Thinking." Google Expeditions. Accessed October 2, 2018. https://edu.google.com/resources/programs/exploring-computational-thinking/.

When libraries prepare youth for college and career or design programs for adult learners, they expose learners and connect their interests to the opportunities made available through technology. This is the first step in making sure youth and adults are equipped with essential work and life skills. More importantly, libraries that provide coding programs help their patrons develop a mindset to seek new or alternative strategies for using technology to find information, think critically, as well as create and share knowledge and ideas. As librarians and library staff embrace the emerging role of facilitators of coding and CS programs based in CT, they propel youth and adults to think differently. Library staff help build a community of thinkers and doers who create and share new ideas or use digital tools to imagine and put into place innovative solutions to community challenges.

Research also tells us that the educational and career opportunities technology brings are not equally available to young people. There are structural and social barriers that create disparities for some groups underrepresented in technology, including Hispanics, African American youth, and girls generally. Even when formal CS education is available, not all students are equally encouraged or individually inclined to pursue the options. Students in rural communities are also less likely to have access to CS courses or be exposed to computers at home. Nor do all uses of technology lead to the skills and fluency necessary to know how to most effectively use it.[1]

The library community—information professionals dedicated to ensuring equitable access to information—must take an active role in ensuring such opportunities are available to everyone regardless of zip code, cultural or

ethnic background, gender identity, or age and ability. They can actively serve children and teens who are less likely to have access to or be exposed to technology, CS curriculum in school, or extended learning opportunities. To support all youth as they journey through the technology-rich educational and career landscape, libraries need to consider how effectively their coding and CS programs connect to youth interests and broaden participation. Coding and CT through the library are catalysts for youth to pursue their interests and discover new ones and ensure they have a portfolio of skills and literacies to meet life challenges and opportunities head-on.

ALA and Google Inc. are collaborating on the Libraries Ready to Code (RtC) initiative to build capacity, provide resources, and create a space for peer-to-peer learning so any library can design and implement coding and CS activities that promote CT literacies among children and youth. The initial RtC report, "Ready to Code: Connecting Youth to CS Opportunity through Libraries," found that librarians and library staff in school and public libraries are essential community resources ensuring youth have access to technology and are equipped with the skills and competencies required for full participation in today's and tomorrow's global economy and society.

IS IT CODING, COMPUTER SCIENCE, OR COMPUTATIONAL THINKING?

While the RtC initiative began with a scan of coding and computer science programs in libraries, it did not take the project team long to realize libraries are at varying levels of understanding why they should be part of the CS educator community and how best to do so. Evaluation data collected from a small cohort of faculty from library and information science schools and the RtC cohort libraries reveals a shift over the course of the projects from focusing on coding for coding's sake to a more nuanced approach that places computational thinking literacies at the center for library engagement. Whether cohort libraries view CT as necessary for workforce or early learning, or equitable access to opportunity, the cohort was in general agreement that CT is a fundamental literacy for children and youth.

WHY LIBRARIES AND CODING?

From early-learning activities with families, caregivers, and young children, to in and out of school time learning for youth, to college or career activities for young adults and activities for professionals already in the workforce, library

programs are designed to address community needs. Libraries are key places for inclusive informal and lifelong learning experiences. Over the course of the RtC initiative (2015–2018), through focus groups, interviews, site visits, work with faculty at library and information science schools and iSchools, and the collaborative work of the 30 libraries (members of a cohort) selected to participate in the RtC project, evaluation and assessment data (both qualitative and quantitative) highlights how the library value of meeting community needs fits into CT programing for children and teens. Further, the RtC initiative identifies the contributions libraries that offer CT make for the youth they serve, their communities, and CS education stakeholders more broadly.

The RtC cohort libraries developed coding and CS programs while exploring and refining the skills and mindsets library staff need to ensure such programs foster CT literacies. Through a vibrant community of practice that developed among the cohort, participants gained confidence in developing CT programs while shifting from viewing coding-specific skills as the endgame of their programs. The cohort also contributed to the initiative's understanding of just what the library's role could be in addressing the gaps in access to CT programs among children and youth. Libraries are essential partners and, given a full array of support and resources, excel at designing CT programs that range from one-time events to multi-week sessions.

> "Ultimately, when youth practice CT, they find new ways to communicate their ideas, express themselves, and practice problem solving. Library staff can embed CT in addition to traditional literacy in their work with children and teens, empowering them with the literacies they need to be lifelong learners and to succeed in college and career."
>
> —Claudia Haines, RtC cohort member and youth services librarian, Homer (Alaska) Public Library; see chapter 8 for more from Claudia

FACILITATING CT LITERACIES THROUGH THE READY TO CODE THEMES

RtC research uncovered 5 themes that are integral to successful acquisition of CT literacies through libraries. These themes take into account the needs of youth, families, adults, communities, and libraries. They are organized in the RtC Facilitation Pathway, designed to help libraries find a good fit with CT activities offered in the Ready to Code website's collection of resources. See the facilitation pathway at www.ala.org/tools/readytocode/pathway/. See the Libraries Ready to Code website for more examples illustrating the themes along with tools and resources: https://www.librariesreadytocode.org.

Broadening Participation

The Leaky Tech Pipeline highlights 3 reasons why addressing underrepresentation in technology careers is important:

- The growing diversity of the U.S. population and need for a robust future workforce,
- The benefits associated with having a diverse workforce, and
- The detrimental impact of underrepresentation on exacerbating economic inequality for diverse communities.[2]

Through expanding their reach, working with community organizations and members, and developing recruitment and retention efforts that specifically focus on diverse youth and diverse learning environments, libraries play a role in addressing technology underrepresentation.

Connecting Youth Interests and Emphasizing Youth Voice

The connected learning framework emphasizes creative and social learning experiences that are driven by learners' personal interests. The framework's core principles include learning contexts that are peer supported, interest powered, and academically oriented along with experiences that are production centered, openly networked, and bring together learners and adults around a shared purpose.[3]

Engaging with Communities

In an RtC strategy brief, Susan Baier, library director for the McCracken County (Kentucky) Public Library, notes how she began learning about the community: "When I started out as a library director, I spent my first few months in meetings with community stakeholders. A common thread soon became evident—preparing a workforce for the future was a key concern for local employers with technology jobs they couldn't fill. Companies were approaching schools asking how they could attract youth to their industries. I saw an opportunity for us to better position the library as a partner in education and workforce development by offering CS/CT programs for youth."[4]

Engaging with Families

Families that take part in library CT literacy activities have the chance to become familiar with these skills and gain an understanding of the role these skills play in young people's lives.

Demonstrating Outcomes Through Impact

It should be expected that not all CT literacy activities that a library provides will be successful. However, there is extreme value in recognizing at the planning stage of a CT library activity what success will look like and how the library will measure that success.

THERE IS AN ENTRY POINT AT YOUR LIBRARY

For many library staff, the idea of including coding and CT activities in the services provided to youth and families may seem daunting and even a little bit scary. There are ways to start small and build as skills and knowledge are gained.

These tips and resources from the Libraries Ready to Code Collection can help you take first steps into this work:

- If you need to gain support from others within the library, such as colleagues or administrators, take a look at the slide deck—http://bit.ly/rtc_waseca_deck/—created by the Waseca (Minnesota) Public Library. It provides an overview of why libraries play a vital role in bringing coding and CT literacies to youth and families.
- Unplugged activities that don't require any technology to help youth gain CT skills are a great way to get started in this work. To learn more about designing and implementing these types of activities, take a look at the unplugged lesson plan from the Homer (Alaska) Public Library—http://bit.ly/homer_rtc_unplug ged. (You can see more about Claudia Haines's work in this area in chapter 8.)
- Looking for ways to get started with bringing community partners into coding and CT library activities? Take a look at the community partner invitation—http://bit.ly/rtc_kent_recruitment/—developed by the Kent County (Maryland) Public Schools.

No matter the entry point and resources you use to get started with this work, don't forget that every community is different. When using materials from other libraries, think about what should stay the same and what needs to change based on your community makeup. Ask yourself about the audience you serve, the partners you may work with, and the materials and resources available for the activity.

NOTES

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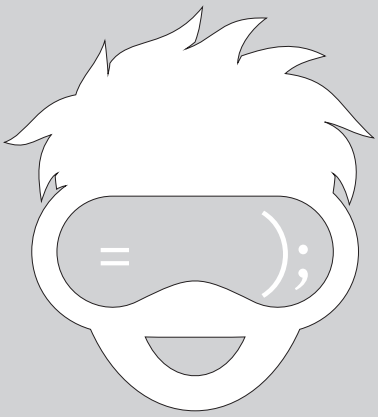
PART I



PROGRAMS FOR KIDS

(AGES 3-7)

1

Make Your Own Cartoon with PBS Kids ScratchJr

JOANNA SCHOFIELD
Branch Services Librarian-Generalist | Cuyahoga County (Ohio) Public Library

PROJECT DESCRIPTION

What if I could make a cartoon story where my rocket can fly? What if I could make my pigs dance? What if my characters could sing "Happy Birthday"? These are just some of the things young children may want to do if they knew how to code. So how can we introduce coding to the youngest of children? One great resource for engaging and motivating young coders is PBS Kids ScratchJr. PBS has developed an entire curriculum for introducing the app and making fundamentals in their Family Creative Learning Project. This project is designed to teach young children the meaning of coding and making and how to use PBS Kids ScratchJr to create their own stories and images.

Age Range

- Kids (Ages 3–7)
- Adults

Type of Library Best Suited For

- Public Libraries
- School Libraries

Cost Estimate

- $0
  PBS ScratchJr is a free app for iPads and Android devices.

OVERVIEW

The PBS Family Creative Learning Project is a free guide and slideshow for libraries looking to teach coding to families with young children. It is designed to be a 4-week program with families meeting once a week for 2 hours. Each

week covers a slightly different topic. Adults and children are split into 2 different rooms for instruction, and the program concludes with participants working together on the app and sharing their experiences. The PBS Family Creative Learning Project walks you step by step through the process and provides information for facilitators. You can access the documents at https://ideastream.pbslearningmedia.org/resource/fcl-scratchjr-rtl-2015–2020/family-community-learning-with-scratchjr-rtl-2015–2020/.

The program requires 2 staff facilitators. The program should be limited to no more than 10 families.

Software/Hardware Needed

Each family requires:

- A tablet with the PBS Kids ScratchJr application installed

Materials List

- Printed activity cards from facilitator website
- Peanut Butter
- Jelly
- Plastic knife
- Plates
- Food for dinner
- Napkins
- Cups for Water
- Water source (water fountain, water cooler, water tower)

STEP-BY-STEP INSTRUCTIONS

Eat

A major component of this series is community building. To encourage participants to get to know each other better, the session always begins with a communal dinner. For our program, we ordered pizza. You can order anything you like for the meal or even reach out to local restaurants to see if they would be willing to donate food. This portion usually takes up the first 20 minutes or so of the program.

Explore

- This is the time when adults and children are encouraged to split into different groups. The "Explore" time is for creative discussions and experiences.
- During the first week, the facilitator opens with a discussion of why adults are separated from children at this point (adults are having facilitated conversations about the maker movement while children are conducting maker activities). During the first week, adults discuss the use of technology in their children's lives and the pros and cons of technology usage.

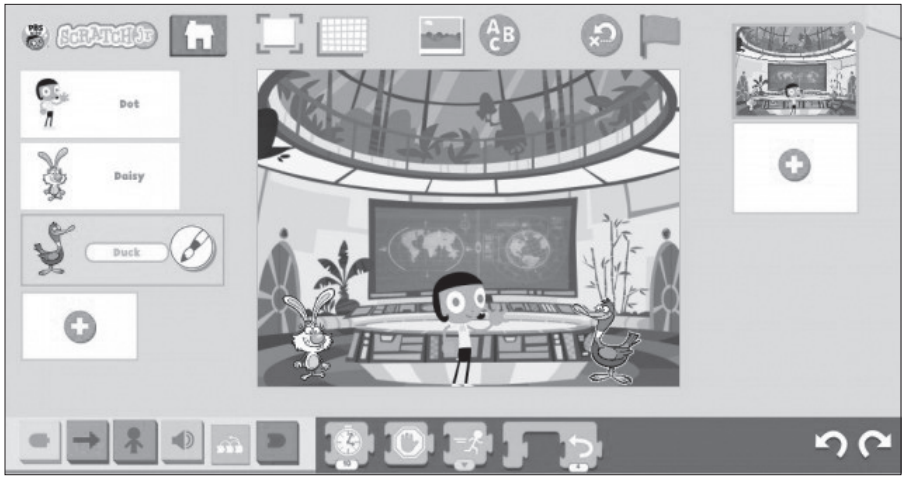


FIGURE 1.1

The PBS ScratchJr interface

- Adults are also introduced to the PBS Kids ScratchJr app (figure 1.1) and given a few minutes to explore its contents. Children are discussing "what is a maker?" and creating maker hats.
- The second week, adults and children are separately introduced to coding and play a game called Robot Chef. The purpose of Robot Chef is to program a person to make a peanut butter and jelly sandwich. This teaches the complexity of a simple task and how important it is to give specific instructions. After playing Robot Chef, the groups are able to play Robot Dancer, which utilizes dance cards to program an individual dancer.
- The third week, everyone explores the engineering design process. Adults begin with a brief discussion of the engineering design process and engineering as a profession. Next, they break up into groups of 2–4 individuals and are challenged to create a paper airplane that will fly the farthest. In the other room, the children talk about designing and engineering. Next, they participate in a paper airplane challenge similar to what their parents did.
- The fourth week, adults engage in a short discussion about how to extend these engineering and making facets into their home life with their children. The children read the book *Rosie Revere Engineer* by Andrea Beaty.

Make

Each week the families are reunited for creative play on the PBS Kids ScratchJr app. There are note cards available on the facilitator's page that can be printed

to show participants how to do basic functions, such as creating a sprite, moving the sprite around the screen, or having the sprite make noise. This time is really meant to engage children with their parents and work through creating images and stories on the PBS Kids ScratchJr app. The facilitator is there to help troubleshoot, but the emphasis should be on the family's exploration of the app.

Share

Each day students are encouraged to share their progress with the whole group. On the last day, groups are encouraged to share their final projects and explain how they developed their ideas.

LEARNING OUTCOMES

Participants will:

- Gain an understanding of engineering and the maker movement.
- Become familiar with PBS Kids ScratchJr.
- Work together with their parents to create something in PBS Kids ScratchJr.
- Gain an understanding of basic coding.

RECOMMENDED NEXT PROJECTS

- There are numerous iterations of Scratch that participants can master. After PBS Kids ScratchJr, participants can work in ScratchJr. After ScratchJr, participants can move into Scratch (https://scratch.mit.edu).
- There are other coding activities that participants can use, such as Codecademy, Code.org, and Khan Academy.

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