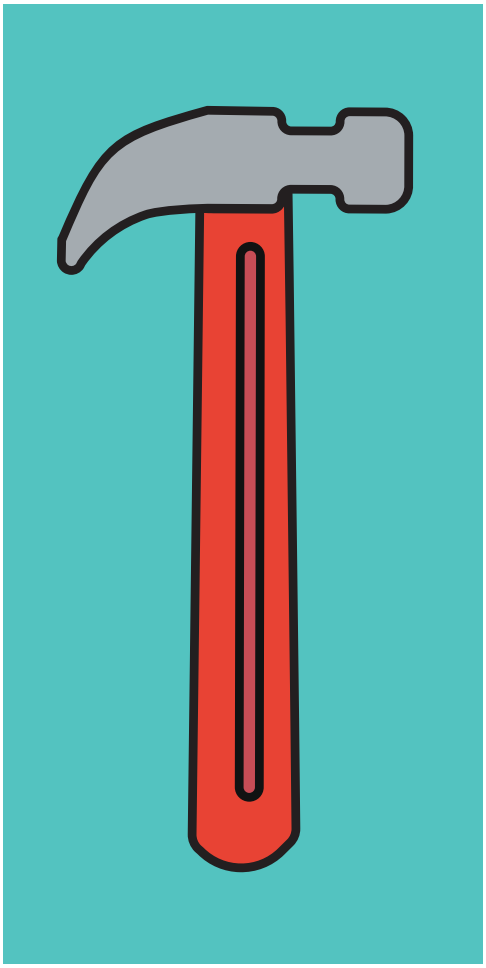
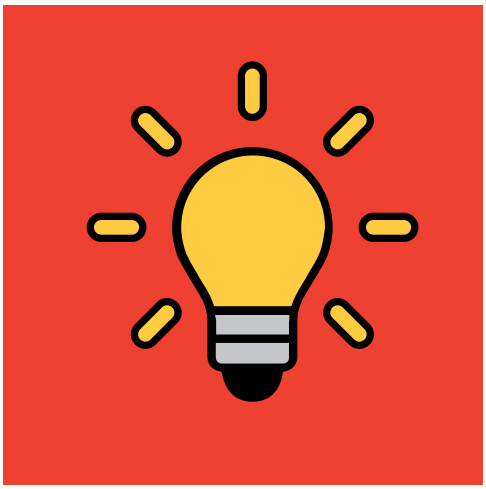
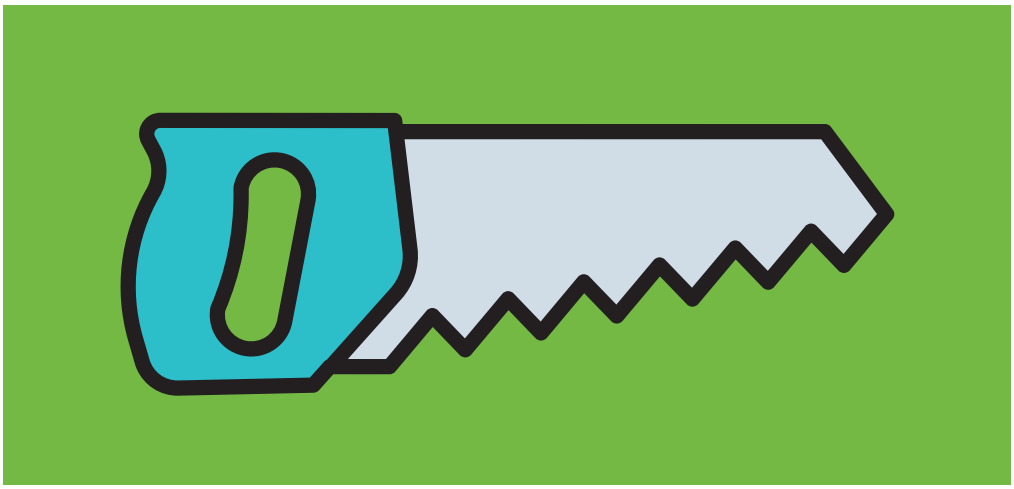
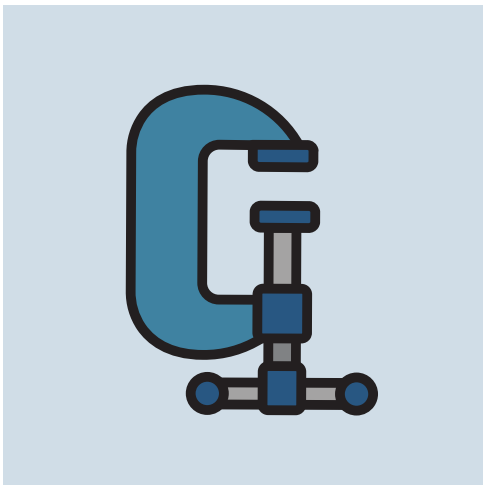
LITTLE MAKERS TOOLKIT





Keene Public Library





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Chapter 4

Chapter 5

Chapter 1

INTRODUCTION

The purpose of this toolkit is to provide library educators with evidence, examples, and excitement for how they can facilitate maker-centered learning for young children, ages 2 to 6, in *any* library setting.

Based on the successful Little Makers program at New Hampshire's Keene Public Library, the pages of this toolkit offer insight into running both in-person and virtual maker programming, with parents and caregivers playing a key role. We explore why making and tinkering are essential to early childhood development, how to approach program planning, facilitation techniques, and reflection tools.

Through sharing this knowledge, we hope to help fill the gap in resources available to librarians that take an open-ended, process-oriented, child-directed approach focused on developing the "maker mindset" more than just teaching specific STEM (science, technology, engineering, and math) concepts. A maker mindset focuses on creativity, experimentation, and open-ended problem-solving. With a maker mindset, a learner approaches a problem from various perspectives, tapping into their natural curiosity and creativity, and viewing mistakes as moments for learning and growth. The programming we offered through Little Makers helps build the foundations of a maker mindset.

Throughout the toolkit, we focus on:

- **Playful process** — Young children are capable of (and enjoy!) activities that focus on play, tinkering, and open-ended exploration rather than on creation of a final product.
- **Co-learning** — Parents, caregivers, and library educators must think of themselves as co-learners who work alongside children to guide them, rather than giving them answers or strict directions.

- **Demystifying STEM** — The acronym STEM is nothing to be afraid of! Most adults and children are already engaging in STEM learning in their everyday lives. It's important to recognize these moments and provide children with the vocabulary and mindset they need to succeed later in life.
- **Parents and caregivers as key participants** — When planning and implementing programming for young children, parents and caregivers are, in many ways, the primary audience, and careful attention should be given to engaging and supporting them.

Using these principles as a guide, this toolkit provides several models, tools, and lessons learned that you can draw from to develop a program that best fits the needs of your library and community. Rather than offer a "step-by-step" process, we offer knowledge and examples to help you shape your own custom programming. It's the maker way!

The Little Makers Program

Developed by the Keene Public Library, the Little Makers program provides opportunities for young children, ages 2 to 6, and their caregivers to engage in co-learning through tinkering and making activities. Little Makers is made possible by a National Leadership Grants for Libraries Program awarded by the Institute of Museum and Library Services (#LG-95-18-0191-18).

This project explores whether public libraries can provide STEM programming for very young children and their adult caregivers that results in new attitudes, skills, and competencies, fostering higher-level thinking and problem-solving skills.

ABOUT KEENE PUBLIC LIBRARY

Established in 1898, Keene Public Library (KPL) is a small but energetic library in the vibrant town of Keene, New Hampshire (population 23,281). The library's mission is "To provide free, open, and convenient access for all Keene residents to acquire information for growth in their personal knowledge; for lifelong learning and enjoyment; for the fulfillment of informational needs, desires, and curiosities; and for enhancing quality of life in the community."

The Youth Department staff are composed of innovative thinkers who remain dedicated to the philosophy of lifelong learning. KPL takes pride in being a certified Family Place Library, one of only two in the state! This initiative illustrates KPL's commitment to providing specialized resources, equipment, and programs to the youngest patrons and families, in a deliberate and nurturing manner. KPL is a cherished regional resource and integral part of the cultural and educational life of the city.

The goals of the program are twofold:

- To engage early learners ages 2 to 6 in STEM, tinkering, and making activities through early STEM library programming in an inviting environment
- To increase caregiver and parental understanding of the importance of STEM, tinkering, and making activities and to increase their efficacy in engaging their children with STEM

From 2018 to 2021, the Keene Public Library experimented by offering various programs for young children and their families, both in-person and online, that foster the roots of the maker mindset and creative thinking through making and tinkering.

The hope was that young children would:

- Have fun at the library STEM, tinkering, and making activities
- Show a capability for engaging in STEM activities
- Ask their parents how and why questions
- Begin developing a positive view of STEM

And that parents and caregivers would:

- Choose to bring young learners to the library for STEM, tinkering, and making engagement
- Increase use of appropriate scientific vocabulary and tools
- Feel more comfortable engaging their children with STEM, tinkering, and making activities
- Support their child's STEM learning
- Perceive the library as an essential STEM, tinkering, and making learning center

This toolkit represents the outcomes of this work and lessons learned.

"[Little Makers] definitely gave me an even deeper appreciation than I already had for [my child's] capacity, from the youngest age, to understand scientific concepts." *—Parent/Caregiver*

Using This Toolkit

One of our main goals in creating this toolkit is to offer our experience with Little Makers as a model for other librarians to use to shape their own unique programs. On the pages that follow, we share our approaches to both in-person programming hosted at the library and virtual programming for implementation at home, insights into best practices for facilitation with young children and their parents or caregivers, and a window into how you can start planning your program using some simple tools we offer.

You'll notice a few recurring features throughout. **TINY TIPS** share bite-sized bits of information particularly useful in working with very young children. **PAUSE AND PONDER** offers a resting place to digest the information you just read through—a list of questions designed for you to, well, pause and ponder!

In the **Resources** section of our toolkit, you'll find seven activities for young makers and their parents or caregivers to engage in at the library. Several of the activities also offer take-home sheets with suggestions on how to extend the learning at home. We call them "Explorations" because they are just that—loosely guided modes of exploring different materials and properties. You can use these as-is, but our hope is that you also use them as a springboard to develop your own unique explorations, designed specifically for your community. We also offer our criteria for selecting books, the Exploratorium's Learning Dimensions tool, a parent and caregiver interview guide, and a facilitator reflection form. Throughout this toolkit, you'll see these resources highlighted with a **TRY IT** callout, like the one shown here.

TRY IT!

Check out the Criteria for Selecting Books in Resources.

We hope you find the information we share to be useful and that you have as much fun reading our toolkit as we had putting it together for you!

Other Helpful Toolkits and Programs

Lastly, we're excited to add our experiences, stories, knowledge, and voice to the ever-growing knowledge base available online. Here are a few of our favorite resources, where you can glean even more insight:

- Digital Promise: This organization works at the intersection of education leaders, researchers, and technology developers to improve learning opportunities for all and close the digital learning gap.
- The Exploratorium's Tinkering Studio: The Tinkering Studio believes that tinkering experiences empower both learners and educators to develop an understanding of science processes and ideas, as well as their own potential as learners. In 2022, they held a multimedia virtual event, Tinkering Together, that explored tinkering, making, and STEAM in early childhood.

- Maker Ed: This organization provides training, support, and resources to individuals, institutions, and communities who are integrating maker education into their learning environments.
- Makers in the Library: This online toolkit provides resources and opportunities to connect with others, centered around the creation and sustainability of community-driven library maker programs.
- Making + Learning: The goal of Making + Learning is to build the capacity of libraries and museums to create and sustain effective makerspaces and related programs for learning.
- Reimagining School Readiness Toolkit: These research-backed resources were created by the Bay Area Discovery Museum for librarians to help families prepare children ages 0 to 8 for success in school and life.
- Tinker Kit: This educator's guide is designed for museums, libraries, and early childhood settings to increase their capacity to support the optimal development of all children through intentional family-engagement activities.

Chapter 2

WHY LITTLE MAKERS?

Libraries are the perfect place to introduce young children and families to making, tinkering, and STEM.

Libraries are free, open to everyone, and offer programs where children and families can attend together. Statistics from the American Library Association (ALA) show that minority and economically disadvantaged families make up a high percentage of groups that visit libraries frequently. Libraries bridge the gap for children who don't have access to expensive daycare facilities, STEM camps, or museum passes.

In 2013, the Institute of Museum and Library Services (IMLS) published *Growing Young Minds: How Museums and Libraries Create Lifelong Learners* with the call to become more intentional about the library's role in early learning and preparing all children for a lifetime of learning and success. The report described 10 ways museums and libraries support young children. Number three directly relates to the Little Makers program and this toolkit: "Supporting development of executive function and 'deeper learning' skills through literacy and STEM-based experiences."[1]

The Little Makers program offers multiple opportunities for children to use the thinking skills of inhibitory control, working memory, and cognitive flexibility, known as *executive functions*. Research shows that executive functions, more than IQ, predict a student's success in school.

STEM and science have been a priority in libraries as far back as 1994, when the American Association for the Advancement of Science (AAAS) and author Maria Sosa published *Great Explorations: Discovering Science in the Library*. Sosa encourages family involvement, noting, "Libraries can help make parents more aware of the importance of

1 Institute of Museum and Library Services. (2013). *Growing young minds: How museums and libraries create lifelong learners.* https://www.imls.gov/publications/growing-young-minds.

science. They can also provide opportunities for families to participate in informal science experiences that provide a strong foundation for learning science."[2]

Further, a family's involvement and attitude are the most important predictors of student success.[3] Research resoundingly points to the importance of libraries engaging families in STEM fields and activities, but little research has been done to show *how* libraries can best do so specifically with very young children.

Starting Young

Research tells us that children's early experiences build brain architecture and lay the foundation for lifelong thinking skills. Young children are highly receptive to learning from STEM activities. A robust body of empirical research over the past 30 years demonstrates that starting in infancy, children develop and test intuitive theories about the world around them, much like scientists do.[4]

2 Sosa, M. (1994). *Great explorations: Discovering science in the library.* Washington, DC: American Association for the Advancement of Science.
3 Henderson, A. T., & Mapp, K. L. (2002). *A new wave of evidence: The impact of school, family, and community connections on student achievement.* Austin, TX: National Center for Family and Community Connections with Schools.
4 Gopnik, A. (2012, September 28). Scientific thinking in young children: Theoretical advances, empirical research, and policy implications. *Science 337*(6102), 1623-1627.

Babies enter the world exploring, testing, and evaluating cause and effect. Preschoolers and some verbal toddlers can learn concepts in specific science domains,[5] exhibit reasoning skills for making sense of science investigations,[4] use number sense to estimate and compare quantities,[6] and apply algorithmic thinking to create simple computer programs.[7]

An early introduction to STEM, tinkering, and a maker mindset can develop science vocabulary and fluency, but it can also foster curiosity, leading to a lifetime of learning. In 1993, the National Education Goals Panel (NEGP) suggested that children who start school with "a lack of curiosity are at greater risk of subsequent school failure than other children" and reported that kindergarten teachers believed that curiosity was a more important predictor of school readiness than the ability to count or recite the alphabet.[8] In fact, researchers estimate that preschoolers ask an average of 76 information-seeking questions per hour![9] And we want them to continue asking critical questions throughout their life.

However, typically, parents and caregivers are far more comfortable supporting children's literacy development—reading with and to young children—than they are incorporating STEM learning through everyday experiences. Many adults don't yet recognize the potential of activities, such as building, fixing, crafting, shopping, cooking, gardening, hiking, etc., to inspire children's curiosity and build their STEM content knowledge.

Making & Tinkering

Think about a time in life when you were curious about how something worked. How did you find out more? Did you read a book? Take it apart? Ask another person? Among the ways we explore our curiosities is by making and tinkering. In this toolkit, we use the terms *tinkering* and *making* interchangeably, but it's worth looking at what these terms mean.

We define tinkering as exploring materials, tools, and ideas, while making refers to the process of using hands-on, interest-driven learning to construct ideas and products. Both are related and contribute to the maker mindset, which promotes that capabilities are continually developed, improved upon, and refined through experiences involving success, mistakes, and persistence.

5 Gelman, R., & Brenneman, K. (2004). Science Learning pathways for young children. *Early Childhood Research Quarterly 19* (Special issue on Early Learning in Math and Science), 150–158. http://ruccs.rutgers.edu/images/personal-rochel-gelman/publications/GelmanBrennECRQ.pdf

6 Clements, D. H., & Sarama, J. (2003, January). Young children and technology: What does the research say? *YC Young Children, 58*(6), 34-40.

7 Bers, M. U. (2008). *Blocks to Robots*. New York: Teachers College Press.

8 National Education Goals Panel (NEGP). (1995, September). *Building a Nation of Learners*.

9 Chouinard, M. M., Harris, P. L., & Maratsos, M. P. (2007). Children's questions: A mechanism for cognitive development. *Monographs of the Society for Research in Child Development, 72*(1), i-129.

"I really think it was a confidence booster for her just to be able to work with these materials and build something, make something, explore, see what she can do." *—Parent/Caregiver*

This Venn diagram by the National Association for the Education of Young Children (NAEYC) simplifies the concepts and shows their interconnectivity as it relates to the STEM field of engineering.

Through the act of tinkering, children engage in improvisational problem-solving. They learn about material properties and proper tool use, developing fine motor skills along the way. This foundational work leads the way to making even more complex projects. At the core of all making and engineering is the ability to understand materials, use tools, and identify and test possible solutions. Tinkering is the gateway to developing these essential skill sets.

Early childhood is the prime time to explore making and tinkering. Children are constantly using their senses to explore the materials around them. They tinker as they explore how things work by taking things apart or putting them together. Making and tinkering activities that don't come with blueprints tend to encourage and amplify children's creative ambitions and self-directed learning. And many making activities also focus on developing collaborative learning, with an emphasis on learning by doing, building critical social-emotional skills.

Playful Process

Esteemed child psychologist Jean Piaget famously said, "Play is the answer to how anything new comes about." In other words, play is how we learn. It's natural for children and all animals to play. It's the main way we learn about ourselves, our relationships, and our environment.

When you hear the word play, you might think of creating mud pies in the backyard as a child, making up games with your friends, or building a fort with your siblings out of blankets and pillows. What you might not think about is the variety of skills you gained by participating in these activities, from social-emotional skills, building your imagination and creativity, problem-solving, and so much more! We know that play is one of the most effective ways for children to gain a large suite of skills, including STEM.

> "Play is not frivolous: It enhances brain structure and function and promotes executive function (i.e., the *process* of learning, rather than the content), which allow us to pursue goals and ignore distractions." —*The Power of Play*[10]

Play is at the heart of children's learning, as developmental psychology demonstrates over and again. In a recent article for *The Atlantic*, developmental psychologist and author Alison Gopnik argues that "Play lets the young learn by randomly and variably trying out a range of actions and ideas and then working out the consequences … The gift of play is the way it teaches us how to deal with the unexpected."[11] And how better to help young children than by preparing them for the unpredictability of life!

Children also, importantly, need to interact with materials and ideas in order to learn.[12] Particularly as children grow and become more aware of and curious about the world around them, interacting with interesting and novel materials, exploring cause and effect, and playing with physical objects all build children's thinking skills. And one of the most authentic ways to engage in this type of exploration is through tinkering. As was

10 Yogman, M., Garner, A., Hutchinson, J., Hirsh-Pasek, K., Golinkoff, R. M., (2018). The Power of Play: A Pediatric Role in Enhancing Development in Young Children. *Pediatrics*, *142*(3), e20182058. https://doi.org/10.1542/peds.2018-2058
11 Gopnik, A. (2016, August). In defense of play. *The Atlantic*. https://www.theatlantic.com/education/archive/2016/08/in-defense-of-play/495545/
12 Hawkins, David. 2002. "I, Thou, It." The Informed Vision: Essays on Learning and Human Nature. 51-64.

mentioned in the previous section, tinkering is defined as the open-ended exploration of materials, where the focus is on the process, the doing, the exploration, and not necessarily on creating a "thing."

Current research suggests that there's a large spectrum of types of play, and each serves a distinct purpose in a child's life. Therefore, free play, imaginative play, tinkering, etc., all have a place. In this toolkit, we lean toward presenting experiences and programs for children and families with a tinkering and exploration lens in mind, not necessarily an end product, since that tends to be an area of growth for many library educators.

Learning Through Tinkering

For the Little Maker project, we used the Learning Dimensions tool developed by the Tinkering Studio at the Exploratorium to guide the creation of our programming. This tool helped to establish the learning dimensions that are central to each tinkering activity we offered.

Initiative & Intentionality

- Setting one's own goal
- Taking intellectual and creative risks
- Working without a blueprint
- Complexifying over time
- Persisting through and learning from failures
- Adjusting goals based on physical feedback and evidence

Social & Emotional Engagement

- Building on or remixing the ideas and projects of others
- Teaching and helping one another
- Collaborating and working in teams
- Recognizing and being recognized for accomplishments and contributions
- Developing confidence
- Expressing pride and ownership

Creativity & Self-Expression

- Responding aesthetically to materials and phenomena
- Connecting projects to personal interests and experiences
- Playfully exploring
- Expressing joy and delight
- Using materials in novel ways

Conceptual Understanding

- Controlling for variables as projects complexify
- Constructing explanations
- Using analogues and metaphors to explain
- Leveraging properties of materials and phenomena to achieve design goals

Problem Solving & Critical Thinking

- Troubleshooting through iterations
- Moving from trial-and-error to fine-tuning through increasingly focused inquiries
- Developing work-arounds
- Seeking ideas, assistance and expertise from others

For our target age group, these learning dimensions manifest themselves in the following ways:

Social & Emotional Engagement: The Little Makers program is about co-learning. It's designed to encourage adults and children to learn together by having fun and realizing that you don't have to know all of the answers. These experiences help children develop the skills to interact productively with others.

Initiative & Intentionality: Facilitators of the Little Makers program model excitement and provide opportunities for children to apply new skills and prior knowledge through listening carefully, responding to, and taking pleasure in each child's own unique curiosities. Children might also show initiative by planning for future activities or persisting through challenges.

Problem Solving & Critical Thinking: Children develop problem-solving skills through opportunities for hands-on discovery, inviting children to use materials in new ways, and allowing children to find their own solutions.

Conceptual Understanding: Conceptual understanding isn't about knowing, but rather about understanding. Conceptual understanding is demonstrated when children grasp new ideas and then transfer and use them differently. For this age, this is more visible over a longer period of time.

Creativity & Self-Expression: By focusing on the process rather than the product, the Little Makers program encourages children to come up with new ideas and not stress that there's only one right answer. Allowing children adequate time and space for creativity to flourish is important when designing programming.

In this reformulated version of the framework below, the learning dimensions are reiterated at the top. The left side shows indicators of participant agency, from responding to exploring to owning, for each learning dimension. This progression is partially dependent on the developmental stage of the participant, in our case the child attending the programming.

DIMENSIONS OF LEARNING FOR MAKING AND TINKERING

Levels of Agency	Initiative & Intentionality	Social & Emotional Engagement	Creativity & Self Expression	Conceptual Understanding	Problem Solving & Critical Thinking
Responding Initial interactions and observations	Initial Engagement	Working Side by Side	Browsing Materials	Noticing the Phenomena	Making Initial Observations
	Active Participation	Building Together	Personalizing Projects	Asking Questions	Engaging in Trial-and-Error
Exploring Probing the problems, variables, and possible solutions	Expressing Intentionality	Modeling for Others	Playfully Exploring	Observing the Variables	Learning Through Failure
	Persisting in the Problem Space	Collaborating with Others	Striving to Create a Unique Solution	Seeking Explanations	Honing in On Key Variables
	Taking Intellectual and Creative Risks	Mentoring Others	Applying Aesthetic Solutions to Achieve Design Goals	Expressing Tentative Theories	Testing more Focused Solutions
Owning Taking intellectual risks, applying understanding, and contributing to the community	Shifting Project Goals	Co-Leading Group Activities	Recognizing the Creative Work of Others	Constructing Explanations	Applying Unique Solutions
	Planning a New Idea	Creating New Activities	Re-mixing and Re-building	Expressing Conceptual Understanding	Eager to Find a new Problem to Solve

Through the Little Makers program, we found that the Responding level of agency was age-appropriate for our audience of ages 2 through 6. But remember that even within that age range, you'll still see differences that aren't a reflection of the quality of your program, but rather the developmental stage of the individual child. For instance, working side by side (or "parallel play") is developmentally appropriate for young toddlers, but it's not until ages 4, 5, or even 6 that some children can effectively build together. Using these markers as a guide, library educators can begin to observe learning happening in tinkering and making experiences. We'll refer back to this chart later when we talk about program planning and reflection.

Designing Developmentally Appropriate Programming

Most resources available—whether they be activities, program ideas, or frameworks—may not have been designed specifically for early childhood or the particular age range you're trying to reach. Therefore, you must always keep in mind the age and developmental stage of the children you serve when designing early childhood programming.

The difference between designing for a 2-year-old and a 5-year-old is vastly different. You can't expect a 2-year-old to be able to rip tape or to sit still for more than about 10 minutes at a time. They just don't have the fine motor skills yet and are still working on building executive function skills like self-control. Children's brains are developing so rapidly during the early childhood years that social skills, fine motor skills, and many others will be vastly different.

Realizing that this age span has so many differentials in demonstrating cognitive understanding, we relied on many resources. The table below highlights the typical abilities and interest levels of various ages based on an article from *Early Childhood Today*.[13]

Age 2–3	▪ Ask questions about why things are the way they are and how things work. ▪ Observe similarities and differences between objects. ▪ Conduct experiments, such as stacking blocks in a new way. ▪ Predict cause and effect.
Age 3–4	▪ Enjoy sorting and classifying objects. ▪ Begin to classify things by their functions. ▪ Notice and compare similarities and differences between objects. ▪ Use words to describe their observations. ▪ Become interested in complex experiments and using new materials in a variety of ways.
Age 4–5	▪ Enjoy exploring and using new materials and objects. ▪ Use concepts such as height, size, and length to compare objects. ▪ Enjoy learning about real-life places and things and how they work.
Age 5–6	▪ Engage in long-term science projects, such as growing plants, recording the weather, and collecting and comparing shells. ▪ Classify items by a variety of similarities and differences. ▪ Have a long attention span for activities that interest them.

The American Library Association's Association for Library Service to Children (ALSC) and the National Association for the Education of Young Children (NAEYC) can be helpful resources to refer to as you begin to experiment with modifying programming to meet the needs of your particular audience. We touch on more specific things to keep in mind throughout the rest of this toolkit and the Tiny Tips feature.

13 Science Development and Young Children. (2001). *Early Childhood Today*, 15(6), 48.

Chapter 3

A TALE OF TWO PROGRAMS

When the Little Makers program launched back in 2018, we envisioned it as an in-person experience for adults and children to attend together in the library. But 2020 changed everything.

We began by offering a Saturday series of two-hour drop-in sessions at the library that focused on guided discovery and fun for children, while modeling inquiry and play for adult caregivers. Due to the COVID-19 pandemic, we had to quickly switch gears to find new ways to continue serving families in our community. In the spirit of our values (playful process, co-learning, demystifying STEM, encouraging parents and caregivers to be key participants), we wanted to present families with programming, materials, and ideas without prescribing exact activities.

What follows is the tale of two programs and an outline of how you might run either an in-person or at-home program (or both!). Take a look at our comparison chart on the following page as you start to think through the challenges and opportunities of each model. And consider how you might be able to blend both types of programming to best serve the needs of your community.

	In the Library	At Home/Virtual
Parent/caregiver engagement	Variable. A key focus for facilitators is to engage adults and model interactions.	High. Adults, by necessity, had to be more involved in setting up and facilitating the experience.
Child engagement	High. Since there were a variety of stations and materials available, children could find multiple ways to start and stay engaged.	Variable. Attention spans for young children are short in a virtual setting.
Materials	The space affords the ability to have larger activities and experiences, such as tinkering with a wind tube or overhead projector.	Activities must be planned around tools and materials that can be gathered at home or can be put in a kit and delivered to parents or caregivers.
Collaboration	Children can engage with peers by either playing with or next to them.	Interactions between the parent/caregiver and child or parent/caregiver and library educator become the focus.
Impact	Children are allowed a rich tinkering experience, while parents/caregivers are provided a facilitation model and a minute to sit back and observe.	Tinkering becomes more integrated into the daily lives of parents/caregivers.

In the Library

CREATING SPACE

When designing the space for the Little Makers program, we started with the overall feeling or impression we hoped the area would inspire—the ambiance, if you will. There are many theories regarding colors in a child's play space. Deciding colors may or may not be something you have control over right away, but in the Little Makers space, we devoted a good deal of time to choosing just the right colors and deciding where they would be used.

You also want people to feel safe and comfortable. There are many ways to accomplish this, from a warm, welcoming smile as they enter the room to having signs and materials available in your patrons' native language. For young children, containment may or may not be a problem, depending on your space. In our scenario, some gates are required. Parents and caregivers rely on the two

entrances we have and make a point of keeping the gates themselves shut. Preventing a child from running up the ramp in our space or falling up or down the stairs means adults can relax a bit, especially if they have more than one child to watch. We also made sure to have a quiet, semi-enclosed space away from the main activity areas for children and adults who need to take a break or have a little alone time.

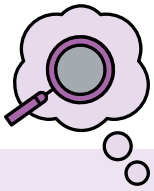
Keep in mind that young children often interact with materials more on the floor level. They move from tables to the floor and back again. They tend to sit right down and build on the floor, scoot around, and push things along the floor. Making sure that the flooring is safe and comfortable for the age group is extremely important.

TINY TIP!

Decide where strollers can be temporarily stored either inside or outside of your programming space, and place a sign to designate it. Use a picture or universal symbol on the sign to make it quickly and easily recognizable for all of your patrons.

Another key consideration is storage space for large equipment, small tools, and consumables. We purchased some colorful, curved, mobile bookcases, which are extremely useful for dividing the room, and the shelves can accommodate tools, books, or display items. The shelves have clear plexiglass to see through them entirely, but items are still secure if the shelf gets moved. We also installed cabinets with doors for tools and supplies. It can be important to have certain things "out of sight" so that children and their caregivers can focus on what you have intentionally chosen to present that day.

If you have access to an ample open space, it allows for enhanced creative building with materials like cardboard and blocks. Children in the Little Makers program built multiple long, extensive ramps with the various blocks and materials because the space was available. Some children even incorporated the furniture into their extremely creative building. And their imaginations didn't stop there—seated parents were often asked to hold up the top end of a ramp to ensure the height provided the necessary speed.



PAUSE AND PONDER

As you create the ambience for your space, ask yourself:

- In what ways does the space foster curiosity and allow for open-ended exploration for children and adults of all ages? How does the space and seating allow for adults and children to work together comfortably?
- How do children and adults feel when they enter the space? Is there music playing when they enter the room? Are materials available in the native languages spoken by your patrons? What tone do the colors set?
- How do your patrons move through the space? Can children flow easily from one activity to the next? Are parents able to see and easily reach their children no matter where they're seated?

But even without an ample, newly decorated space, making and tinkering activities can still take place! Whatever your area may be, rest assured that you can make it work for your program with a bit of planning.

When the Little Makers project began, the Keene Public Library was undergoing a renovation, and our room needed to serve multiple purposes. We created our design with constant room reconfiguration in mind. We planned on making messes, so when we learned that the room wouldn't have a sink and would be carpeted, we made sure to select carpet tiles that would be easy to clean. We also wanted furniture that was movable and reconfigurable to be used in more than one way. We selected our furniture with young children in mind but tried to make the seating adaptable to accommodate adults.

Furniture considerations included: adjustability, wheels, cleanability, weight, locking casters, durability, cost, versatility, and storage. We purchased affordable, wooden, work-type tables that are strong enough for hammering and at the right height for small children. We found that a good table height is about 24 inches tall. An excellent alternative to purchasing new might be using old wood tables; coffee tables are typically about the right height.

We also wanted a mixture of seating options. We had chairs with backs for posture and stability and stacking block stools. Because we're trying to encourage co-learning, an important consideration is finding comfortable seating for parents and caregivers when they're working on projects with their children. There must be adequate seating to accommodate adult involvement in the activities.

If you have ample space but it's also used for many other things in addition to the program, think creatively about the activities you choose. For example, when the Little Makers space wasn't available, we held the ramp-building activity in the Youth Department. The children built ramps that wound throughout the shelving units, under tables, everywhere! Participation by the targeted age group was high, but so was participation by older children.

PROGRAM ACTIVITIES

The Little Makers program activities weren't designed to be sequential or based on a set of themes or scientific concepts. The focus was on the five Learning Dimensions described in Chapter 2 and on experimenting with different materials and activities which allow that type of discovery to flourish.

The primary objective during the Saturday Little Makers program was to be engaging enough for the participants across the age range, so there needed to be several different types of activities taking place at one time. One example is to include different types of blocks, some that are bigger and lighter weight for younger children and others that are smaller and require more fine motor skills for older children.

TINY TIP!

Disclosing the ingredients of the materials involved in a sensory experience is one way to ensure that adults are informed and can keep their children safe. Have a clear policy and be open to discuss with anyone who may express concern.

Try to have a few engaging activities—no more than three or four—rather than overwhelm the children with too many choices. Children should feel comfortable staying in one place for as long as they like without feeling as if they're missing out on something at another station or area. Parents and caregivers also then have the option to self-select activities they feel are most appropriate for their children.

Our program relied on activities and materials that provided a range of sensory experiences that are both familiar and new to the children. Some examples include:

- **Olfactory**: scented dough, leaves, flowers
- **Touch**: dough, pom-poms, sandpaper, slime
- **Sight**: light table, overhead projector, items arranged on nearby shelves
- **Sound**: music, wind tunnel, hammering

PAUSE AND PONDER

- Is there flexibility for children to spend as much or as little time as they want engaging in an activity?
- What type of sensory experiences are provided?
- Do you have a range of tools and materials that are both familiar and new to children?
- How many activities will you have out? Do they appeal to a range of ages?

There was also a combination of low, medium, and highly facilitated activities. An example of a highly facilitated space would be a woodworking area. Highly facilitated activities meant that a staff person should be stationed in these areas to work with children, parents, and caregivers. The staff person's role is to inform adults how to use the tools safely with their children and to provide assistance to children when needed. We chose to place the more highly facilitated activities toward the back of the room, furthest away from the entrance, so that if parents and caregivers didn't want to engage in that activity, they could steer their child away. We used movable shelves or gates to divide the room to keep spaces separated and distinct. We talk more about facilitation in Chapter 4.

SELECTING MATERIALS AND EQUIPMENT

From the very beginning, we selected the materials for the program with an eye toward accessibility, adaptability, ease of use, and cost. We constantly kept our focus on creating playful experiences that allow for open-ended exploration and co-learning, in addition to being developmentally appropriate for our intended age group.

Most activities involved the purchase of smaller craft items like tape, pom-poms, balls, etc., keeping in mind that children might need assistance handling these depending on their level of coordination and fine motor skill development. With all materials, of course, we had to be mindful not to include any smaller materials that could be a choking hazard.

TINY TIP!

If you don't have a no-choke testing tube available, you can make your own! Kodo Kids has a version that is great to use at the library or share with adults.

There's also a lot of research showing the importance of bringing in natural materials for young children to play with. In Little Makers, we brought in flowers and leaves so kids could create pictures with different materials. Don't be afraid to use materials from right outside your library in your programming. Not only does it help cut down on cost, but it can also provide unexpected learning experiences! We noticed that bugs sometimes hitched a ride on our collected leaves. We quickly turned this into a new exploration with the addition of a few magnifying glasses and an open mind.

In addition to these smaller materials, your library may want to invest in some larger items that can be used time and time again. Some of these larger items were offered to the library as a trial by the manufacturer in exchange for providing them with feedback on how their product performs.

Here are a few of our favorite things:

Color-changing light table allows for exploration of light, color, and shadow, as well as building with interlocking or transparent blocks.

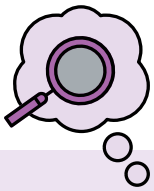
Wind tunnel allows for exploration of airflow and lift as children play with different materials, like scarves, coffee filters, cone cups, etc., or objects of their own creation.

Overhead projector allows for exploration of light, color, etc.

Mirror box facilitates making reflecting art, while exploring concepts around symmetry.

Ramps offer engaging engineering experiments that relate speed with design. We used many items to make our ramp systems: curved moldings we got for free from leftover building projects or sympathetic hardware store personnel, rubber moldings, cardboard box leftovers, tubes from poster mailings, and so much more.

Conveyer belt allows children to build hand-eye coordination, explore cause and effect relationships, and discover how machines can help make a tough job a little easier.



PAUSE AND PONDER

- Are materials safe and at the appropriate level for young children?
- Will the material stand the test of time and use? Is it easy to repair? How can it be cleaned?
- Does the material serve more than one purpose so that it can be used for multiple activities?
- Where and how will the materials be moved and stored?
- How and when are you using food during your program? (Thinking about and articulating a food policy is standard with any program, not just preschool ones.)

LENGTH AND FREQUENCY OF PROGRAMMING

Crucial factors to consider for your programming are the length of time you plan to hold each session and how long of a series you'd like to host. We ran the Little Makers program as a five-Saturday series. Each session was two hours with flexible start times and end times, and drop-ins were welcomed. Some children and parents stayed for the entire two hours, while others left and came back. Some of the participants came every Saturday, while some came once or twice and then didn't attend again.

The attendance varied according to interest and expectations about the program. We often had parents and caregivers ask about the next session as they were leaving the current one! Thankfully, we had brochures with dates and times for the projected upcoming events. Sometimes the question was about when a particular concept might be featured prominently. The family wanted to be sure to attend on that date. For example, one family loved building complicated ramps and would spend the two hours working on a very elaborate ramp project. For others, circuits interested them, and they wanted to be sure to attend when exploring circuits was part of the session.

Some of the activities were available consistently every week. For example, on most Saturdays, blocks and the light table were out for experimentation. However, the type of blocks and the items to place on the light table varied all the time. Children became accustomed to seeing and using blocks and a light table, but the materials found at the activity station were always different, and how they were used was up to the child.

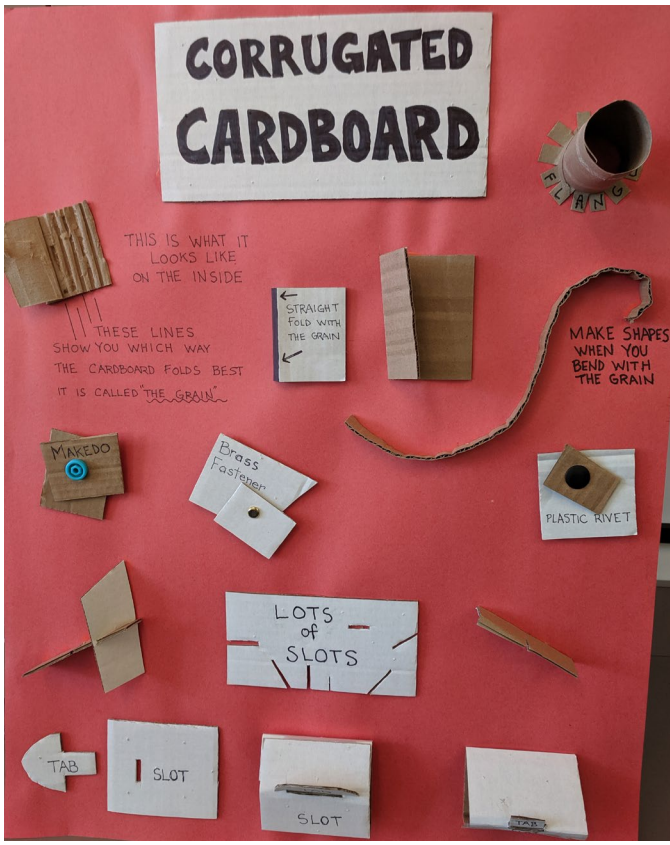
"The way the room was set up, there were different types of activities and he'd go from one to the other, check it out, and then decide which one he wanted to work on."

—Parent/Caregiver

PROMPTS AND SIGNAGE

One of our goals was to help demystify STEM for parents and caregivers. And one way to accomplish this is by introducing vocabulary that applies scientific terminology to everyday experiences to help familiarize it. Often, adults might not be familiar or comfortable with science and math concepts, so displaying signs that broaden their vocabulary, with familiar

or playful examples, helped make adults more comfortable. We used accompanying graphics and simple analogies. For example, the sign for "pendulum" showed a picture of a swing. The hope is that these words would not only be used while in our programs but modeled for use back at home, too.



We experimented with ways to create meaningful prompts. First we tried signs on the wall with scientific words or question prompts. We heard parents using some of the language posted on the wall, but it was unclear if this method was globally effective. Even though parents didn't always read our signs, they were often handy for our library educators. We could quickly refer to them to highlight vocabulary words or remind ourselves of open-ended questions (e.g., How does that work? Why do you think that happened?) while working with families.

When activity areas needed directions, posting detailed explanations wasn't valuable, since we noticed that most adults don't read longer signs. Prompts were written on posters, kept to short phrases or single words as much as possible. When we didn't have written materials for parents and caregivers, things became more spontaneous, as if both parties could play together to figure out the concepts based on short vocabulary lists and nearby definitions.

"After doing both in-person and virtual programming, I would never go back to only doing it in person." *—Little Makers Staff*

At-Home Programming

When the coronavirus pandemic shut down the library in March of 2019, we had to rethink the entire outlook for how we would facilitate another round of Little Makers activities. Like most libraries, we were unsure when or if we would be open for programming in the coming months. We wondered if we'd be able to offer the same types of exploration activities in another way. How best could this be facilitated? Would we be able to evaluate the levels of engagement in making and tinkering that we saw during the in-person program at the library? Should we even try to offer something?

These discussions became more intense and focused as time continued. We decided that we absolutely should offer programs, but the big issue was how. Should we curate websites and show a list of age-appropriate activities that could be done at home? Should we shoot video of and post online a book and activity prompt for caregivers to use to engage their child? Would anyone participate? Were caregivers even interested in virtual programs, or did they already consider their children to be online too often?

In the end, our virtual model consisted of both a synchronous and asynchronous experience for our patrons. Using Niche Academy, a learning portal the library bought a subscription to, we were able to build weekly making and tinkering exploration activities for adults to facilitate from anywhere. In addition, regular live Zoom meetings provided connections to library staff and helped guide parents and caregivers on the learning activities provided for that week.

By moving to a virtual model, our focus turned even more toward parents and caregivers. They became the sole facilitators of their children's making and tinkering. We offered advice, guidance, and meaningful opportunities—and the adults really engaged in learning alongside their children.

The first step was to attract participants, and it all began with advertising. People who had participated in the Little Makers program in the past and those who participated in other library programs had provided us with email addresses, so we were able to send hints and teasers about how the program would run in the summer. As we developed our ideas, patrons continued to receive information and were asked to provide feedback based on their interest levels in the programming. When it became clear that we had interest and enthusiasm on the part of the staff and families to make this virtual program work, we started to refine the programs.

PROGRAM STRUCTURE

We first ran the program as a five-week series in the summer of 2020. The short, live Zoom meetings for families were held on Mondays and Fridays, to bookend the week with ideas for further exploration. When fall came and some adults started returning to work, we ran it as a three-week program to keep it more manageable. The following outlines the five-week series. We offer these details for you to use as inspiration as you shape your own program offerings.

Every Monday at 11 a.m., we held a Zoom meeting that participants could join to learn what the weekly activities might involve. Both caregivers and children participated. It was an opportunity to ask questions, hear a story read, discuss successes they had with previous activities, or preview and predict some of what they might

do based on the week's theme when it was revealed. In one meeting, when discussing what they might do to explore colors, one child thought aloud about using a flashlight to look through a bubble. It was an "Aha!" moment and a much-needed confirmation that virtual tinkering experiences were possible. He was thinking about the tools we had provided in the materials kit and extrapolated a use for the flashlight that we hadn't considered.

Once the Monday kick-off meeting for the week ended, participants could log in to our Niche Academy page and explore the additional activities around the theme for that week. Niche Academy is a straightforward platform where you can create a sequential set of lessons or activities for the user.

It's worth noting that we did have some adults express discomfort early on with the notion of open-ended play and exploration. They voiced that they would be more comfortable with projects that had a clear end product, likely because they were more familiar with this style of learning. We explained why open-ended exploration is so important to the developing minds of young children, and adults did become quite engaged. You might consider having key benefits in mind to offer in these instances.

We also decided to present participants with a scavenger hunt based on the theme each week. This was done online through an app called Goosechase. Participants get a password to join in the hunt and can document their completion of the hunt through pictures. The scavenger hunts served as the kickoff activity each week.

At the end of the week, participants were asked to attend a Friday morning wrap-up at 11 a.m. This Zoom meeting allowed time to share stories and a slideshow of pictures and movies sent in of the children participating in that week's activities or scavenger hunt. Children were also asked to reflect on the week and share anything they wanted to.

Families were able to communicate with our library point person at any time through email or calling. They were provided with one person to contact at Keene Public Library with their questions, concerns, thoughts, and reflections on the week. The contact person remained in close contact every week and used the photographs and videos people sent to create a slideshow of activities for the Friday morning meeting.

TINY TIP!

When you choose meeting times, keep in mind nap times, lunchtime, normal preschool hours, and adult work schedules.

Each week's module followed the same format, which included:

- A video introduction to the week, which could be a recording of the Monday morning Zoom meeting, that typically included a story or a Keene Public Library video introducing the program

- A section called “Tips on Facilitating Tinkering and STEM Learning,” which had ideas on how to ask good open-ended questions and prompts to remind caregivers to let their child explore
- A video introduction of the concept, either produced in-house or gathered from the web and used with permission
- A “Safety Tips” section that was included when necessary to explain some of the possible dangers, such as teaching children not to inhale the bubble solution when blowing bubbles in a straw
- A “Science Talk” section, which included vocabulary as well as simple, direct information related to the concept at hand, so caregivers could be sure to impart correct information
- Multiple areas titled “STEM Play” and “Making,” which included many age-appropriate activities and ideas for how to explore the concept at hand and also included extension activities, as well as more ways to ask questions during the activity to stimulate STEM thinking and a maker mindset
- A “Reflection” section, which offered writing prompts, as well as information on why reflecting on things is so important
- The Friday Zoom meeting, which was added after it was recorded
- A “Documentation” section, which included ideas and ways a caregiver could record the experiences they had that week
- An area called “Additional Resources for Parents and Caregivers,” which included links to online videos or resources they could use if they wished to explore further with their child or on their own

We offered making and tinkering activities that would provide ideas for caregivers to use with their children and included vocabulary and concept information at an adult level. Parents and caregivers could log in to the system as often as they wanted. They could use whatever part of the module they wanted to access and choose to complete the activity or not.

Although we didn’t require participants to reflect online, we offered adults an area in the Niche module to include a writeup, video, or photographic reflection, if they chose to. Some of the reflections were very involved, whereas others were just a quick note. For example: “My boys are two and three years old. So their big sister and brother helped in making ramps with the cardboard from their diaper boxes. We also made a shoebox ramp. They loved watching each of the small balls they had roll and go down the ramps. Their favorite one was the shoebox ramp because they could fix it in different ways. They loved to put it on different things. They used it on the table, a chair, and the outside stairs.

They loved the stairs because of all the different levels. Their ball was the wooden one that came in the bag."

During our Friday Zoom meeting, we also set aside time for real-time reflections from parents, caregivers, and the children themselves. Some children shared nonverbally. One week, a boy sat quietly in his mom's lap throughout the whole session, holding a paper plate with his special color exploration painting on it along with another item he had created that week. When his mom told him that it was his turn to share, he became timid and ran offscreen to hide his creations. As soon as he had laid them down offscreen, he returned to his mom's lap and quietly participated in the rest of the meeting. As he was running offscreen, his mom calmly described his actions as his "independent way of sharing." We all smiled and understood what she meant. Some children find it challenging to be in the spotlight even when they expect it and act differently on screen than they may in person. We understood that his sharing was done differently, but he had shared his creations with us nonetheless.

You can visit our Niche Academy page and explore our offerings.

MATERIALS AND KITS

To make the activities inclusive for all families, we knew that we needed to provide all of the supplies participants would need. We purchased all of the consumables, as well as generic items that could be used across the many activities, and we placed them in bags to supply to participating families.

Families who were signed up for the program received a bag of materials and tools, as well as written flyers with activity ideas to explore.

Materials included: a variety of balls (large, small, wood, plastic, soft, hard, etc.), pom-poms, rubberbands, unpainted wooden beads, colorful wooden beads or large plastic beads, small pieces of wood, wire, yarn, fabric scraps, pipe cleaners, craft sticks, plastic bottle tops, plastic buttons, colored film, white cardstock, construction paper, wooden skewers, paper straws, plastic straws, plastic cups, feathers, wooden wheels, paper doilies, paper muffin liners, watercolor paint, school glue, a glue stick, transparent tape, duct tape or painters tape, markers, liquid detergent, berry baskets, clothespins, wooden spools, coffee filters, a wooden spoon, sidewalk chalk, a book to read, and a book to record reflections.

Tools included: scissors, rulers, a magnifying glass, a prism, a hole punch, a flashlight, measuring tape, cardboard-cutting tools, cardboard-connecting tools, and a glue gun.

TRY IT!

Check out the Cardboard Exploration in Resources.

Parents and caregivers were reminded that although the bag was full of beautiful tools and exciting materials, they could supplement the supply with recyclables and natural materials that could be found around the home. We also encouraged adults to create a little makerspace area in their home, if they had space, and organize the consumables and tools.

Playing and Making Brid

Repurpose and reuse materials to
a bridge structure

Included

- Popsicl
- Pipe cle
- Straws
- Tape
- Beads
- Clothes

What you'll need from home:

- Additional materials to build with
- Scissors, glue
- paperclips, or other things that can be used to parts together

Playing with Wind, Motion &

Repurpose and reuse materials to
a Wind Chime

Included

- One do
items fr
- A variet
and key
- Craft wi
- Craft wi

What you'll need from home:

- Additional items to hang from your dowel tha with the wind, make a sound or just be beauti
- Scissors, tape, glue.

Playing with Ramps and Balls

Repurpose and reuse materials to create
your own pathways and targets

Included in this kit:

- 4 Cardboard tubes
- 1 roll masking tape
- 1 "V" shape cardboard
- 1 Plastic cup
- 1 ball

What you'll need from home:

- Additional tubes and cardboard
- Other interesting materials you find around your home that you use to create pathways and targets for your balls.

Chapter 4

THE ART OF FACILITATION

If you take only one thing away from this toolkit, it should be that how you facilitate your program can make all the difference.

How you become a model and effective facilitator is one of the most important parts of the program and can really change what type of experience children leave with. And equally as important is how you empower parents and caregivers to engage with their children during your program and once they leave your library.

For example, imagine that two different library educators download the same activity from the internet about experimenting with balls and ramps. One of the educators gathers all the children together at the start of the program to talk about gravity and how the height of the ramp affects how fast gravity pulls the ball back down to the earth. Then the educator asks that each child take one ramp, one ball, and a stack of books and that they add one book at a time to increase the height of the ramp to see if the ball moves faster or slower.

Meanwhile, the other educator puts out a variety of different types of materials that children could use to build ramps (e.g., cardboard poster tubes, foam insulation, curved molding), along with balls of various sizes, and asks that children explore how to make the ball move. This educator walks around the space and asks children why they think their ball is moving faster or slower and if the ball feels heavy or light. The educator inserts the word gravity when a nonverbal child points in excitement at how fast their ball moved.

Even though both educators start from the same activity, the experience is very different for the two groups of children. Because most of us are accustomed to the first type of learning that we experienced ourselves in school, we tend to gravitate toward the step-by-step model that explains how something works before we try it out. But the purpose of this

toolkit is to push library educators slightly out of their comfort zones to engage children in tinkering experiences that focus more on exploration and curiosity rather than on learning a particular concept.

This method not only provides a more playful atmosphere for the children, but it also models for parents and caregivers how this type of exploration can easily be facilitated at home, with no planning required! Adults are reassured that they don't need to be experts or know the subject at hand but rather can explore and co-learn alongside their child.

Likewise, you don't have to be a facilitation expert out of the gate. Facilitation techniques are tried, evaluated, and iterated on. We're always learning to be better facilitators. Just as you encourage participants in your program to explore and learn, give yourself room to develop techniques that work for your community. Facilitation is a skill that you continually develop.

Levels of Facilitation

Facilitation, meaning direct staff intervention or involvement—whether in the form of teaching tool safety or just asking questions to prompt exploration—can run from low to high. Some activities might start as low facilitation and then move to medium or high facilitation depending on the level of engagement by both adults and children. Suppose a parent begins using terms the child doesn't understand but helps them explore the concepts. A staff facilitator could help to elicit understanding by modeling questioning techniques. This would be considered a higher level of facilitation. Called *scaffolded learning,* asking the right questions is meant to assist a child in interpreting what they're experiencing. The more the facilitator has to help the parent and child understand the concepts behind a particular activity, the higher the level of facilitation involved.

In the Little Makers program, activities that inherently require a high level of facilitation are categorized accordingly because of either safety considerations or the use of tools and materials that may be unfamiliar to both children and adults. For example, one of the highest levels of facilitation takes place during activities such as woodworking. Adult assistance is needed with cutting, gluing, joinery, etc. This activity starts with the facilitator demonstrating tools and safety techniques with the parent or caregiver and child. Then the facilitator steps back to let them explore.

When it comes to teaching adults to facilitate woodworking, the emphasis is on explaining how to be safe using any of the tools, the use of safety glasses, and being aware of your body in space in relation to the tool being used. The staff facilitator provides

reminders when necessary and discusses how to introduce new tools—particularly saws—with the adults before offering them to the children. We set up our highly facilitated activities further in the back of the room so they were less accessible to children without adult supervision and so parents and caregivers who perhaps didn't want their child to participate could easily steer the child away.

Another highly facilitated activity is the circuit activity using conductive and nonconductive dough. When parents, caregivers, and children sit down at the table with the materials, a facilitator is on hand to ask questions that prompt participants to figure out what the dough, wire, and LED lights are for, in case the materials may be unfamiliar. If not addressed with facilitation, unfamiliarity can sometimes lead to disengagement.

TRY IT!

Check out the Circuit Exploration in Resources.

In our case, the conductive dough and circuits didn't initially seem to engage the children when we tried to offer them without much facilitation. But when the staff facilitator approached the table and explained to the children that they could use the dough to test whether a bulb lights up (rather than smooshing the dough to build with as if it were playdough), they began experimenting. Once parents and caregivers understood the open and closed circuits, the station got very busy. Both adults and children were learning at the same time why some dough is conductive and how to create a closed circuit to turn the light on.

Through trial and error, we found that the circuit activity is most successful with a facilitator who understands the concepts of the activity. We also found that testing all the components offered, particularly the LEDs and batteries, in advance is really important. Facilitation is iterative. Give yourself room to learn which types and levels of facilitation are best for each of your program offerings.

Naturally, highly facilitated activities require more consideration as to how or whether to offer them. The larger the number of highly facilitated activities offered, the more staff is necessary. And, if there are safety issues involved (such with the woodworking activity), a staff member must be on hand at all times. Usually, because of staffing shortages, we had only one high-facilitation activity offered during each session.

TRY IT!

Check out the Woodworking Exploration in Resources.

Other activities like using the overhead projector and wind tunnel are considered low facilitation. Children (and adults!) can freely and openly experiment with them, and the materials are generally familiar or easy to figure out. When they saw our setups, they knew what to do right away. Still, having a facilitator available to suggest new materials or ask questions to guide the children's discovery was often very helpful, making these activities more medium facilitation.

For example, at the wind tunnel station, while we did confirm that children could play for quite a long time just letting scarves, paper, or feathers fly up and out, we had staff

on hand to ask questions. If parents or caregivers weren't interacting, staff would offer prompts so the adults realized that wind resistance and gravity could be explored through this activity. Questions may include: Why won't that item fly out? What about this one? Can you sort them out so you have a pile of things that fly and ones that don't?

TRY IT!

Check out the Wind Tunnel Exploration in Resources.

In order to minimize facilitation for some activities, picture prompts and occasional demo objects were very helpful. With the use of these tools, we didn't have to have a staff facilitator available at all times for every activity. Parents or caregivers would engage with their child using the demo object to begin the activity.

For example, when we designed a thematic activity around wind and movement, we built a car with a sail and placed it between the woodworking station and a design-creation area. As they entered the room, we told adults that the challenge for the day was to design and build a wind-powered vehicle. Children could interact with the wind tunnel and other force and motion activities right away. As they engaged, many of the parents and caregivers used the pre-created demonstration vehicle to inspire their children to design and build something of their own.

While we rarely provided examples directly tied into the stations and activities of the day, in this particular case, we found it very helpful. The examples we did always provide were examples of childrens' work displayed on our shelving units. So even though children, parents, and caregivers weren't seeing examples directly tied into the activity they were doing, they were always seeing creations and made objects that could spark ideas for new creations and objects.

Other low-facilitation activities also included experimenting with the conveyor belt and various blocks and ramps. Low facilitation doesn't mean low interest or engagement with the activities. In fact, we often changed the types of materials used for these activities each week to keep them fresh. Different kinds of blocks and ramps with various sizes, shapes, and finishes were used.

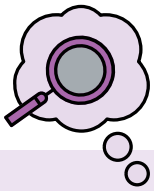
TRY IT!

Check out the Ramps Exploration in Resources.

For the ramp-building activity, sometimes there were cardboard tubes out, sometimes there were long wooden cove moldings from the lumber store, sometimes there were rubber ramps, and sometimes all of those things were available. Sometimes wooden balls were out to use on a ramp. Other times it was felt balls or even cars. Sometimes felt balls were used for sorting rather than for going down the ramp or being put on the conveyor belt. Many children happily spent quite a bit of time sorting things in different ways. Posted on the walls were terms and questions adults could use to talk to their children about force, motion, sorting, and

counting, so this activity was low facilitation. Very little modeling had to be conducted in this area, other than asking open-ended questions.

However, at times, even the ramps became medium facilitation depending on the age of the child and whether an adult had to help with ramp repairs or redesign. If a child struggled too much, a staff facilitator would typically ask questions about *why* something might be happening: Why do you think the ball falls off that curve every time? Or they might ask: Can you try something else, like another ball? Can you recurve or straighten the ramp? The necessity for intervention and prompts increased the facilitation level of the activity.



PAUSE AND PONDER

As you plan your activities, ask:

- What type of facilitation (high, medium, or low) does each activity require?
- How many staff members are available for facilitation? How does that affect the type of activities you might offer?
- How can parents and caregivers be empowered to help with facilitation? What signage or visuals can you provide to help them?

Techniques for Question Prompts

The Little Makers program focuses on co-learning. Have fun, relax, and take advantage of not having to have all the answers. Adults should act as guides along the way to help children work through frustrations and also provide scaffolding (or small hints and tips) to further their experimentation and deepen their understanding.

We realized that keeping it simple is the most important way to start. We kept questions short and to the point when addressing young children. We also modeled language using synonyms with parents and caregivers to increase their exposure to the idea that asking preschool-aged children open-ended questions elevates learning in every arena, not just STEM.

Modeling language and the questions to ask during an activity allows parents and caregivers to continue to develop those skills with their children at home. As caregivers focus their questions, they help their child make sense of what's happening to or around them, and the learning becomes more concrete. The emphasis should be on getting children to talk and not limiting them to yes or no answers. "What" questions allow a child to brainstorm or observe something they noticed. "Why" questions ask them to dig deeper into their understanding or allow them to show off their knowledge on a particular subject.

As families work on a project at the library, parents and caregivers can be prompted to ask:

- What happened to the_____?
- What have you already tried?
- What have you changed about what you're creating?
- What are some ideas that you haven't tried yet?
- What are some things you saw other people trying?
- What do you notice about _____?
- What do you think will happen if you _____?
- Why do you think _____ happened?

Keep in mind that when you ask a "why" question, the answer may not be conceptually within a child's reach. But just by asking the question, you're stretching a child's mind to find the answer. Be sure to be patient and give them ample time (at least two minutes) to process and respond. Be mindful to not correct imaginative answers that don't fit the science; instead use them as springboards for further prompts in the right direction. Children may—and often do—just shrug and say, "I don't know." To get them past that stage, provide language prompts to dig deeper into their thinking or understanding of what they were doing.

For example, when two boys played with a ramp system, one ball kept flying off the curved ramp. One of the adult caregivers asked, "Why do you think the ball keeps flying off on that curve?" Both boys just shrugged and went back to putting more balls down the ramp. The adult prompted, "Does it have anything to do with the weight of the ball? Look, what just happened with that particular ball?" One child looked at the wooden ball he had in his hand and said, "The felt balls don't work." He then let his ball go down the ramp, and it flew off the curve. The adult said, "Why didn't that ball work?" The child ran to gather up more balls and the other child said, "Maybe it was too fast."

TINY TIP!

Even if a child is nonverbal, asking questions is still vital! You are building a child's mind while finding the answer and modeling important social skills.

The significance of that interaction is that the adult pursued the question despite the initial reluctance of either child to speculate. Each boy eventually tried to answer the question logically. This interaction may lead to a more direct discussion later or make a child stop, think, and investigate further. All of these are social interactions, and the interplay of words is a powerful part of the learning process. In fact, parents told us that social interaction between the children was a main missing element in the virtual, at-home programming.

Managing Frustration

When a child is working on something and the caregiver or library educator notices they've begun to experience difficulties, rather than telling the child how to fix a problem, we try to coach the child on the path to self-discovery. For example, during one of our sessions on circuits, a child was having a hard time getting the LED to light. No matter what battery she connected it to or which way she twisted the wire connectors, the light just wouldn't go on. She worked on it for about five minutes.

Noticing that she was about to walk away frustrated that things weren't working, a facilitator approached. Rather than saying, "Maybe that light is burned out," she said, "Can you think of a reason why that bulb may not light?" When the child said that the batteries didn't work, the facilitator affirmed her hypothesis and asked her to change the batteries to see if her idea was correct. When that didn't work, the facilitator prompted her to think more about it by saying, "Do the lights ever go out at your house? Why?"

This got the child to think about the bulb rather than the batteries or connections. She pointed to another bulb and said, "Can I try that one?" There were many bulbs of varying colors, so the facilitator said, "Why not try many of them to see what happens. Do you think they'll all work?" After some testing, the facilitator followed up by handing her more to try and saying, "What colors do you think will light if you try these?" The girl spent another 10 minutes trying out the bulbs and finding out that some of them also didn't work. She began sorting them and was quite happy to see that the original problem wasn't the connections she had made but a burnt-out bulb.

The child had gained confidence by trying many bulbs. She then helped another child complete a circuit to work together to test objects. The facilitator continued to ask questions such as, "Can you make more than one bulb light up at a time? How would you do that?" A question prompt at the right time can lead to more exploration and investigation rather than frustration and defeat.

At times, though, children might just need to take a break for a minute and step away from the activity that is frustrating them. That's when having different activity stations set up for a child to move to or a quiet nook for reading and imaginative play can be helpful. A break gives the brain a moment to rest and reset, so the child can come back more calm and with potentially new creative ideas.

Sneaky Science

Throughout the Little Makers program, we aimed to help make STEM concepts more accessible. One way to do this is by "hiding" the science in the play and exploration while using facilitation to point out the STEM learning when it naturally makes sense. Remember, the objective of our programming is to help parents and caregivers engage their young children in STEM-related talk and activities. This type of programming is designed to both engage children and help adults understand how children learn and grasp how the world around them works.

There may be no obvious STEM outcome observable from the children's activities; however, children gain valuable insight into the world and materials around them through play and exploration. That's not to say there wasn't a focus on a particular set of scientific concepts to explore—just that there was no expectation to build a specific project, for example, a car to go down a ramp. Instead, children could freely play with and explore the concepts of speed, force and motion using the wide variety of the materials on hand. Parents, caregivers, and children built a myriad of ramps together at varying heights. They tried making loop-de-loops with rubber ramps, made hills, incorporated curves, and used many different materials to make their ramps work.

They explored rolling various balls down the ramp to see which would go farther, or faster, or around the curve. They discussed why things worked or didn't work. They kept revising or rebuilding when things didn't work, and even tried to make their designs better when they did work. Adults talked about force and motion and prompted the children to wonder what might happen if the ball was dropped from a certain height or pushed harder. They wondered what would change if they tried different materials, and they devised tests to find out. The whole process was inspiring to watch. And though it all, the STEM learning happened organically.

TINY TIP!

Children learn through observation, repetition, trial and error, and experimentation. Be patient and let children lead. They are much more engaged when they do.

Through their explorations and play, we saw significant evidence of scientific reasoning skills. Children investigated materials, tested hypotheses, revised expectations, and tested again. They were actively trying to make meaning out of what they were doing.

As another example, we hosted a day of exploration involving light and shadow. The room being used was kept dark, and there was an overhead projector, a light table, and flashlights, along with many props to use with each tool. The concept that light travels through materials with holes, like lace, and that solid objects block the light is one way of learning how shadows behave. This helps children extrapolate and begin to make sense

of the world around them. When they experimented by laying a dark object on top of a colorful projection to block the light, they then had observational data to understand. Children may not be able to explain the scientific phenomena or use the related vocabulary, but they did gain a better understanding of light and shadow.

Further, with an adult facilitator using words like opaque, translucent, and transparent, the children could begin to connect those words to what was happening when light shines through, gets blocked, or is partially visible. All participants had significant involvement, vocabulary and concepts were used during their play and experimentation, and everyone was busy and challenged.

Helping Adults Take the Lead

One staff member noted that the person facilitating an activity is helping to empower parents and caregivers to both understand the language related to the scientific concepts at hand and then convey that understanding to a child. When interacting with their children, adults were generally too busy to read lengthy signs with explanations, descriptions, directions, or concepts. They need one-word prompts or short questions that they can view and use in the moment. We adapted our signage in response to help them.

For example, around the aforementioned light table, we placed the terms *translucent, opaque,* and *transparent.* Parents and caregivers could see the words and were subtly reminded to use them with their children as they interacted with the materials at the station. Definitions were posted as well, so if they were unsure of the terms, there was something available to refer to. This proved to be helpful.

TRY IT!

Check out the Light and Shadow Exploration in Resources.

Through the Little Makers program, we encourage a maker mindset with the way we speak with and praise children. For example, in the midst of play, staff facilitators might describe what a child is doing using some of the STEM vocabulary. We actively strive to acknowledge and praise their actions, efforts, and perseverance, all of which are more important than "success." Then, we point out to the adults what we did and why we did it. Giving adults and children the language to ask questions around the problems allowed them to explore in different ways.

A goal is to help adults have similar conversations with their children even after they leave the library. What better way to accomplish this than to start practicing in a safe environment? Don't be afraid to be explicit and let parents and caregivers know exactly what you're doing and why. Mention that these are the types of things they can continue to do back at home, extending their child's learning.

Guiding Facilitation Virtually

Running programs virtually for our at-home programming provided a whole new challenge. We needed to guide adults on how to facilitate with their children during the week without us there to model and facilitate it for them. Through the Niche Academy platform, we were able to not only meet with parents and caregivers in real time during regularly scheduled Zoom meetings, but we also provided tips and strategies throughout the week that could be viewed asynchronously. Several examples are provided below.

Go slow. Your child's ability to process information can take a few minutes, so give them enough time to put it all together.

Let your child lead. Your child sees the world quite differently than you do. So much is new to them. Your child's questions and suggestions for new things to observe and try can lead to discovering and learning something new together. Allow them to decide what to play with and how. Ask: "What would you like to try?"

Let children make their own observations. Anyone can notice and observe what's going on—there are no wrong answers. Listen carefully and encourage curious exploration and experimentation. Your enthusiasm in the process is more important than arriving at a specific place. Ask: "What do you notice?"

Challenge yourself. Your child may want to use things in different ways that you may not think are appropriate or that could make a mess. Ask yourself if what your child wants to do is safe. If there's no danger of injury and you can deal with the mess, let them explore and try to use things in new and novel ways.

Reflect. Take time each day to reflect with your child. Reflection helps reinforce what we learn each day. Ask them what they did, what was fun, and why. Listen for them using new words, draw pictures about what they've done or discovered, and re-enact or tell stories through play with their toys.

Try to avoid giving answers. Play is about discovery. Your child will explore more deeply if you don't tell them what you know, and you let them discover something new for themselves. Ask: "What do you think? What do you wonder?"

Explain your thought process. When you do help solve a problem or share an observation, verbalize your thought process and explain what you see.

"I think I almost got more out of it than he did. Just learning how to play with your children, I think is so important, especially in times of technology." *—Parent/Caregiver*

Throughout the virtual experience, we reinforced to adults that conducting maker activities with young children provides opportunities for observing, exploring, asking questions, seeking answers, making predictions, and sharing what is discovered. By tapping into children's natural curiosity, we allow them to come to their own conclusions.

We wanted adults to recognize that if a child is especially excited about a specific object, they should try to play and learn alongside the child by exploring the properties of that object and learning what they appreciate about it. For instance, sometimes simple items like tape can be the most exciting for a young child. We already know from experience that tape is sticky. Imagine seeing a roll of bright red tape for the first time and not knowing what it is! We wanted to encourage adults to give the time and space to wonder alongside their children. Below is another example of a set of tips we offered to help facilitate these discussions.

- Orient your child to new tools and materials. Give them a place and time to explore these new materials safely.
- Wait before jumping in to help your child. Let your child work through difficulties. When you do step in, ask questions rather than offer a solution. Try using "what if" statements.
- Ask open-ended questions and then wait for your child to answer the question. Respect your child's ideas.
- If your child asks you a question you don't know the answer to, say, "I don't know the answer. Let's figure it out together." Work together to solve the puzzle.
- Use relevant scientific and technical terms in context. Explain the meaning of terms by using analogies, for example, "A ramp is like the slide in the playground. Ramps help move heavy things like your body from high to low."
- Give suggestions rather than directions.
- Show enthusiasm.
- Encourage safe risk-taking and experimentation.
- Celebrate moments of wonder, surprise, and joy.

The virtual experience of our at-home programming reinforced what we already saw through in-person programming: Parents and caregivers are a key piece of the puzzle. Whereas in the library, adults can sometimes let the library staff do the work of facilitating, with the programming at home, parents and caregivers were the main facilitators. When we design programming, we need to think about supporting their needs equally as much as the children's needs. We're continuing to work on how the resources and experiences we had online can be translated to an in-person environment to support adults in the best way possible.

Chapter 5

PROGRAM PLANNING, REFLECTION, AND ITERATION

If the pandemic has taught us anything, it's that we're highly capable of being adaptable, switching gears, and creating new experiences with lasting effects.

Most likely, you already have some form of early childhood programming taking place, whether it be through storytime or other hands-on programming and events. The knowledge we share in this guide isn't suggesting that you scrap what you've already been doing in favor of some shiny new program. Rather, we hope it encourages you to explore what's possible when you modify or enhance your current early childhood offerings.

The important part is to set goals with clear timelines and deliverables and not be afraid to just give something a try! It's so easy to push changes off to the next month or year, but incremental changes can add up and make a big difference over time, so don't be afraid to start small.

Program planning, reflection, and iteration form a constant cycle. As lifelong learners, we know that programs are never "perfect." There's always some way that we could reach a child that is struggling, invite a new caregiver into the experience, or work on our own question-posing strategies to be the best models for adults. This constant iterative programming cycle is part of truly embracing the maker mindset that you hope to instill in the children. Thinking of yourself as a "maker" and "tinkerer" of child programs can be a

very helpful mindset. Focus on making small changes with intention and being flexible to learning from and with your patrons and staff as you go.

In this chapter, we talk about our ever-changing program model and the ways in which we gather feedback from our staff and families to make adjustments and keep improving. We're still tweaking and refining our program today!

The Evolution of Program Planning

As mentioned, program planning is never done. Our program evolved over time as we learned more about the needs of our community, what worked, and what didn't. We wanted to create an environment where children and caregivers could freely engage with materials, experiment, and play. After surveying many state preschool curriculum guides and looking at the way other programs were setting up their spaces and what activities they were offering, we began planning.

After exploring, it was agreed that we could categorize the concepts we hoped to reinforce in the Little Makers program by using the common acronym STEM as the basis. We began with the following brainstorm:

Science	inquiry, light, color, shadow, gravity
Technology	coding, circuits, patterns, sequencing
Engineering	building, ramps, woodworking, circuits
Math	measuring, counting, patterns

We also kept in mind the Exploratorium's Learning Dimensions tool, outlined in Chapter 2, to guide us. We then reflected as a team about what the most important characteristics of a Little Makers program are so we could always keep them in mind when planning. Essentially, we tried to identify what makes a Little Makers program a Little Makers program.

We decided on these essential characteristics:

- Playful exploration of STEM
- Open-ended
- Authenticity of materials and tools

In the initial planning stages, we considered having multiple activities around one theme, but this approach seemed to lose the open-ended quality we were striving for and became too limiting. It was also difficult to figure out how to use themes without dictating the outcome of each activity. We wanted to be sure we weren't setting up families to produce a particular "thing" or finished product. Instead, we noticed that when we approached the theme more loosely (a week of ramps and things that roll, a week of

exploring light, reflection, and color, a week of exploring sound, etc.) but supplemented it with other self-directed play stations where lots of tools and materials were available to explore, things just happened organically and were more in line with reaching our goals.

We decided to focus on simple activities and play that lead to a deeper understanding over time. One of the ways children begin to develop understanding is repetition. Every time they hear something said or watch it done, they internalize and extrapolate. This is equally as important for adults too! Having adults see the same activities modeled for them over and over again can help them internalize the learning and feel more confident to try similar things at home. We also tried to illuminate how these concepts are already part of our everyday lives by drawing analogies, pointing out similarities, etc.

SMALL TRIALS: POP-UP EVENTS

At the start of our program, when the Keene Public Library was under construction, we offered pop-up events to help familiarize staff with the tools, while allowing them the opportunity to practice facilitation techniques. A pop-up event was a single activity around a particular topic, such as circuits, where we experimented with conductive clay.

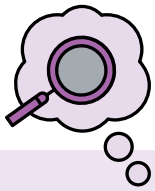
These events took place during the same two-hour window of time as our regular Saturday programming, but because the library was under construction, they often took place in the Youth Department at a single table or in the small story room. And because of the location, they weren't limited to preschool-aged children, so the age range varied greatly.

These trial runs were wonderful experiments that helped flesh out which activities and tools we might want to incorporate into our regular Saturday programs once the new Little Makers space opened up. They became an important part of our program-planning evolution.

Our first sessions entailed a lot of trial and error. Sometimes it seemed as though we put out too many stations of activities, but we knew we needed more than one activity for this age group. The challenge became to have enough, but not too much, available. We decided to structure each session with two or three consistent and repeated activities, alongside two new activities. That equation struck the right balance for our community.

In addition to the specific activities we offered, our program plan needed to include open-ended questions and language prompts. As we discussed in Chapter 4, facilitation is a

key part of how a program is received. Using open-ended questioning techniques and language is so important for young developing minds. Even if a child can't use the words themselves, exposure to scientific language prepares their minds for the future. Children learn language through interaction. The interaction can be specific verbal discourse about a particular topic or indirect commentary during an activity—with each iteration, children begin picking up the terms.



There are a host of great program planning resources available online. We used a helpful Learning Tool from Making+Learning, shown below. We customized ours by adding Little Makers characteristics that are important to us, along with the Exploratorium's Learning Dimensions, so we would be sure to keep them in mind as we developed our plan.

PAUSE AND PONDER

As you begin your program planning, think about:

- What are the main goals of your program?
- What makes your program unique?
- How do your current program offerings match up with the Exploratorium's Learning Dimensions? Are there any gaps or places where you could tweak or enhance your programming?
- In what ways can you "start small" and try making minor changes to your programming?

Little Makers Program Planning

1 Learning Goal

What do you want your learner to be able to do, know or feel?

2 Evidence

What would it look like to demonstrate this learning goal?

"I would see..."
"I would hear..."

3 Activities

What activities would produce the intended evidence of this learning goal?

How would you design the activities given maker-based characteristics?

LITTLE MAKER CHARACTERISTICS

Involves playful exploration of STEM

Open-endedness

Authenticity of materials and tools

LEARNING DIMENSIONS

Initiative and Intentionality

Problem Solving and Critical Thinking

Development of Understanding

Creativity and Self-Expression

Social and Emotional Engagement

children's museum PITTSBURGH MAKING+ LEARNING Institute of Museum and Library Services

Making+Learning is a cooperative agreement between the Children's Museum of Pittsburgh and the Institute of Museum and Library Services.

"This has definitely helped me come up with ideas on ways I can interact with [my child] and get him kind of thinking about things, building his confidence, and that he can do these things." — *Parent/Caregiver*

The Importance of Reflection

An essential, and sometimes neglected, part of developing a program is taking time for reflection. We all tend to be exhausted after a program has ended, but we can't stress enough how just taking five minutes to jot down a few notes before you leave for the day can really help. Make sure to do these reflections after each session. Take the time to hold discussions with staff and other volunteers who ran the program. It's incredible what valuable insights can be shared and capitalized upon.

For example, after several debriefings, we began to wonder if having a theme for each session that connected the activities together was essential. Did we see the children making and tinkering differently when the program was unstructured and only loosely connected thematically? We found that the answer was no. That allowed us to let go of some of the angst generated around what the program would look like on any given Saturday. This, of course, doesn't mean that planning didn't take place—that was a necessity! However, it allowed us to let go of constraints and create a more playful environment for the participants and the library staff involved. The stress of trying to connect each activity to a particular theme was gone.

For all staff and volunteers involved, ask yourselves questions related to the program sessions, such as:

- How did the session work? Was it successful?
- What did you observe? What stood out to you?
- Is the environment impacting the programming?
- How can you improve or change the environment to further benefit patrons?
- What resources do you have on hand in terms of materials, personnel, space, etc.?
- Did you have sufficient staff for facilitation?
- What might you do differently next time?

It's also important to reflect on what children learned during the program. Again, referring back to the Learning Dimensions tool can help. We've included the Learning Dimensions

tool and an expanded view of all of the indicators of children's learning in the Resources section. When you review this tool, think about the goals of your program and what levels of agency you might expect. Did you notice any children engaging in building together or working side by side? Were they noticing phenomena or asking questions about what they observed? All of this becomes valuable information as you determine what changes you might want to make.

You may have other skills that you hope children gain (outside of the levels of agency outlined in the tool). For example, one of the essential scientific skills we noted was perseverance. We could see a lot of evidence of that when kids were exploring with the pulley system, the conveyor belt, the ramps, and even the circuits. Kids kept trying things and working with others to figure it out.

From there, we created a reflection sheet that we offer in the Resources section. Feel free to use it as-is or adapt it as needed to fit your particular program. The purpose for us was to:

1. Document the implementation of the program.
2. Provide a tool for program facilitators to reflect on the program in practice.
3. Track potential progress toward meeting intended outcomes and note the strategies implemented to reach them.

TRY IT!

Check out the Facilitator Reflection Form in Resources.

Reflection for Adults and Their Children

Reflection is an integral part of STEM learning. Reflecting helps us process information. This is especially important and empowering for young children because much of what they do is new to them. Reflecting involves remembering what things looked like, how they changed, felt, tasted, and more. Essentially, reflection helps children (and adults!) remember what, how, and why, offering them dedicated space to think about and process what they experienced and learned.

Taking time to talk about what was fun, why it was fun, what happened, and why it happened helps children make meaning and connections between what they're doing and the world around them. You might have a conversation, tell a story, or make a drawing together. You could look at photos of what you made that day and talk about it. You may find children reenacting events with their dolls or telling their own version of an event through play. You can encourage children to rethink experiences by recalling what fun you had together, what problems you had, how you solved problems, and what you discovered. What's more, reflection that includes talking, writing, and drawing develops core literacy, comprehension, and communication skills.

We experimented with collecting reflections from adults and children through both our in-person and at-home programming. We describe the methods we used below.

VIDEO SELFIE STATION

For in-person programming, we played around with setting up an area where children could video themselves sharing a bit about the creation they made. Since we didn't have a totally enclosed photo booth setting available, we just set aside a small area (in our case, a couch) where video interviews could be conducted.

To help them reflect, we asked questions like:

- Tell me about what you made.
- Did you have any big problems while you were creating this?
- What could you do to improve your design?
- Did anyone help you with this? How?

Some children were shy when a library educator would video interview them. We then encouraged parents and caregivers to ask the questions and explored whether this could be a self-directed station. We're still exploring!

SCAVENGER HUNT

For our virtual programming, we used an app called Goosechase to go along with our weekly Zoom meetings and Niche Academy activities. This was consistently one of the most popular activities we suggested. Each week we posted a series of different scavenger hunt challenges aligned with the theme for that week. Here's an example for our week focused on Light and Shadow:

Hunting for Light: Light is a type of energy that allows us to see things in the world, but where does it come from? Find a light source in your home and take a picture of it.

The Sun: The sun is a big ball of light energy. The sun is what gives us light during the day. Draw a picture that includes the sun and take a photo of it.

Blocking Light: Use your flashlight and see if you can block out all the light with an object like your hand. Take a picture of how you blocked the light.

Blocking Light and Making Shadows: If light can't pass through an object, like your hand, then the object is *opaque*. Using some of your toys and your flashlight, play with blocking light and making shadows. Experiment with making shadows on different surfaces, such as a wall, a curtain, a table, or the floor. What do you notice when you hold the flashlight close to and far away from your toy? Take a photo of the shadow you create.

Hunting for Shadows on a Sunny Day: Take a walk outside on a sunny day and look for shadows. What do you find? Take a photo of your favorite shadow. Tip: If you take a walk a few hours before or after 12 noon, it's easier to find shadows.

Making Shadow Art: On a sunny day, find your shadow and trace it with chalk. Decorate it and take a photo.

Hunting for Transparent Objects: A *transparent* object is one that you can see through. Light can shine through a transparent object like a glass of water or a window. Find a transparent object and shine your flashlight through it. What happens? Take a photo to share.

Bouncing Light: When you shine a light on a shiny surface like a mirror, the light bounces from that surface to another. This is called *reflection*. Can you bounce light off your mirror and onto the wall? Give it a try and snap a picture.

At the end of each week, we would collect all of the submitted photos and put them in a slideshow that we would feature on our final live Zoom meeting for the week. Both adults and children loved seeing themselves and their scavenger hunt finds featured on the screen. These photos allowed for a natural moment to reflect and talk about what they did, what they found, if anything was difficult or surprising, etc.

IMPROVING YOUR PROGRAM USING DATA

When it comes to measuring success and collecting data about how the program went, we often hear library educators say, "I'm still working on that." Don't beat yourself up about it. Know that this is a struggle for everyone because most of us aren't trained evaluators!

If you have the budget, hiring an external evaluation team can be a great way to get some concrete data about your programming. Through the Little Makers IMLS grant, we were able to do just that. However, we also tried to experiment with ways to collect data ourselves that fit in naturally with the program.

Below we outline three methods you can try to collect valuable data you can then use to continually improve upon your program.

Interviews

Conducting in-depth interviews can involve a major investment of time, but asking brief interview questions can serve as an informal way to make connections with and get feedback from parents and caregivers who attend your program. The goal for any interview is to get insight into a person's experience and what they thought and felt. Rather than the interviewer talking and telling, you want the interviewee to talk as much as

possible. Through the conversation, you can identify what information they share seems most important to them and follow that direction to delve deeper.

If you need a more systematic way to collect data for reporting purposes to a funder or other key stakeholder, then you'll want to conduct more formal, in-depth interviews where you invite participants to be interviewed for 20 or 30 minutes. The introduction for this type of interview is extremely important because establishing trust and building rapport help people open up and answer the questions you ask honestly.

You'll want to ask permission to record the interview (your phone works well) and then use a transcription app, like Otter.ai, to transcribe the audio recording when it's time to analyze your results. Remember that making sense of what you heard during the interview and compiling the data in a systematic way can be time-consuming. If you go this route, be mindful to stay objective and not cherry-pick the data, focusing on only what you want to hear.

Asking brief interview questions can also serve as a great, informal way to foster interactions with parents and caregivers—and it can be done via email or phone, in addition to in person. Have a notebook handy to jot down key ideas and thoughts as they emerge and keep a record of these conversations on your staff reflection form as well. If possible, try asking the same series of questions to see if you can see any patterns emerge.

TRY IT!

Check out the Parent/Caregiver Interview Guide in Resources.

Surveys

If you're considering using surveys as part of how you measure the success of your program, our advice is to keep it simple. If possible, start with a survey tool already in use at the library so you won't have extra data to analyze and your patrons won't end up with survey fatigue. It's a real thing!

We decided to piggyback off a survey tool we were already using at our library, Project Outcome, published by the Public Library Association, a division of the American Library Association. This is "a free online toolkit designed to help public libraries understand and share the impact of essential library programs and services by providing simple surveys and an easy-to-use process for measuring and analyzing outcomes."

There are seven standard questions and three questions that you can customize to meet your specific needs. The resource includes both immediate surveys (intended to be delivered right after a program ends) and follow-up surveys (intended to be sent out sometime later after participants have left your program). We chose to modify the follow-up surveys since we were most interested in learning what "stuck" about our programming. Then, we added the following three customizable questions that focus on child and caregiver outcomes as well as soliciting a story about their experience. As you will notice, the questions were directly related to the Exploratorium's Learning Dimensions too.

"It gives me more confidence because it showed me that it's okay to let her lead sometimes, not always have an answer, and look up answers together." *—Parent/Caregiver*

Little Makers Survey Questions

(Customized Questions 8–10)

8. Parent Outcome Multiple Choice: What thing(s) did you learn by participating in the Little Makers program? (Check all that apply.)
    a. I feel more confident when doing open-ended tinkering and play with my child.
    b. I ask more "how" and "why" questions.
    c. I think more "out loud" with my child.
    d. I follow my child's lead more.
    e. I focus more on the process than the product now.
    f. I share my excitement and engage more with my child when discovering.
    g. I pay more attention to the language I use while my child is tinkering and exploring.
    h. I better understand the "maker mindset."
    i. I see more ways STEM is already embedded in my child's everyday life.
    j. Other, none, or N/A
9. Child Outcome Multiple Choice: What behaviors has your child demonstrated as a result of the Little Makers program? (Check all that apply.)
    a. Responding — S/he has initial interactions and makes observations during activities.
    b. Exploring — S/he probes the problem, variables, and/or possible solutions.
    c. Owning — S/he takes intellectual risks and/or applies understanding.
    d. Initiative — S/he develops own ideas or goals and/or expresses interest.
    e. Problem-Solving — S/he demonstrates troubleshooting and/or trial and error.
    f. Understanding — S/he has moments when s/he "gets it."

g. Creativity — S/he uses materials or thinking in novel ways.

h. Socio-Emotional — S/he demonstrates increased confidence, collaboration, and/or personal development.

i. Other, none, or N/A

10. Parent/Child Outcomes Open-Ended: Please share one specific memorable highlight from the Little Makers Program. (Perhaps elaborate on your responses to questions 8 or 9).

One of the wonderful benefits of using Project Outcome is that the surveys were developed with a national audience in mind and have been validated. The surveys are intended to be delivered electronically, and the website includes a platform to analyze your results, taking some of the time burden off your staff.

Talkback Board

One informal way we tried to collect feedback was inspired by the University of California, Irvine's Connected Learning Lab Talkback Board. A particular prompt or question is posted in a highly visible location (bulletin board or white board), and patrons are invited to respond or place their votes. We posted questions that we were curious about, like "What did you learn today? Where did you get stuck?" Then, we left sticky notes out with writing utensils for patrons to write their responses and post them on the board. It provided a quick and easy way to get a general sense of how a program went that day or if we were able to meet a particular goal.

Resources

EXPLORATIONS

Cardboard Exploration

Cardboard is a simple material with endless opportunities for exploration. Children can quickly become engineers by designing, shaping, creating, and building.

Try It

1. Present children with various recyclable cardboard items: boxes, egg cartons, flat cardboard sheets, or any size cardboard pieces you can find. Try to find both a thin box board and a thicker "multi-ply" board to experiment with.
2. Provide various types of connectors: plastic screws and hinges, different types of tape (duct, plastic, masking, paper), child-safe glue guns, etc.
3. Offer children things with which to decorate the boxes (markers, paper letters, paper to draw on, etc.) and measuring instruments, such as rulers or tape measures.
4. Have on hand tools that can cut through heavy cardboard, such as child-safe saws or scissors.
5. *Option #1:* Just let the children play with the materials provided, and see what they build naturally.
   Option #2: Provide a directed activity question, such as: Can you build a tall building, or make a tower, or design a room, or put together some other creation with your cardboard pieces?

TINY TIP!

Wearing aprons with pockets can help you keep track of the cutting tools you don't want kids to have unsupervised access to.

Learning Opportunities

Children become engineers and problem solvers every time they spend time building. Be sure to include different sizes, thicknesses, and shapes of cardboard to help children see the relational differences in scale: bigger, smaller, taller, shorter, longer, wider, etc. Just by playing, they'll practice spatial awareness and learn the language of geometric shapes: square, rectangle, circle, cone, tube, etc. If you're using measuring instruments, like a ruler, discussions on inches and feet happen naturally when talking about size differences. Feel free to also use nonstandard measurements (like number-of-hands tall and number-of-books wide) to practice these skills.

Open-Ended Questions

- What kinds of things are made out of cardboard? (Have examples ready to show if needed.)
- How do you think that box is made?
- What happens if cardboard is thicker or thinner?
- How can we add one piece to another to build something new?
- What shapes do you see?

TINY TIP!

This activity is exciting for many adults too! Be mindful when adults start to take over a child's project, and guide them to take the role of "helper" or "assistant engineer" instead.

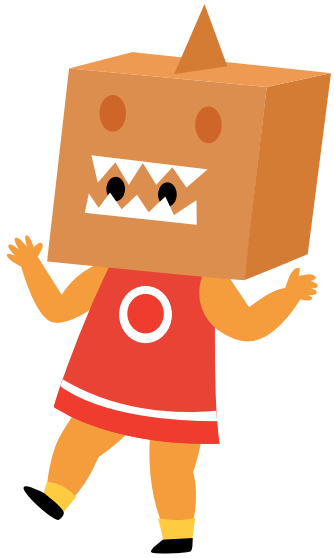
WORDS AND CONCEPTS TO EMPHASIZE

- Build
- Stability
- Balance
- Foundation
- Construction
- Measurements
- Relational sizes (smaller, bigger, taller)
- Shape names (circle, square, diamond)
- Tool names

Cardboard Exploration *at Home*

Take home a book like:

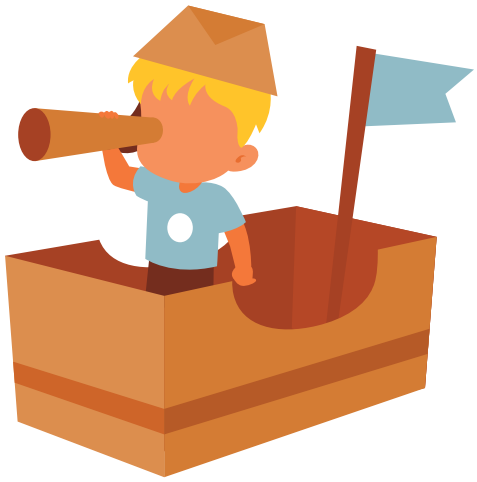
- *Big Box for Ben* by Deborah Bruss
- *Not a Box* by Antoinette Portis
- *The Big Brown Box* by Marisabina Russo
- *What to Do with a Box* by Jane Yolen & Chris Sheban
- *The Nowhere Box* by Sam Zuppardi



Explore and tinker with cardboard with your child. Remember to use the same language you used and heard at the library to emphasize the concepts learned.

Ask your child questions like:

- What can we build today?
- Why do you think the boxes fell over?
- Which one is bigger or smaller?
- Can you point to the tube, rectangle, etc.?
- How long is that piece?



Circuit Exploration

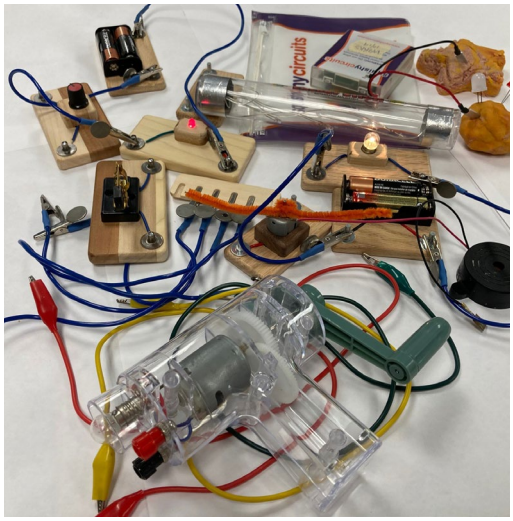
Exploring electricity with young children can be somewhat intimidating, but keeping it simple allows children to develop a solid basis for understanding electricity as they get older. The objective is for them to explore, observe, and make predictions.

Try It

1. Provide children with a variety of tools and materials such as: circuit blocks, various alligator clip wires, battery packs, switches, buzzers, spinners, squishy circuits (conductive and non-conductive clay), small light bulbs (different colors), or a Makey-Makey banana piano with a computer station.
2. Allow children to explore using the alligator clips, attaching to batteries, and seeing what they can get to light up, make a sound, etc.
3. Use analogies to help children understand the basics of electricity. A train analogy is a great one to use: The train must leave the station before the next one arrives, but things can stop the train on the tracks so that it won't move unless a switch is thrown or the flow is allowed to continue. The vocabulary of circuits—open circuit, closed circuit, etc.—can make more sense when discussed through this analogy.
4. Talk to children about the flow of electricity and that both ends of the battery must be connected for the electrons to flow. As the children explore, adult participants can explain that there must be a complete circuit for anything to happen.

TINY TIP!

Try starting this activity with a take-apart of a simple flashlight or cheap electric toothbrush to help children see the real-world application of circuits.



Learning Opportunities

The flow of electricity may seem like the stuff of magic at such a young age, but simply by playing with materials and exploring how to complete a circuit to make something happen, children are gaining valuable foundational learning for electrical engineering and mathematics concepts.

Book Recommendation:
Switch On Switch Off by Melvin Berger

Open-Ended Questions

- How does electricity flow?
- What connections need to be made for the circuit to be complete?
- What do batteries and bulbs do?
- What do we need to do to make something happen (the bulb light up, the switch turn on, or the spinner spin)?
- How can we connect things to make this work?
- What if it doesn't work? What can we try?

TINY TIP!

Try using an energy stick to quickly demonstrate closed circuits using your own body as a conductor!

WORDS AND CONCEPTS TO EMPHASIZE

- Circuit (open or closed)
- Conductor
- Battery
- Electricity
- Insulator
- Counting (number of bulbs that light up)
- Patterns (putting colored bulbs in a pattern)

Light and Shadow Exploration

Playing and exploring with light and shadows is an interactive, fun way to introduce young children to making predictions and observations. The activity can be very simple by using flashlights or sunlight outdoors. Or, it can be made more complex using other mediums, such as colored filters and an overhead projector.

Try It

Option #1: Outside

If you're able to go outside in the sunlight:

1. Children can use their shadows on the ground to discover that their body is blocking the light.
2. They can trace the shadow using chalk and learn math terms such as long, short, tall, wide, etc.
3. Discussions can be shaped around objects being translucent, transparent, and reflective, as well as predictions on which objects will produce a shadow.

Option #2: Indoors

If you're indoors:

1. Give children flashlights and objects to place in front of the light.
2. Put paper on the wall so children can trace their shadows or the shadows of shapes they're putting in front of the flashlight.
3. When shining the flashlight, move it to help them understand the difference between the light being close, making a smaller shadow, and the light being farther away, creating a giant shadow.
4. Use colored filters, such as cellophane or transparent color pages, to explore with the children. Do the colors appear on the wall or stay black like their shadow? What happens if you mix the colors together?
5. If you're using an overhead projector, explore the relationship between the light shining up and what's the same and different about how the image appears on the wall.

Learning Opportunities

However you decide to do your explorations, children will be gaining awareness about different light sources and exploring the following ideas and concepts:

- Shadows are created when you block the light source.
- You can change the size of a shadow.
- Colors can be combined and filtered through a light source.
- Some materials are translucent while others are opaque.

Open-Ended Questions

- How can we make a shadow?
- What can we do to change the shape of a shadow?
- Where does the light come from?
- How do the colors of shadows change?
- How can we change the shape of a shadow?

WORDS AND CONCEPTS TO EMPHASIZE

- Shadow
- Light source
- Filter
- Translucent
- Transparent
- Opaque
- Reflection
- Bigger, smaller, closer, farther, larger, taller, shorter
- Prediction
- Observation

Light and Shadow Exploration ***at Home***

Look around your house for everyday items that can be used to explore light and shadow, such as nightlights, flashlights, headlamps, or just the sunlight shining through windows. Explore together with your child, encouraging a sense of wonder.

Explore with flashlights together and discuss why the light shines through some things but not others, continuing to investigate the terms transparent, translucent, and opaque. You can even create a visual graph of the number of items in your house that fall into one of those three categories.

Experiment with making shadows on different surfaces, such as a wall, a curtain, a table, or the floor. What do you notice when you hold the flashlight close to and far away from your object?

Take a walk outside on a sunny day and look for shadows. What do you find? Find your shadow and trace it with chalk and decorate it.

Tip: It's easier to find shadows if you take a walk a few hours before or after 12 noon.

Ramps Exploration

Exploring with ramps looks like play, but the concepts behind what's happening are absolutely science! By experimenting with designing and building ramps, children become mini engineers. And by exploring and observing how different objects move or remain static on the ramps, they're introduced to concepts in physics (friction, energy) and math (speed, angles, measurements).

Try It

1. Provide various materials that can be used to build ramps, like blocks of any kind, sandbags, anything flat and long (like wooden or rubber moldings), cardboard tubes, furniture (to provide height), fasteners, etc.
2. Also provide varied items to use on the ramps. There should be items that roll naturally (balls of various sizes and weights, round containers, plastic lids, etc.), toys with wheels, items that don't roll naturally (rocks, toy animals, seashells, etc.), and anything else that you can find that children can test on their ramp.
3. Let the fun begin! Children seem to naturally want to build a ramp when the materials are available. Let them experiment with using different materials to build the ramp itself and then let them play with trying to roll various items down the ramp.

TINY TIP!

Start with balls and move on to using cars later. The balls help younger children focus on how the ramp is working without the distraction of the car itself.

Learning Opportunities

Children will learn about how things roll down an incline, remain motionless on a flat surface, or might require a push (or other force applied) to move. The concept of friction—the resistance of motion when two objects rub against one another—can also be explored. When using a ramp, the wheels or round objects that roll down the ramp produce energy in the form of motion. They meet resistance (friction) while rolling, which eventually slows them down.

Open-Ended Questions

- What height ramp do you need to get something to roll down it?
- How can we make a longer ramp?
- How far can you get that _____ to go? How can you move it farther?
- What materials make the _____ move faster on the ramp?
- How can we put a curve in the ramp? Can you make a ramp like a roller coaster with a loop-de-loop?
- How can you make the ramp go over something and under something else?

When the children are experimenting to see what items go down the ramp, questions could include:

- Why do you think that _____ didn't go down the ramp?
- Why did the _____ fall off of the loop?
- Why didn't it go around the curve?
- Why is it slower on that ramp than on that one (if there are contrasting materials on each ramp or if they're at differing heights)?

TINY TIP!

Give this activity as much room as possible. Ramps encourage cooperative play; the more kids, the more space is needed. Be creative with the space you use and don't be afraid to include places like the library stacks as well.

WORDS AND CONCEPTS TO EMPHASIZE

- Design
- Construction
- Friction
- Motion
- Energy
- Speed
- Angles
- Distance measurements

Ramps Exploration *at Home*

Bring home a book like *Roll, Slope, and Slide: A Book About Ramps* by Michael Dahl.

Go to a local park that has a slide and gather materials found in the park to roll down the slide. These can be the children themselves, rocks, pinecones, or any other exciting materials they want to experiment with.

Time the items as they roll down the slide. Ask children why they think the amount of time is different for each item.

If the child went down the slide, ask them if they feel it would take longer or shorter if the adult went down the slide? How about a friend? You can chart the items and their times.

On the next trip to the park, bring various types of balls and send them down the slide. Make sure to mark and measure the distance, as well as keep time.

Questions to ask could include: Which do you think will travel the longest distance off the bottom of the slide? Why?

Try to find things that won't roll down the slide and ask why.

Suggest that your child climb up the slide in different types of shoes and ask which pair was harder. Ask: Why do you think the different shoes affect your ability to climb up the slide?

Simple Machines Exploration

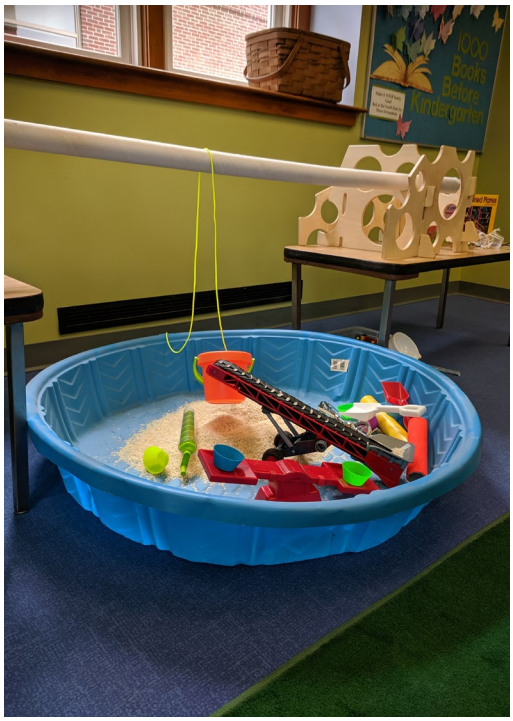
Free play with levers, pulleys, and conveyor belts allows for experimentation and discovery. Many children are amazed by how a simple machine, which has very few moving parts, can make work a lot easier!

Try It

1. Set up a sandbox area or simply a large box filled with sand, pebbles, rice, beans, or other material that's safe for the children to handle.
2. Allow children to explore moving the materials using toy trucks (front loaders, backhoes, etc.), buckets, and shovels.
3. Consider placing a dowel with a pulley system attached to it across the top of your boxed-in area. Have children try out the pulley system and ask if it's easier or harder to lift the bucket with the pulley than without.
4. Provide materials for making levers, such as pencils, popsicle sticks, spoons, rubber bands, tape, etc. Invite children to build a catapult and experiment with this form of a lever. Have on hand various soft items that can be launched. Whatever you use, enable children to play, and test to see whether the length of the lever or where the fulcrum is placed makes a difference in how far the load can be launched.
5. If you have access to a small conveyor belt, demonstrate turning the crank to move the loads from one side to the other and back again. Place a basket or bucket on the end of the conveyor belt and have children experiment with moving things along the conveyor belt and having them land inside the bucket or basket.

TINY TIP!

Relating a lever to a teeter totter can be helpful as you explore!



Learning Opportunities

The main concept is that "Machines can make work (pushing, pulling, lifting, or hauling) easier." Basic engineering and physics principles, like balance and force, as well as math concepts related to weight and distance, become real for the children through hands-on exploration coupled with discussion.

Book Recommendation:
How Do You Lift a Lion? by Robert E. Wells.

Open-Ended Questions

- How can we lift something that weighs more than we do?
- How can we make a simple machine to move something without using our muscle power?
- What can you design to move an object?
- What does a conveyor belt do?
- How does a catapult work?
- How does a pulley work?
- How does a lever work?

WORDS AND CONCEPTS TO EMPHASIZE

- Balance
- Leverage
- Pulley
- Fulcrum
- Lever
- Conveyor belt
- Weight (heavy vs. light load)
- Load distribution (too much on one side or another)
- Counting (how many pieces can be moved at one time)
- Distance (how far one item gets when catapulted and which item went farther)

Wind Tunnel Exploration

Exploring with wind and air is both fun and exciting for young children, partly because wind is everywhere around them in their daily lives. Children learn that air and wind aren't visible, but their effects are!

Try It

1. Present children with pre-sorted bins of various materials such as balloons, beach balls, scarves, stuffed animals, bean bags, parachutes, tissues, different weight fabrics, etc. The bins can be labeled or unlabeled. If marked, the labels might be heavy, light, fast, slow, float, etc.
2. Use a wind tunnel if you have one or set up some electric fans around the space. You can also have the children make hand fans or give them straws to blow through to move the various objects. Whatever wind source you use, ask the children to try to move the object with the wind.
3. When a child picks up an object, have them predict and observe:
   - What will it do?
   - Will it move, roll, fly, or float in the air?
   - What goes the highest?
   - Which goes the farthest?
4. They can then test the objects and see if the original labels were accurate.
5. Ask: Can we find a way to make something that is heavy fly or move in the wind? Have them tinker with attaching a parachute to a heavier object.
6. You can also attach streamers to a fan to explore how things move. Ask the children how it's the same or different and to describe what they see.

TINY TIP!

You can DIY your own wind tunnel with an appliance-sized cardboard box and a box fan. We also built a ramp coming out of it, so children could experiment with how their objects would move on different textures or surfaces.

Learning Opportunities

By exploring which objects move in the wind and which don't, children come to understand the impact wind can have on the objects around them. Beneath the surface of

the play are concepts of science and mathematics, like speed, force, measurements, weight, and scale. Intentional play coupled with open-ended questions and use of specific words lays the foundation for this knowledge-building.

Open-Ended Questions

- How does the wind move things?
- Why do some things float and others don't?
- How can we make something that is stationary move in the wind?
- If the wind direction or force changes, how does it change the object being moved?

WORDS AND CONCEPTS TO EMPHASIZE

- Air pressure
- Force
- Speed
- Surface
- Scale measurement
- Farther
- Shorter
- Faster
- Slower
- Higher
- Heavy
- Light

Wind Tunnel Exploration ***at Home***

Take home a book like *Leaf Man* by Lois Ehlert.

There are many extensions to the learning at the library. You can explore and ask: Do dried leaves fly better than green leaves? You can design leaf characters and create their adventures. Where will the wind take them?

You can test objects at home with a hand fan or straw. Which objects move and which ones don't? Why?

Try to use a straw or just your breath to blow on water or sand. What senses can you use to notice the effects of wind? What happens when you blow softly or for a long period of time?

Go out and fly kites. Make your own or purchase one. How does it react in the wind? How is that different from a balloon? Why do you think that is?

Bubbles are a great way to explore wind at home. Why does your breath make the bubbles move a certain way? Why do the bubbles slowly sink and not float forever?

Woodworking Exploration

Young children enjoy the process of hammering, screwing, sawing, and being empowered to use tools in general. Often they can even design and build something to take home. There's always a great deal of trying and experimenting with wood and how it can be attached to itself or other things using glue, nails, or screws. This trial and error is essential to a young child's process of discovery.

Try It

First, a few important points to keep in mind as you set up the space for exploration:

- It's essential to have tools that fit a child's hands.
- The area where your woodworking activity takes place should be laid out to maximize safety.
- Having tables and chairs at child height is important for these activities.
- Wood should be clamped tightly to tables.
- Use stationary and movable tables or shelves to create a safe sawing area.
- Even when hammering, the amount of room necessary for a reliable swing should be considered.

Tools and materials to use: Safety goggles/glasses, gloves, sanding blocks, sandpaper in varying grits, tools sized to fit small hands (hammers, screwdrivers, mallets, etc.), clamps placed in strategic places so children have ample room and won't hit anyone, child-safe hand saws of different types, hand drills, and hardwoods and softwoods (balsa, pine, oak, etc.) of varying lengths, thicknesses, and sizes.

TINY TIP!

You can start an exploration of woodworking without any tools! Providing various types of scrap pieces of wood along with craft materials and glue allows for open-ended exploration and helps ease the transition to exploring with new materials in the future.

1. Monitor the work area carefully when children and caregivers enter. Safety rules and equipment should be given to each participant every time they come into the space.
2. Begin with a slow introduction to the tools. You might even begin with just the sanding of various wood types, move on to putting out screwdriver sets and pegboards with mallets, and later bring out saws and drills with softwoods and hardwoods for comparison. Techniques for using each tool should be demonstrated to both caregivers and children before using it.

3. When children are sawing or hammering, there should be adult and facilitator supervision. The facilitator must circulate and monitor each child's activity.
4. New tools can be introduced depending on the children's needs.
5. Teach children that tools must be returned to where they were taken from, and they should clean their work area for the next person.

TINY TIP!

Children may be more concerned with watching what others are doing or seem so interested in another child's activity that they neglect their work, but this is all part of the exploratory process. Just let it flow naturally.

Learning Goals

Exploring with wood and tools can be very empowering for children. Through play and experimentation, children are introduced to concepts of mathematics, like measurement and angles. They also get to try their hand at being engineers, designing and building an object of their own creation. You can emphasize the rudiments of measuring and making things a particular size. Children will also practice perseverance and focus, gain hand-eye coordination and fine motor skills, become problem-solvers, and achieve personal satisfaction.

WORDS AND CONCEPTS TO EMPHASIZE

- Length
- Measurement
- Angles
- Design
- Construction
- Names and uses of differing tools
- Joining
- Sanding
- Grit

Open-Ended Questions

- How can we change wood?
- How long is it? Can you make it shorter? By how much?
- How do we construct something or take it apart?
- How can we change the texture of wood?
- What can we learn about the strength of different types of wood?

Woodworking Exploration *at Home*

Take home a book such as *Old MacDonald Had a Woodshop* by Lisa Shulman.

Continue to call out the names of the tools in your home environment and use appropriate ones together. This helps your child develop independence, confidence, and competency with woodworking.

Discuss the importance of safety when using tools. But remember that you can start an exploration of woodworking without any tools by providing various types of scrap pieces of wood along with craft materials and glue to explore and attach.

Challenge children to create something new with wood and other craft materials attached by nails, glue, or screws. Ask: How might you connect those two things together? What will work best?

Use a tape measure or ruler to help them make things bigger or smaller.

When sanding, ask: How is the wood changing? How does it feel in your hands before and after sanding it? Why do you think this happens?

Criteria for Selecting Little Maker Books

Keene Public Library had many books on the topics we selected for our Little Makers activities. Many of these titles were gleaned from Best Of lists on the web or from print sources. When making book selections, we used typical best practices and the following as our starting point:

- Followed our policies and procedures, based on ALA guidelines
- Read through many book review resources
- Consulted librarians, preschool teachers, and blogs
- Considered patron recommendations

One of the main factors we considered when selecting books for our program was the age of the children. The span was from 2 years old to 6 years old. The National Science Teaching Association (NSTA) provides excellent suggestions for choosing science books for this age range. One essential question NSTA asks is "Is the book fun to read?" Always keep that in mind when purchasing books for preschool children!

TINY TIP!

Search and explore our extensive annotated bibliography of Little Makers books on our website.

Our primary considerations when selecting books include:

- Developmentally appropriate for children ages 2–6
- Fun, captivating, and engaging story
- Highlights or models the Learning Dimensions of the maker mindset
- Integrates STEM disciplines and has factually correct depictions of science, technology, engineering, or mathematics content
- Features illustrations that enhance the text and provide an alternate way of telling the story and illustrating the concepts presented in the book
- Includes culturally diverse people, ethnicities, and languages
- Provides meaningful connections to children's real-world, authentic problems
- Incorporates ideas around divergent thinking, assimilation of new ideas, teamwork, exploration of multiple solutions, or acknowledgement of failure as a reality that can be mitigated or surmounted

Exploratorium Learning Dimensions

Initiative & Intentionality	Social & Emotional Engagement	Creativity & Self-Expression	Conceptual Understanding	Problem Solving & Critical Thinking
• Setting one's own goal • Taking intellectual and creative risks; working without a blueprint • Complexifying over time • Persisting through and learning from failures • Adjusting goals based on physical feedback and evidence	• Building on or remixing the ideas and projects of others • Teaching and helping one another • Collaborating and working in teams • Recognizing and being recognized for accomplishments and contributions • Developing confidence • Expressing pride and ownership	• Responding aesthetically to materials and phenomena • Connecting projects to personal interests and experiences • Playfully exploring • Expressing joy and delight • Using materials in novel ways	• Controlling for variables as projects complexify • Constructing explanations • Using analogues and metaphors to explain • Leveraging properties of materials and phenomena to achieve design goals	• Troubleshooting through iterations • Moving from trial-and-error to fine tuning through increasingly focused inquiries • Developing work-arounds • Seeking ideas, assistance and expertise from others

The Exploratorium's Learning Dimensions of Making and Tinkering one-pager is freely available in a number of languages on their site.

DIMENSIONS OF LEARNING FOR MAKING AND TINKERING

Levels of Agency	Initiative & Intentionality	Social & Emotional Engagement	Creativity & Self Expression	Conceptual Understanding	Problem Solving & Critical Thinking
Responding Initial interactions and observations	Initial Engagement	Working Side by Side	Browsing Materials	Noticing the Phenomena	Making Initial Observations
	Active Participation	Building Together	Personalizing Projects	Asking Questions	Engaging in Trial-and-Error
Exploring Probing the problems, variables, and possible solutions	Expressing Intentionality	Modeling for Others	Playfully Exploring	Observing the Variables	Learning Through Failure
	Persisting in the Problem Space	Collaborating with Others	Striving to Create a Unique Solution	Seeking Explanations	Honing in On Key Variables
	Taking Intellectual and Creative Risks	Mentoring Others	Applying Aesthetic Solutions to Achieve Design Goals	Expressing Tentative Theories	Testing more Focused Solutions
Owning Taking intellectual risks, applying understanding, and contributing to the community	Shifting Project Goals	Co-Leading Group Activities	Recognizing the Creative Work of Others	Constructing Explanations	Applying Unique Solutions
	Planning a New Idea	Creating New Activities	Re-mixing and Re-building	Expressing Conceptual Understanding	Eager to Find a new Problem to Solve

Initiative & Intentionality:
Actively leading the learning pathway

Level of Agency	Actions / Intentions	Indicators
Responding Developing an initial idea	Active Participation	• making adjustments • seeking help • showing curiosity
	Initial Engagement	• identifying initial interest • participating in a step-by-step activity • copying an example
Exploring Complexifying over time	Taking Intellectual and Creative Risks	• trying a solution that may not work • pursuing ideas without checking with a "teacher" first
	Persisting in the Problem Space	• staying engaged when something doesn't work • valuing info from failed experiments • solving a problem and moving onto a new one
	Expressing Intentionality	• testing tentative ideas • sharing ideas and goals with others • setting one's own goal
Owning Pursuing new ideas	Planning a New Idea	• sketching or planning the next idea • pursuing project ideas between contexts (i.e. home, school, museum)
	Shifting Project Goals	• adjusting goals based on physical feedback and evidence • following pathways of personal interest

Social & Emotional Engagement:
Collaborating with and contributing to the community

Level of Agency	Actions / Intentions	Indicators
Responding Entering the community	Working Side-by-Side	• building alongside others • noticing what others are making • sharing space, tools, and materials
	Building Together	• working individually on a collaborative project • adding to a group construction • expressing pride and ownership
Exploring Interacting with the community	Modeling for Others	• being recognized for ideas • developing / displaying confidence • giving and receiving feedback
	Collaborating with Others	• physically and intellectually connecting with another project • working with someone on a shared vision • collaboratively working in teams
	Mentoring Others	• becoming a repeat participant • teaching and helping one another • applying understanding to someone else's project
Owning Becoming central to the community	Co-Leading Group Activities	• co-facilitating activities • recruiting others to participate • planning and preparing the activity setup
	Creating New Activities	• developing / leading new activities for others • making a space for new group experiences • documenting the experiences for other learners & educators

Creativity & Self Expression:
Responding aesthetically to materials and phenomena

Level of Agency	Actions / Intentions	Indicators
Responding Noticing aesthetic possibilities	Browsing Materials	• manipulating materials or mechanisms • finding familiar and unfamiliar materials • expressing joy and delight
	Personalizing Projects	• decorating or modifying an example • expressing personal narratives • connecting projects to personal interests and experiences
Exploring Exploring aesthetic affordances	Playfully Exploring	• responding aesthetically to materials and phenomena • project focus is inspired by materials • participating with enthusiasm
	Striving to Create a Unique Solution	• testing the unique qualities of materials • identifying related project problems in other people's work • using metaphor and analogy as design input
	Applying Aesthetic Solutions to Achieve Design Goals	• using materials in novel ways • prioritizing aesthetic choices • explaining purposeful design decisions
Owning Harnessing aesthetic applications	Recognizing the Creative Work of Others	• noticing the aesthetic choices of others • engaging in critical aesthetic dialogue • acknowledging relationships between different project outcomes
	Re-mixing and Re-building	• modifying one project into another • freely expanding the palette of materials • utilizing materials from other places

Conceptual Understanding:
Developing understanding over time

Level of Agency	Actions / Intentions	Indicators
Responding Identifying the concept(s)	Noticing the Phenomena	• observing and noticing • initial interactions
	Asking Questions	• noticing the unexpected • expressing confusion • striving to understand
Exploring Probing the concept(s)	Observing the Variables	• playing with key variables • keeping track of the results
	Seeking Explanations	• controlling for variables as projects complexify • testing new ideas for confirmation of understanding
	Expressing Tentative Theories	• testing a design solution • sharing an "aha" moment (articulating insights) • recognizing the limits of a current design
Owning Mastering the concept(s)	Constructing Explanations	• carrying out research online • creating models to further conceptual understanding • identifying related real-world ideas
	Expressing Conceptual Understanding	• applying solutions to new problems • using analogues and metaphors to explain • defending or arguing current understanding

Problem Solving & Critical Thinking:
Troubleshooting through iteration

Level of Agency	Actions / Intentions	Indicators
Responding Identifying a problem	Making Initial Observations	• noticing affordances of materials and phenomena • becoming intrigued by the phenomena
	Engaging in Trial-and-Error	• testing and observing • evaluating initial tests • trying something more than once
Exploring Iterating solutions to a problem	Learning Through Failure	• identifying areas of surprise • seeing similar problems in others' work • noticing what's not working
	Honing in on Key Variables	• troubleshooting through iterations • dissecting problem components • describing the problem to others
	Testing More Focused Solutions	• stepping back to reflect on the problem • identifying what NOT to focus on • seeking specific ideas/tools/materials to solve the problem
Owning Resolving a problem	Applying Unique Solutions	• materials used in unexpected ways • solutions are varied • developing work-arounds
	Finding a New Problem to Solve	• ability to finish one project, take something apart, and start again • eager to engage in the process again

Facilitator Reflection Form

Facilitator name: _____ Date: _____

Program Title: _____

Other Staff: _____

Attendance: Children _____ Caregivers _____

List the activities or stations you facilitated or supported today and approximately how many children and caregivers you engaged with at each.

_____

_____

_____

_____

While making or tinkering, children often engage in these learning dimensions:

- Initiative and intentionality
- Social and emotional engagement
- Problem solving and critical thinking
- Creativity and self-expression
- Conceptual understanding

Please describe examples you observed. Be as specific and descriptive as you can.

Dimension: _____ Description: _____

_____

_____

_____

Dimension: _____ Description: _____

_____

_____

_____

Dimension: _____ Description: _____

What is one thing that you felt worked well? Why?

What is one thing that you felt didn't work well? Why? What would you do differently next time?

Overall, how do you feel today's activities were received by the attendees? How do you know? Feel free to include any quotes from interactions/conversations/brief interviews.

Parent/Caregiver Interview Guide

Interviews are a great way to discover ideas and perspectives that you didn't already know, suspect, or consider. When conducting a discovery-oriented interview, your main goal is to create a welcoming conversational space for the interviewee(s) to share what they really think. The first step is always to establish trust and rapport. Consider recording the conversation (with permission) or taking detailed field notes. If you're recording the conversation, a transcription tool like Otter.ai can help save time when it comes to reviewing the interview.

This interview guide offers a starting point for formal, in-depth, systematic data collection for a specific group of participants. Quick response questions are usually the best place to start when pursuing a particular idea or topic. The digging deeper questions are useful when an interviewee demonstrates a particular interest in or experience with the topic. For easy reference, we have also pulled out the brief, quick response interview questions you might ask on the fly when the opportunity presents itself.

Brief Interview Questions

1. Which library program activities have you and your child participated in, both in the library and at home?
2. How has this program affected you personally (as a parent, teacher, facilitator, or otherwise)?
3. What is the main thing your child has learned from this program?
4. How would you summarize the value of this program for you and/or your child?

In-Depth Interview Questions

INTRODUCTION

- Thank you for participating! Your observations and opinions are invaluable.
- Our main purpose is to get the kind of rich detail that only a family member/caregiver can provide.
- I'm asking these questions on behalf or as a representative of [fill in the blank].
- The decision to participate is completely voluntary, and you can end the conversation at any time.
- Your responses will remain confidential. May I request permission to record?
- Do you have any questions or concerns?

QUESTIONS

Topic: Program Participation

Quick response: Which library program activities have you and your child participated in, both at home and in person?

Digging deeper:

- Why did you choose to participate in this program?
- What were the biggest factors in that decision?
- How new are these types of activities for you and your child?
- How regularly does your child do tinkering, making, or STEM type things on their own?
- In an average week, how much time would you estimate you and your child engage in making, tinkering, or STEM activities?

Topic: Parent/Caregiver Outcomes

Quick response: How has this program affected you personally (as a parent, teacher, facilitator, or otherwise)?

Digging deeper:

- What's one thing that you felt worked well and why? What's one thing you felt didn't work well and why?
- Do you feel more or less confident than before this program when helping your child with tinkering, making, or STEM activities and learning? What, if anything, changed?
- How often do you find yourself engaging in meaningful dialogue with your child about tinkering, making, or STEM activities? What are those conversations like? How has this program changed those conversations?
- What's your opinion about activities that are hard or about letting your child fail?

Topic: Parent/Caregiver Perceptions of Child Outcomes

Quick response: What is the main thing your child has learned from this program? (Make sure to have this graphic of the Exploratorium's Learning Dimensions printed and ready to show, if needed.)

Digging deeper:

- [Levels of Agency] Overall, would you describe your child's engagement more as "responding" (initial interactions and observations), "exploring" (probing the problems, variables, and possible solutions) , or "owning" (taking intellectual risks, applying understanding, and contributing to the community) in their making/tinkering?
- [Learning Dimensions] Which, if any, of the learning dimensions in the graphic (initiative & intentionality, social & emotional engagement, creativity & self-expression, conceptual understanding, problem solving & critical thinking) did you see examples of in your child's making and tinkering?

Topic: Parent/Caregiver Perceptions about the Program and the Library

Quick response: How would you summarize the value of this program for you and/or your child?

Digging deeper:

- How critical was the library program for instigating tinkering, making, or STEM activities/learning?
- What would be missed if the program were not available?
- Where do you intend to look for STEM activities for your child in the future?
- How could the program be improved?
- What have you or would you share with other families/caregivers about the program?
- What would cause you to participate again or not?
- If applicable, please compare the online versus in-person at the library versions of the program. Which do you prefer? Why?

Final Questions: Is there anything else you would like to share? What have we missed?

Note: Despite how inconsequential this final question might seem, it often generates the most useful data if you just give interviewees a lighthearted second or two to reflect.

Thank you!