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SCREEN-FREE ACTIVITIES for BEGINNERS

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DEANNA PECASKI McLENNAN, PhD

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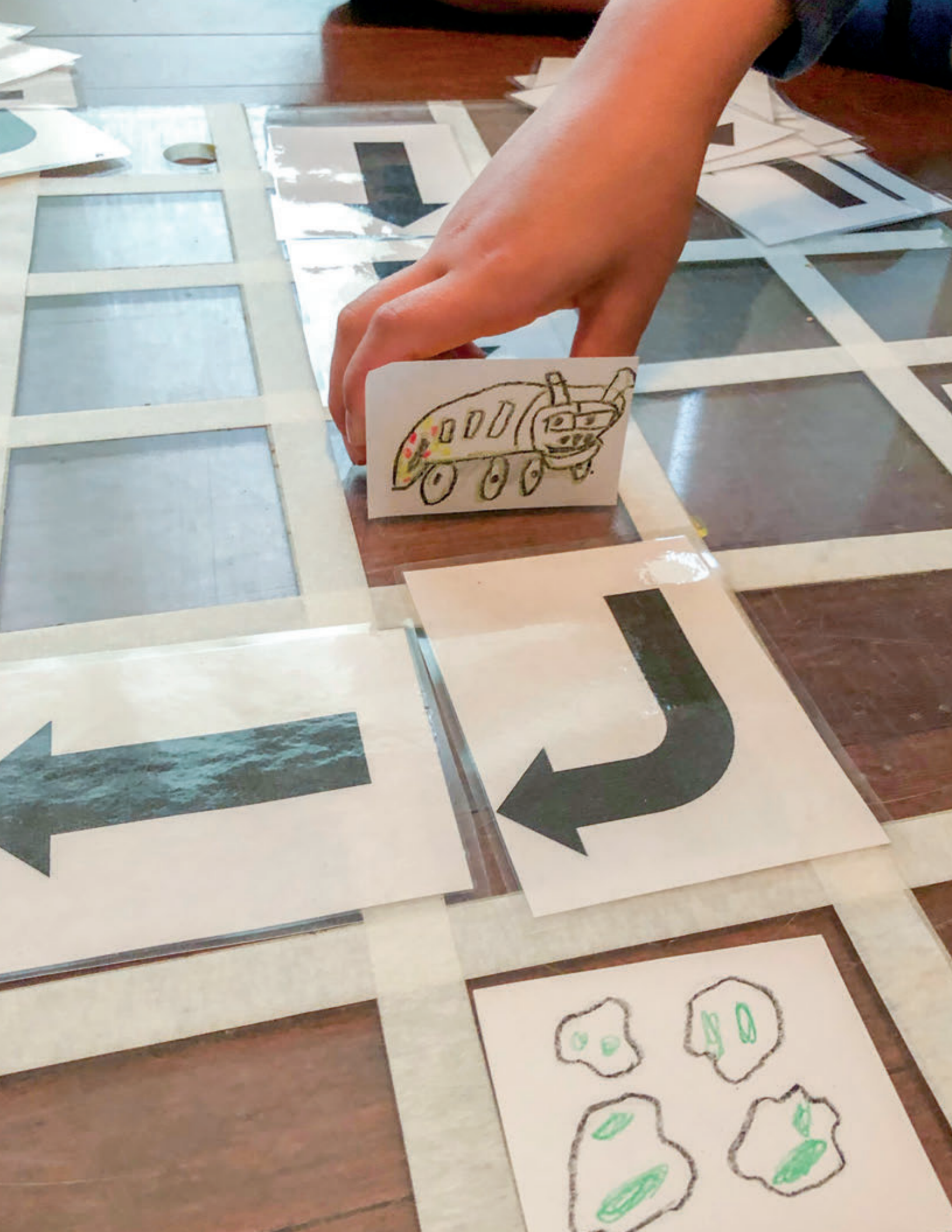

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Activities for Beginners

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For Cadence, Caleb, and Quinn

who bring happiness and love to my life each day
and help me see the world with childhood joy and wonder

Coding is today's language of creativity.
All our children deserve a chance to become creators
instead of consumers of computer science.

—Maria Klawe

Contents

CHAPTER 1

From Following a Map to Coding Our Own Journey

The children were obsessed with maps—treasure maps, road maps, globes, floor plans of the school, maps of the neighbo hood and even the country. Everywhere you looked there were maps. Children were drawing them at the writing center, reading about them in library books, bringing them from home, exploring Google Earth, and incorporating them into their dramatic play outside. And although one would think that this would be the start of an exploration of community or country, it ultimately led our class on a yearlong inquiry into coding.

From Maps to Coding

I am a Reggio Emilia–inspired kindergarten educator in Southern Ontario, Canada. Over the course of a week, I had noticed that the children were fixated on maps. It had started one day when a student named Sawyer brought a map to school afte visiting Canada's Wonderland (a theme park filled with roller coasters and more) the weekend before. I think the novelty of the map was in its unknown—in a time of GPS and smart devices, I doubt that very many children had witnessed their parents using paper maps to navigate travel in the car. I recall the excitement a map could inspire in my childhood: nights before long trips fi led with discussions about the places we'd see as I would listen to my parents planning and watch my father smooth out the wrinkles of our well-loved provincial map and trace our journey with his finge . That map seemed so big, so impossible to me back then. Were we really going to travel that far in just a week?

I believed the children's same thrill existed in their play with the maps. The idea of imagining what fantastical destinations awaited them after their long journeys was riveting, helping children to suspend disbelief and embrace their roles within the context of the play. Stories of adventure, heroism, and discovery punctuated their activities. Each time they'd race by me on their tricycles, maps in hand, shouting directions to the next castle or port of call, I'd have to stop what I was doing and watch. The map, you see, is not a location tool or play prop. It is a language of understanding and communication, a symbolic code no different than the writing on these pages or numbers used in equations.

A child-drawn map displaying locations relevant to his imaginary, dramatic play.

Emergent Learning

As an educator, I use children's interests to guide our classroom programming. Over the course of that week, I had observed and documented the children's mapping activities in a variety of ways to uncover the depths of their learning. I was curious about their explorations and wanted to learn more. Educators who embrace child-initiated inquiries in the classroom are researchers—asking questions, gathering data, and planning how to proceed in the quest for deeper understanding. I photocopied their drawings, studied their writing, asked them questions about their play, transcribed their conversations, took photos and videos of their role playing, and planned how to heighten their explorations and embed rich

learning opportunities within their playful explorations. Not wanting to default to the safe and familiar (a logical inquiry might include studying community and location after noticing the maps in the play), I looked for outside inspiration. I was familiar with the coding the older children in our school were doing and was curious to learn what it was all about. I had been waiting for an opportunity to meaningfully integrate it within the children's play, and I knew the interest in maps was the spark I needed.

There was just one slight issue—I had no experience with coding. At the time, I was embracing authentic math experiences and looking for activities to engage children in rich thinking that grew their confidence and mindset and helped them see the relevance of math to their immediate world. As part of my own personal professional development, I was devouring everything I could read regarding building math capacity in early childhood. One text, *Taking Shape* (Moss et al. 2016), stood out to me because of its emphasis on the importance of spatial reasoning. In this text, an introduction to unplugged coding is provided with sample activities to try in the classroom. I knew that math confidence and achievement were directly related to positive growth mindset and wanted to embed activities in our classroom that promoted collaborative problem-solving and risk-taking in a safe and supportive space (Boaler 2016). Intrigued, I had wanted to try something similar and felt it was an ideal time. Not letting my lack of coding experience or confidence get in our way, I jumped in fully, knowing that learning can sometimes be messy and spontaneous for both children *and* educators. I felt I didn't have to be a master programmer before using coding in the classroom. I would just learn right along with the children. Taking risks in the past has often led us on some of our most meaningful and exciting projects, so I knew to place trust in the process and see what happened. For example, one year the children were interested in observing the life cycle of a praying mantis up close. Despite my reluctance to keep the creature in a terrarium in our classroom, the excitement of watching dozens of babies hatch from the egg sack and the rich math that it inspired in children was worth the price of my inexperience and discomfort.

I also knew that it was important to engage children in coding activities because I was unsure of the exposure they had to high-quality technology in their homes. Some children had regular access and were quite knowledgeable and proficient However, I also knew that regular access does not always equate to rich learning, as many children spend hours with a device each day, playing rote games or watching entertainment videos. Engaging children in complex computational thinking using coding would ensure that technology, even though unplugged, could equalize the playing field and encourage children to become critical thinkers and technological producers instead of passive users.

The next day, we spent time during whole-group circle reflecting on our map play. I displayed photos and videos of the children's explorations from the

previous days and asked them to think about and share what was happening in each piece of documentation. After our conversation, I introduced an unplugged coding board to the children by placing it in the middle of our carpet. I had created a simple grid using a piece of plexiglass and sectioned it off with masking tape. As I presented the board to the children, I asked them to describe what they saw and to suggest what it might be useful for. The children's answers were varied—they hypothesized it was a new game to play, it was something that could be used outside, it looked like a maze—and then someone suggested that it reminded them of a map. Many children nodded in agreement, and the children described how the grid could be transformed to represent location. Everyday play objects, including blocks and magnetic tiles, could be used on top to depict structures and landmarks (making it topographical), real photos could be placed underneath (creating maps similar to what we had observed on Google Earth), or drawings could be inserted into the different squares to show certain areas (like the coordinate games we had played before). Following their lead, we gathered materials and set to work. I wasn't sure of where our activities would take us, but the power of inquiry lies in trusting in the children and the process and providing support and encouragement along the way. The children buzzed with excitement and were eager to incorporate the grid into that day's explorations. And as the room hummed with the sound of their planning, I knew that something big had taken hold. I recognized the sound and feel of a rich inquiry taking root and couldn't wait to see where this new adventure would lead us, with the coding grid now becoming our new map into the unknown. My intuition that day was right. Computational thinking overtook our classroom, and over the course of that year, we spent much time incorporating unplugged coding into our explorations.

Unplugged Coding

Computer programming is a basic language of the digital age. Computer programmers use machine code, which is specific sequences of binary numbers, to give directions to computers. A computer uses these step-by-step instructions to run programs. Gaming systems, tablets, cars, cell phones, and even washing machines all use code to function properly. However, I was not interested in providing opportunities for the children to code using a device. I wanted them to explore the concept of coding, and acquire all the benefits that computational thinking offered without screen time. Unplugged coding is when children use familiar tools, not wired technology, to practice coding. It does not use computers or screen time. Unplugged coding engages children in activities that incorporate computational thinking—creativity, collaboration, pattern recognition, perseverance, and creation. It emphasizes metacognition, problem-solving, and abstract thinking

through interactive and approachable games and activities that are physically, not digitally, manipulated by players. Not all children will grow to be computer programmers, yet all children should have the opportunity to engage in opportunities that help them explore computational thinking. Not only does it help prepare children for the world we live in today (after all, chances are that some children will grow up to have a job in the tech field) unplugged coding teaches many other valuable skills, as well as helping fulfill many of the standards for math practice as outlined in the Common Core. Coding is a vehicle that helps bring children's ideas to life and transfers these beyond the student, enabling them to be read and used by others around the world. These twenty-first century competencies can be grouped into three main categories, as described by the National Research Council (2012):

- **Cognitive** competencies include critical thinking, decision making, creativity, innovation, problem-solving, active listening, and adaptive learning.
- **Interpersonal** competencies include negotiation, teamwork, empathy, collaboration, conflict resolution self-presentation, and cooperation.
- **Intrapersonal** competencies include adaptability, integrity, productivity, initiative, continuous learning, grit, perseverance, and artistic and cultural appreciation.

Just as our maps inspired rich, imaginative role play and journeys across land and sea, the children's coding was a complex and long-term project in our classroom. Regardless of what shape future projects took, coding emerged time and time again. I noticed that with each experience, children seemed to acquire complex math and literacy skills while becoming more confident and committed to their work. Student intention behind the coding became more evident with each subsequent practice, and over time the children, not adults, were directing their work. I was able to integrate more sophisticated coding concepts as the children became more proficient. Coding also transformed my role as an educator; I was able to see deep connections between computational thinking, my Reggio Emilia–inspired practice, and the use of authentic math and literacy tasks in our classroom. As the year progressed, I tweeted our activities regularly (@McLennan1977)and shared many of our classroom explorations through professional writing and presentations to put children's faces on the coding experience and help bring their ideas to the rest of the world (Pecaski McLennan 2017a; 2017b).Our coding work caught on quickly. Many educators were curious to know how unplugged coding worked and how they could also integrate a coding framework into their classroom lessons and activities as well. Some educators assumed that confidence using computers was a necessary requirement and shied away, while others worried their limited technical skills would not be able to keep up.

The more I spoke to educators, the faster a sense of urgency grew inside of me to share our success and encourage all educators to find a place for computational-thinking activities in their classrooms. If we introduce unplugged coding games in the early primary years, children will become more confident and proficient using computational skills and strategies. Just as emergent spaces encourage children to personalize their learning through multifaceted sensory experiences, technology gives children one more of the "hundreds of languages" through which to explore, experiment, and communicate their ideas to others. I want all children to be able to think and speak in algorithms (Wein 2014).

Many educators confuse coding with passive entertainment-style gaming and worry that it will be a harmful distraction in the early primary classroom. What I found is that unplugged coding, and other computational activities, are highly suitable to inquiry-based programs and can be used in many different ways. Coding can become one of the children's languages, used as a means of exploration and communication in a variety of learning domains. It can be a teacher-provided invitation, introduced during whole group time and left to be explored during center time. It can also be a spontaneous response to an interest expressed freely by a child during play. Coding is extremely adaptable, and children's interest and abilities grow with practice.

Coding is also highly conducive to a variety of learning domains and modalities. Many people confuse the experience of coding with the critical thinking and problem-solving skills it encourages in learners. It's not the act of coding but the thinking within the coding that is important: the multifaceted learning environment that coding promotes is what we are striving to create in the classroom for all children. Not a place of predictability and rote routines, but an exciting space where children can't wait to step through the door and see what engaging learning possibilities are available that day. Coding is simply the mode one uses to engage children in complex computational-thinking experiences that can adapt and evolve over time (Umaschi Bers 2018).

Being able to articulate the pedagogy behind our practice is important—why we are choosing coding as an activity for math and literacy instead of more traditional lessons—especially when faced with questions from resistant or reluctant administrators, colleagues, and families. Coding is a newer idea to education, one that many adults may not have had previous experiences with or understandings of. Deconstructing computational activities and making the learning visible every step of the way is important for building support and trust for its implementation into your program. Just as coders use **modularity** to break down activities or procedures into simpler, more manageable parts that create a powerful idea or process when combined, educators must be able to dissect the process of coding to adequately explain and justify its potential for powerful learning and see how these small pieces all fit together. Being able to articulate the standards you are fulfillin

through a solid educational framework gives you credibility and helps bring along more hesitant educators who might be willing to give it a try.

Coding for the Twenty-First-Century Classroom

Regular coding experiences can transform educators, helping them recognize the potential for complex learning by embracing the unknown and valuing the process, not just the product, of student explorations. It can strengthen teaching instruction as connections are formed between unplugged coding and rich, authentic math and literacy experiences. It may give educators the confidence to take risks in their teaching and try something new. Unplugged coding creates a space for educators to become colearners with the children, modeling patience and perseverance in our collaborative problem-solving. I believe that every child should be provided the time, environment, and resources to engage in meaningful computational thinking in the classroom. Coding should be a right for every educator and child. After my time exploring coding with children, I arrived at a number of reasons why it needs to be an essential component of the twenty-first century classroom:

- **Coding is everywhere.** Most appliances and everyday household items require code to work. When children learn about coding, they acquire a sense of how the world around them functions.
- **Coding is easy once you understand the basics.** An educator does not need to know computer programming to use coding activities. Starting slowly and exploring together with the children will model curiosity and a willingness to take risks while helping teacher-learners build community and knowledge in a safe and supportive space.
- **Coding is cost-effective** In a time of reduced budgets and tech constraints, unplugged coding requires no computers to be successful. All one really needs to start is a grid, arrow coding cards, and small props (such as blocks or animal figures) These materials can be easily made or found around the classroom and are transportable to other areas of the school (like the hallway or outdoors).
- **Coding activities naturally incorporate twenty-first century skills.** Children who code experience collaboration, creativity, teamwork, critical thinking, and problem-solving in their activities. They quickly realize that their directions need to be clear and precise so they will have fun and be successful in the coding play. Children learn to strategize as coding play becomes more complex and obstacles and challenges are added to their

games. Algorithms that don't work out build resilience and persistence as children try new sequences and use mistakes as learning opportunities.

- **Coding integrates learning opportunities from multiple domains of development.** In our world of dense curriculum and overwhelming assessment demands, it's essential that educators weave together expectations from different subjects and strands Coding has the potential to use expectations from math, science, literacy, the arts, and physical education, depending on the context and limits of your children's imaginations.
- **Coding is a social activity that builds communication and relationships.** Each person in the activity has a special role to play, and these roles must work together to be successful. The directions given by the programmer must be clear and succinct and followed precisely by all players involved. Children work together to create more complex coding paths. Play from one day can be continued into the next. Coding strengthens children's oral language as they describe movement while giving and receiving directions.
- **Coding provides opportunities for children to engage in meaningful, problem-based math that is highly engaging and relevant to their lives.** These activities integrate spatial awareness, patterning, reasoning, and number sense into a highly motivating opportunity for applying math in a realistic situation that can then be transferred to a coding application when children are ready (such as the Scratch Jr. app or an online Scratch game). The math is often complex and layered and helps educa ors fulfill expect - tions from multiple areas in the Common Core.
- **Coding is empowering.** Children build confidence in themselves as they experience complex coding activities in the classroom. Often these can be challenging as children problem solve through difficult situations and us their mistakes as learning opportunities. Grit and perseverance are developed as children remain with a task until completion.
- **Coding is versatile and can be easily adapted to activities in the gym and outdoor learning spaces, captivating kinesthetic learners and adding another dimension to physical activities.** It is an easy-to-adapt activity that is fun to play outside or on a very large grid. Children can code one another to move around a space or use the change in scenery to inspire a new programming narrative. Bringing these activities outside enhances the experience, as children are free to use big-body movements, loud voices, and their surroundings in the context of their work.
- **Coding can be extended with technology such as easy-to-use apps, websites, and robots for those who want to delve more deeply into the**

concepts or offer home extensions Although in this text we focus primarily on screen-free coding, there are many digital extensions suitable for young children as tangible next steps for those who are ready. Many of these are available as free apps or websites and can be suggested to families who want activities that promote home-school connections, or used in subsequent activities or grades for children who are ready for the challenge.

- **Coding is a global phenomenon and connects your students to their community and beyond!** Educators can create their own personal learning networks by connecting with others worldwide on social media using coding hashtags (#coding, #21stedchat, #kindercoding, #MTBoS, #mathchat, #iteachmath). Classes can participate in the Hour of Code together with children from around the world. Children can reach out to others and share their coding games and learning with others using social media, or research new activities to play.

The Power of Coding

Coding has taken me on an incredible journey of self-expression and risk-taking, as both an educator and a learner. I've written this book to take you along with me. In the same way the children used their maps as a guide for rich, inventive play, you can use the ideas in this book to reflect on your own pedagogy and practice and to help you see the role computational thinking can have in your emergent classroom.

I'm hoping that by sharing vignettes from my teaching practice, linking activities to an educational foundation, and showing the progression of children's thinking over time, I can convince you that coding is a way of being in the classroom. A computational atmosphere needs to be built and nurtured. It's not a series of activities you implement; it's a state of thinking and being that transforms every invested person. Traveling the path together, building your computational schema, using proper terminology in context, and weaving activities together will empower you as a learner. My hope is that this book takes you on a journey to becoming a confident producer, not just consumer, of information and technology in your life. I have also written this book for children everywhere who have a right to learn to code in their early childhood school years, just as they have a right to learn to read, write, and engage in rich mathematical experiences. I'm hoping that by sharing our journey with you, I can inspire you to live each day looking for opportunities to enrich your classroom with joyful algorithms and embrace rich moments of unplugged play and learning, regardless of what shape they might take.

CHAPTER 2

Connecting Reggio Emilia to Computational Thinking

A flu ry of activity ensued as the children crowded close to the floo . A basket of Cuisenaire rods was nearby, and the children were lining them up end to end. What had started as a simple measuring activity evolved into the children working to measure the entire perimeter of the classroom. For over an hour, they meticulously lined the rods, counting as they went. When they encountered problems, such as how to navigate sharp corners, they engaged in rich conversation, referring to previous experiences and deciding as a team how to move forward. Upon fi st glance it might not seem like it, but this measurement task is rich with computational thinking. Working as an efficient team, the chil en collaborated to solve an interesting and complex problem. They were creative in their approach, incorporated previous knowledge and experience, looked for patterns in their work, and communicated clearly with others. Their initial interest in measuring was sustained over several days, and each time their approach became more confident and sophisticated as they lea ned from their mistakes and persevered in the task.

What Is Computational Thinking?

For the purposes of the work presented in this book, computational thinking is defined as "the process of taking a complex problem, understanding what the problem is, and developing possible solutions. These can be explored and represented in ways that a computer, or human, or both can understand" (Bitesize 2018). There is still much debate in the computer sciences regarding the exact definition of computational thinking. Jeannette Wing (2006), a computer scientist and professor, is an advocate for the inclusion of computational thinking in the classroom as an essential component of education for every child. Reminiscent of the Reggio Emilia belief that children should be viewed as capable and driven constructors of their own realities with the right to learn and exist as a member of a democratic space, Wing believes that experiences with computational thinking are a necessity for every child. She argues, however, that computational thinking is a system by which humans, not necessarily computers, process information about the world around them and should be applied to many other disciplines. Coding exists as

simply one of the languages in which communication using computational thinking can occur (Aspinall 2017; Umaschi Bers 2018). Many parallels exist between Wing's view of the learner as a coder and the process through which coders can experiment with the world around them, and the foundations of Reggio Emilia. Computational thinking has many similarities to the inquiry-based process used in emergent classrooms:

- representing problems in new and innovative ways
- organizing and analyzing different forms of informatio
- analyzing a problem and decomposing it into several smaller parts
- organizing a problem into a series of ordered steps
- observing, identifying, analyzing, and implementing different solutions to the problem
- identifying the most effective and efficient solut
- incorporating the problem-solving model across disciplines

As an educator, I have never been reluctant to take risks and see where the less-traveled path might take us. Passionate about improving my practice, I consider myself a learner, continually reading, writing, and researching about how to evolve myself, and our program, for the betterment of all children. Inspired by Reggio Emilia, the children in my care give shape and direction to our learning, and I follow their lead. I have always valued process-based exploration. From my roots in sociodrama (using the power of the arts for social change) to my current fascination with building student confidence and mathematical mindset, I believe in the power of embracing mistakes as opportunities for growth, and I view my classroom as a laboratory for educational research and change (Pecaski McLennan 2008, 2012). Before delving more deeply into understanding the role coding and computational thinking have had in our emergent learning, exploring some of the pedagogy behind my practice is important so that you can understand our learning environment and be encouraged to consider what educational theories have inspired your own.

Reggio Emilia

In my teaching practice, I celebrate each child as an individual, born with an intrinsic desire to interact with and deeply understand the complexities of the immediate world and beyond. Reggio Emilia believes that children learn best through meaningful social interactions, and that they explore and communicate through

A child measures the perimeter of the classroom using Cuisenaire rods.

hundreds of symbolic languages. I use play and inquiry as the heart of our work together, and I attempt to weave children's interests, strengths, and next steps for improvement into our classroom environment and activities. As educators support and guide, they become colearners together with children, engaging in rich explorations through inquiry-based projects. Studying Reggio Emilia in depth has helped me recognize coding as one of these languages and see the deep significance and connection it can have to children's learning. When children have ideas, they desire them to be shared with a greater community, and they are able to communicate these intentions using the global language of coding. It transcends language, culture, and even time and space, and can take children's messages around the world, leading to infinite learning possibilities and positively affecting so many more children than just the original coder. Unplugged coding activities align directly with the beliefs of Reggio Emilia in many ways. Below are several examples:

- **The image of the child:** Reggio Emilia values all children as strong, competent, resilient individuals who are able to guide their own learning and build theories of understanding about how the world around them works. The classroom is considered a democratic space, and children are encouraged to build individual and collective knowledge and understanding together. Children are provided the time and space necessary to move through activities or experiences at their own pace of learning, and all

adults (educators, families, educational stakeholders) have a responsibility to support them the best they can (Wein 2014; Wurm 2005).

- **The role of the environment:** In Reggio Emilia, emphasis is placed on cultivating a safe, supportive, and aesthetic learning environment for all children. Tools and materials in the environment change and evolve based on the children's expressed interests, strengths, and needs, and they are intentionally selected to support deeper exploration in student-driven projects. Coding is not just a cognitive activity. It is an expressive and creative tool through which children can share ideas they truly care about. The environment reflects the image of the child as a capable learner in the ways in which it is organized, materials are made accessible, and documentation of learning is visible throughout (Wein 2014; Wurm 2005).
- **The hundred languages of children:** Play is valued as the most effective way young children learn. In explorations children are invited to use hundreds of "languages" that represent the diverse ways they explore, think, discover, and communicate their observations and theories about the world around them. In our classroom, I have noticed that these languages are process-based and include drawing, painting, sculpting, constructing, dancing, and even beading. Most of the time, the process (or action) of learning is more important than the product (or artifact). Children are encouraged to revisit and refine their understandings through multiple attempts and represent - tions of these ideas over time. Learning is cyclical and organic rather than a traditional linear progression (Wein 2014; Wurm 2005).
- **Relationships with families and the community:** Family is very important, and a community approach to child raising is embraced by many who appreciate the Reggio Emilia approach. Families exist as advocates for their children and are considered a vital component of a successful school environment. They are welcomed into the classroom as they share expertise, resources, knowledge, and support, and their ideas, opinions, and experiences help shape curriculum and policy. School is considered the focal point in the community, and families are welcomed to provide the best experience possible for all children (Wein 2014; Wurm 2005).
- **The role of teachers:** In Reggio Emilia, educators are considered guides in the classroom, listening to children's observations and questions and supporting emerging interests by scaffolding classroom experiences At- tuned and reflexive educa ors carefully observe and document children's activities. Educators are play partners and researchers, uncovering deeper intentions in children's interactions and using these to plan future learning experiences. All adults in the classroom and school work together to ensure

a cohesive approach that values children's explorations and to ensure adequate tools, materials, and experiences can be used to support all children (Wein 2014, 2008; Wurm 2005).

- **Learning through projects and documentation:** Educators actively observe and interact with children as they play and explore together in the classroom. As children express a curiosity or wonder about a topic, educators nurture this spark by providing tools, materials, and activities that help provoke children into deeper exploration. Emergent learning is spontaneous as educators ebb and flow ogether with children, requiring flexibility in planning and implementation as explorations unfold Educators work together with small groups of children in these projects, building on previous knowledge and experiences and using available materials to evolve individual and collective understandings. Educator observation and documentation help make children's learning visible and help plan next steps for enhanced learning. Educators often must be responsive and flexible in changing routines and activities improvising alongside the children while simultaneously planning for future learning opportunities (Wein 2014; Wurm 2005).

The processes involved in computational thinking look very similar to those followed in Reggio Emilia–inspired classrooms that embrace the inquiry process. Consider your classroom:

- Is there a place for the implementation of these ideas in some of your routines?
- What place do student interests have in guiding the direction of activities?
- Can you modify some of your existing lessons to make small changes toward more of an emergent framework?

Recognizing the similarities between the foundations of emergent curriculum and computational thinking is important. Coding has the potential to be used as a language of learning with young children.

Connecting Reggio Emilia to Computational Thinking

If computational thinking is a problem-solving process, then coding can be thought of as a language or representation of layered student expression. Coding is the action of putting together sequences of instructions and problem-solving if or when the activity does not go as planned. Coding occurs over time as children delve more deeply into further exploring and uncovering their computational ideas in

action. Coding empowers children to become computer literate (Umaschi Bers 2018).Coding provides you the freedom to take risks and make mistakes together with your students and to reframe those mistakes through a positive lens! Just as coding provokes deep thinking and venturing into the unknown for children, educators can also enjoy the reprieve from feeling they have to be perfect each moment, and instead embrace messy learning together with the children. Similar to Reggio Emilia's belief that children explore and communicate using hundreds of symbolic languages, coding can exist as language within both computational-thinking situations and emergent-learning contexts. Coding can be both the exploration of a problem and the communication of the response to the problem itself. It transcends disciplines and exists as a flexible language of expression. It is interesting to look at coding through the lens of Reggio Emilia.

If we consider the Reggio image of a child as a coder, we reach several conclusions:

- We recognize that play is the best method of learning for young children. Through play, children can take risks and rehearse for reality, experimenting with different responses o certain situations and learning about themselves and the world around them in safe and supportive environments. They can freely express their emotions and see how their lives intersect with those around them. Children who code can be given opportunities to engage in playful, risk-free coding experiences with multiple entry points.
- We know that children grow and develop over time, strengthening gross- and fin -motor skills as they maneuver their world physically. Big-body coding activities that incorporate physical movement can appeal to kinesthetic learners and incorporate creative actions that appeal to young children. More complex, intricate work can engage the senses and improve fin -motor control.
- We recognize that coding opportunities can build cognitive skills and higher levels of thought as children experience more complex and challenging situations. Various control structures can differentiate the exp - rience and encourage children to think more deeply about the symbolic representation that coding uses. Educators who guide coding activities can modify or challenge based on what they know about that particular child's interests, strengths, needs, and next steps.
- We build the foundation for children's later reading and writing success by exploring language symbolically in coding activities. Symbols that represent ideas within the games can be read, shared, revised, and manipulated, and children can strengthen many aspects of their oral language abilities through the various roles they play. Providing clear directions, transcribing

these into various stable representations (symbolic, written), and engaging in active, responsive listening all ensure a successful coding experience.

- We develop children's social skills as they negotiate, cooperate, take turns, and play by socially constructed rules in structured and open-ended coding games.
- We honor a child as a capable coder by providing time, resources, and support to encourage them to build their own understandings through self-guided projects, being observant and responsive to their needs, and scaffolding and supporting along the wa .
- We advocate for children to be producers and not just consumers of information and technology.
- We support children to share their coding knowledge beyond the walls of the classroom to inspire societal change regarding preconceived views of what young children are capable of achieving, and to encourage the positive use of unplugged technology in the classroom.

A Reggio Emilia–inspired environment supports computational activities in several ways:

- by existing as a safe and supportive space where learners can take risks in their coding activities and use mistakes as learning opportunities for refi - ing their work
- by reflecting the children in the classroom so they see themselves repr - sented throughout the space—they cocreate learning centers together with educators based on their interests and ideas, and translate these into their coding projects
- by providing authentic and relevant learning materials that relate to children's interests, and that evolve over time to represent the growth and change the children have experienced in their coding work
- by providing an aesthetic environment filled with interesting objects that promote curiosity and wonder and can spark student imagination, leading to rich coding projects
- by incorporating flexible use of time and space that can be altered based on the needs of children and the various tech projects on which they are working
- by ridding itself of rote practices, including the use of worksheets, text- books, and tests, and embracing unconventional ways of knowing and being

Recognizing that coding can be one of the Reggio Emilia "hundred languages of learning" demonstrates the following:

- Educators recognize that language can be written, read, and used in meaningful contexts by children in nontraditional ways, using many different symbols (such as drawings, arrows, and grids represented in programming games).
- Children can be effective communica ors in the roles of programmer and computer, giving and receiving directions in a clear and concise manner.
- Computational thinking is a process, not product, of learning. The final ou - come of any coding activity is not necessarily the creation of code but the skills, knowledge, and experience that children have acquired along the way.
- Educators honor the different forms and representations children s learning can take, encouraging them to continue to rewrite their ideas using code until they are as clearly communicated as possible.
- Children and educators value all languages of learning, including code, equally.

Families and the greater community can support computational thinking in these ways:

- recognizing that all children have the right to learn to code, while advocating for equal access to technology for all children
- actively volunteering time and resources to support computational activities in the classroom (such as sharing special interests or talents or inviting children to understand how tech enhances their job)
- researching how to better support technology-based activities at home, especially for those learners who are interested and ready to apply their understanding in new ways (like exploring coding apps)
- modeling and supporting a growth mindset and recognizing children's mistakes as opportunities for learning and growth
- modeling lifelong learning by becoming coders themselves

Reggio-inspired educators who advocate for technology in the classroom display and embrace these qualities:

- They abandon comfortable and familiar teaching practices and instead embrace the journey of transformative progress.
- They trust in themselves, their students, and the process of learning.

- They are comfortable working in the unfamiliar.
- They understand that learning is a team sport and invite their colleagues to join them on the journey.
- They act as guides in the children's explorations, listening to their stories and questions, supporting them with their interests, and scaffolding e - periences to explore these wonderings more deeply using the language of technology.
- They are attuned and flexible in their planning and implementation of new coding activities as they observe children within the learning environment and respond to their learning interests and needs.
- They carefully observe and document children in rich moments of computational thinking using a variety of tools and resources (photos, videos, anecdotal notes, transcripts of conversations).
- They make the rich learning that occurs in computational activities visible through the careful collection, organization, representation, and reflection of pedagogical documentation.
- They become coders together with children, engaging in playful and authentic explorations, solving problems, and reflecting on how o improve the experiences moving forward.
- They are trailblazers as they advocate for change in education.

The Inquiry Process

The inquiry process is a four-step educational approach that empowers children to investigate meaningful questions they have about the world around them. Many unplugged coding activities can follow the inquiry process. In inquiry-based learning, children are encouraged to investigate an area of interest or solve a problem that is of immediate relevance and curiosity to their lives. Educators support children by providing regular opportunities for exploration and reflection using the authentic resources and situations of daily classroom life. As children explore, educators weave curriculum and assessment opportunities throughout the experiences to fulfill their mandates and stay true to the intentions of the inquiry. This is a very different approach than that taken by those who are more comfortable with traditional educational practices. Educators and children assume various roles in the experience—observing a problem, gathering information, supporting one another, experimenting with different solutions, and communicating their findings to a greater audience. The inquiry process may differ from classroom to

classroom but usually follows the same problem-solving format used in traditional mathematical approach (Heick 2019).

The first step of an inquiry project is often sparked by an authentic student question, need, curiosity, or teacher-provided invitation or challenge. This may be related to wonderings that have emerged in free-choice activity time or the result of a problem or question that occurred in routine daily activities. Children use many questions to help them refine their inquiry and narrow the scope of their exploration.

Once a topic of exploration has emerged, children use their existing knowledge and experience with the given topic to better reflect on what they already know and have experienced regarding their topic or problem of exploration. In this next step, they can revise their original question if needed or decompose it into smaller, more manageable parts to explore. Using a wealth of information, including classroom resources and the educator as a guide, children can design a plan for how to move forward in their explorations. They can simultaneously consult other sources of information for support and guidance and continually refin their focus to ensure they are on track in their explorations.

In the third step of the inquiry process, children put their plans into action and test their ideas. As they work, they gather observations and information about the progress of their research along the way. Children can revisit their plans and alter the direction of their work, gathering new resources and sources of information as needed. Children can monitor their progress to ensure they are on track in implementing their plans. At the conclusion of their work, they can gather, organize, and interpret their findings

In the final step of the inquiry process, children can reflect on the inquiry journey they've taken and arrive at a final conclusion. It's important to share new knowledge and understanding with others, and children can determine the most effective venue for doing so. Refl cting on the entire experience is important, and children can use their new knowledge and understanding to inspire future work in some way. Perhaps new questions arose from the inquiry and children want to use these as the next step in their learning.

In this inquiry process, the educator acts as guide, mentor, coresearcher, observer, and documenter. It is a challenging, multifaceted role that requires us to experience many realities together as we support children, gather evidence of their learning, and use our observations to both propel the learning forward and document what we are observing to make it visible. Relinquishing control in the classroom and trusting in a process that we haven't structured from start to finish takes courage. Doing so can be simultaneously thrilling and terrifying. Having courage to venture into the unknown and placing confidence in your abilities as an educator and trust in your students (as well as having a solid understanding of your curriculum and assessment obligations) will give you the support you need to take this journey! Sometimes educators lead; other times we follow.

Connecting Reggio Emilia and Coding

In this chapter, I have shared information about the Reggio Emilia approach to education, hoping that it will inspire you to consider the role that authentic, emergent practices can have in your classroom. Many similarities exist between the foundations of Reggio Emilia and the benefits of engaging children in regular activities that promote computational thinking in the classroom. Coding can exist as both a language of expression and an authentic child-led activity, inspiring children to create complex representations and realities to explore.

These approaches have deeply guided my practice and shaped who I am today. The context of my classroom and reality is different than yours, and what has worked for me might not work in the same way for you. However, as I read, learn, and grow, I incorporate new ideas along the way. Our classroom and program are a constant work in progress, continuing to evolve and change over time as the children and I learn together. Introducing coding to my students has inspired me to rethink traditional models of education and how complex thinking and problem-solving can be used in innovative ways. Engaging children in daily math and language activities is a responsibility for every teacher. How we do it is what will make the difference Energizing, engaging, exciting unplugged coding activities may be the catalyst needed to ignite that spark of passion and cultivate the growth mindset that each child deserves.

In the remaining chapters of this book, I hope to inspire you to rethink your teaching practice and consider how coding can enhance the educational program you offer children. The activities are presented in a simple and easy-to-understand format, suitable for all experience levels. Activities are frameworks and can be modified based on the interests, strengths, and needs of your students, and the context of the inquiries you are exploring. You may find that working from the beginning of the book is helpful if you or your students are coding novices. Or you may prefer to skip ahead and try different activities as interests emerge in your classroom. As you try new activities, become an empowered producer of knowledge and share your ideas beyond your classroom walls! You know your students best. What matters most is taking a chance, moving a little outside your comfort zone, becoming a colearner, reframing mistakes as opportunities, embracing success, and celebrating your achievements with others. It's a tall order, but if you can do all of that, you are well on your way to becoming a master coder!