

# How to Design Successful Hands-on Activities for At-home Learners

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Children's Creativity Museum  
Children's Science Center Lab  
Discovery Museum  
Explora  
Marbles Kids Museum

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howtosmile.



This project was made possible in part  
by the Institute of Museum and Library  
Services #CAGML-246996-OMLS-20.

InterActivity 2022, St. Louis



### Ready to respond

- ★ **Largest and oldest** online collection of hands-on STEM activities
- ★ **Established resource** for educators (museum, K12, homeschoolers) looking for free digital materials

# Project Overview

- IMLS CARES Act Grants for Museums and Libraries
- **Update, refresh, and retool existing digital infrastructure** to meet the growing needs of informal educators offering at-home STEM educational programming during the COVID-19 pandemic.
- Intended Audience
  - **Caregivers and learners at-home**
  - **Informal educators reaching at-home audiences**
- New at-home activities collection, at-home framework, and museum cohort.



This project was made possible in part by the Institute of Museum and Library Services #CAGML-246996-OMLS-20.



# Members of the nationwide Howtosmile At-Home Activities Team

**\*Children's Creativity Museum, San Francisco, CA**

**\*Lawrence Hall of Science, Berkeley, CA**

**Boston Children's Museum, Boston, MA**

**Carnegie Science Center, Pittsburgh, PA**

**Center of Science and Industry (COSI), Columbus, OH**

**Children's Science Center Lab, Fairfax, VA**

**Discovery Museum, Acton, MA**

**Explora, Albuquerque, NM**

**Exploration Place, Wichita, KS**

**Florida Museum of Natural History, Gainesville, FL**

**Marbles Kids Museum, Raleigh, NC**

**Museum of Life and Science, Durham, NC**

**Sciencenter, Ithaca, NY**

**Paulmichael Maxfield & Cassie Byrd - Advisors**

**Conducted 4 full team meetings and asynchronously  
reviewed frameworks, exemplars, and cataloging plans.**



# What did we do?

1. **Reviewed and commented** on a draft at-home activities framework after discussing **exemplar activities** and each museums' experiences.
2. Filled out a **Cataloging Plan** for each museum showing how activities fit the evolving framework along with revisions to make them **more at-home ready**.
3. **Worked in cohorts** to review each other's Cataloging Plans and finalize additions to the new **At-Home Activities Collection**.
4. Finalized the new **At-Home Activities Framework** and cataloged additions into the collection.

<p><b>The activity has an exceptionally effective and easy-to-use guide.</b></p>	<p><b>BCM (Alissa and Michelle):</b> <i>1 to picture!</i></p>	<p><b>Kevin D:</b> <i>1 for pictures and videos</i></p>	<p><b>EP (Victoria and Erica):</b> <i>Simple is best. 1+ for picture instructions.</i></p>
<p>Add a clear introductory question and/or description, complete materials list, and accessible background information to support STEM content.</p>	<p><b>Garrison L:</b> Pictures are <b>HUGE</b>. It's a great way to introduce the activity, but when the kid's are reading, the pictures may have difficulty with the language.</p>	<p><b>Kevin D:</b> <i>driving, the materials lists sections makes it easier for the students to go back to the middle of the page.</i></p>	<p><b>Christine (DCD):</b> Having photos and videos instead of relying on written instructions, the activity may be more successful. <i>Using a video for the activity is 6 steps or 10 minutes. A photo can be helpful for the activity.</i></p>
<p>Label basic activity characteristics such as target age range and time required.</p>	<p>Include step-by-step instructions with pictures. Learners should not have to read between the lines for challenge steps.</p>	<p><b>BCM (Alissa and Michelle):</b> <i>Sections to provide a materials list, a recommendation, and directions, materials needed with alternative materials, and a photo.</i></p> <p><b>Erica (EP):</b> <i>For grown-ups, this is the video if any.</i></p>	<p><b>BCM (Alissa and Michelle):</b> <i>If making a poster, make sure the text is large and contrast as you name the activity. If using multiple languages, make sure to include subtitles, talking about what you are doing as you are.</i></p>
<p>Divide into clearly labeled sections so information is easy to find.</p>	<p>Consider adding a video walkthrough of activity, a photo of all necessary materials, and suggested extension activities.</p>	<p><b>Marci H:</b> <i>Make sure each section is easy to read, easy to understand, and easy to follow. People who are able to read may not be able to do the activity. (Kind 1 to 3rd grade, no photo pictures)</i></p>	<p><b>Florida Museum Team:</b> <i>1 to pictures and videos, including background, materials, and what supervision or parental involvement is needed or not.</i></p>
<p>Reyna H - adding a picture of materials can be more than a "consider"</p>	<p><b>Tara H - or a drawing if a picture can't possible</b></p>	<p><b>Kevin D:</b> <i>numbing or bullet pointing, which makes it easier for the students to go back to a long block of text.</i></p>	<p><b>Bindrahi M:</b> <i>I'm hesitant about including a time requirement for an activity. I think it's better to include a suggested activity and let students exploring for as long as they'd like.</i></p> <p><b>Kevin D:</b> <i>1 to picture, especially restricting time range.</i></p> <p><b>Erica (EP):</b> <i>1 to picture, especially restricting</i></p>

Cataloguing Plan: YOUR MUSEUM NAME HERE

1. Add **FIVE** activities that you will contribute to the At-Home collection. *The goal will be to reach 20 activities from each museum by the end of the project. Please provide a link to the web or a sharing service (e.g. google drive, dropbox, etc).*

[Here you could add a current collection at your museum (either online or in digital format), activities that are ready to be digitized. In order to assist in the peer review of your plan please include links to websites/files, or detailed descriptions in your cataloging plan.]

Activity title & short description	Link

# SCIENCE MUSEUM GROUP

Find a way to make your smartphone speakers louder – no batteries required!

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**You will need...**

**Photo of materials is better than simply a list of materials**

**Low cost materials with a common object (cell phone)**

**Scores**

Plastic cups  
A ruler  
A small cardboard box  
Scissors  
Plastic tape  
A plastic bottle  
A kitchen towel or paper napkin  
A score sheet

**Top tip:** If you have another phone, install a sound level meter app (the free ones are available) and use it to measure how loud the sound is. If you can't do that, then listen to the sound and compare it with the sound of the phone on its own.

**Reflection questions and discussion extensions:** builds confidence in learning, problem exploration & discovery

**Think and talk about...**

- Which items made the best sound booster?
- What do you think the sound would work as well?
- Why do you think the sound is louder when you use the booster?

**Investigate...**

- Experiment with different shapes
- What happens if you create a booster made from a different material?
- Can you design a muffler for the sound produced by a speaker?



# At-Home Activities Framework

A guide for tailoring hands-on activities for at-home learners and caregivers.



**The activity has an exceptionally effective and easy-to-use guide**

Add a short introductory question and/or description, complete materials list, safety notices, and STEM background information, in plain language.

Label basic activity characteristics such as target age range and time required.

Include specific step-by-step instructions with pictures. Learners and caregivers should not have to read between the lines when using instructions.

Divide into clearly labeled sections so information is easy to find.

Consider adding a video walk-through of activity and photos of all necessary materials.

Consider an ending section for extension activities or suggestions on how to age-up or age-down the activity when appropriate.

Consider adaptations to make the activity guide accessible to as many learners and caregivers as possible (e.g., larger font sizes, high-contrast colors, instructions with minimal wording, multiple languages).



**The activity uses common, low-cost household materials**

Use common items found around the home or recycled materials.

Do not require expensive materials or those that can't be sourced locally.

Consider including a list of alternative items that can be used if learners do not have access to the listed materials.

Avoid food waste if possible.



**The activity encourages caregivers and learners to work together in a meaningful way**

Include prompts on how the caregiver can interact with the activity and work together with their learner.

Add simple questions for caregivers to ask learners when appropriate.

Consider relevance and creativity as entry points for caregiver participation.



**The activity is related to the everyday lives of learners**

Include ties to observable scientific phenomena (e.g., shadows, ripples in water, vibrations, sounds from musical instruments) or daily activities (e.g., playing, riding in a car or bus, eating, learning) that are accessible to the target age range.

Use connections that motivate children (e.g., animals, favorite characters, food, sensory items, games).

Consider using a story or storybook to frame the activity.

Within activity steps and outcomes, create opportunities for learners to practice patience, sharing, working together, and helping others.



**The activity engages the learner's senses**

Include sensory elements such as vibrant colors, rich sounds, interesting textures, fragrant smells, and tasty treats.

Consider adding information about loud noises, flashing lights, and other potentially extreme stimuli for learners with sensitivities.

Consider adaptations for learners with sensory disabilities.



**The activity lets learners practice and express their creativity**

Include steps or recommendations for learners to express themselves and add their own ideas.

Include open-ended questions that encourage learners to try multiple solutions.

Consider adding creative pathways for learners and caregivers to repeat or grow the activity.



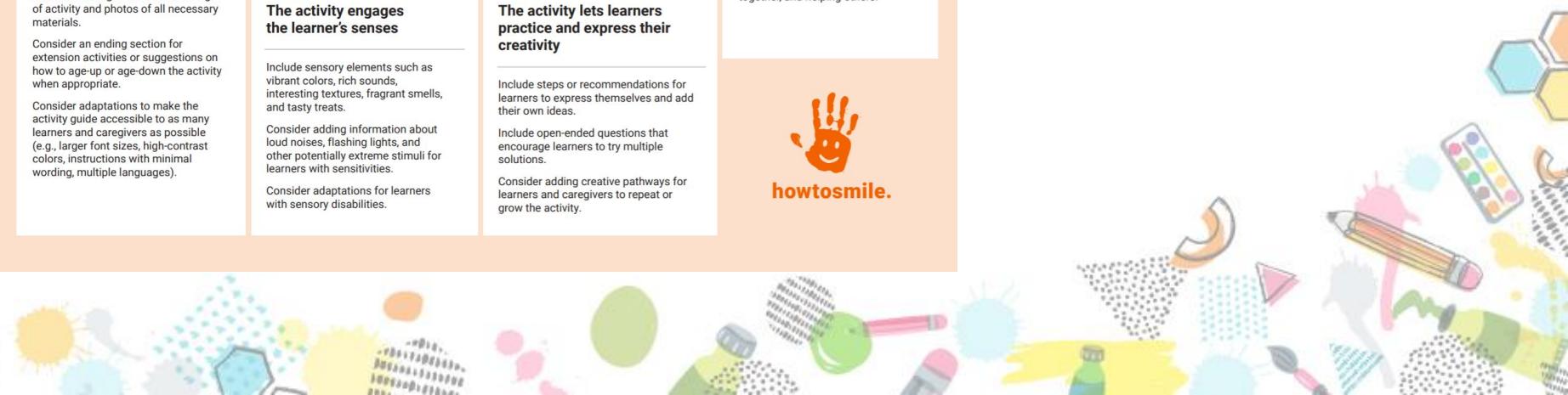
**howtosmile.**

# New Framework

Now posted!

Sources and extensions on the Pg2.

[howtosmile.org/topics/athome](http://howtosmile.org/topics/athome)



# A good at-home activity...

...has an exceptionally effective and easy-to-use guide

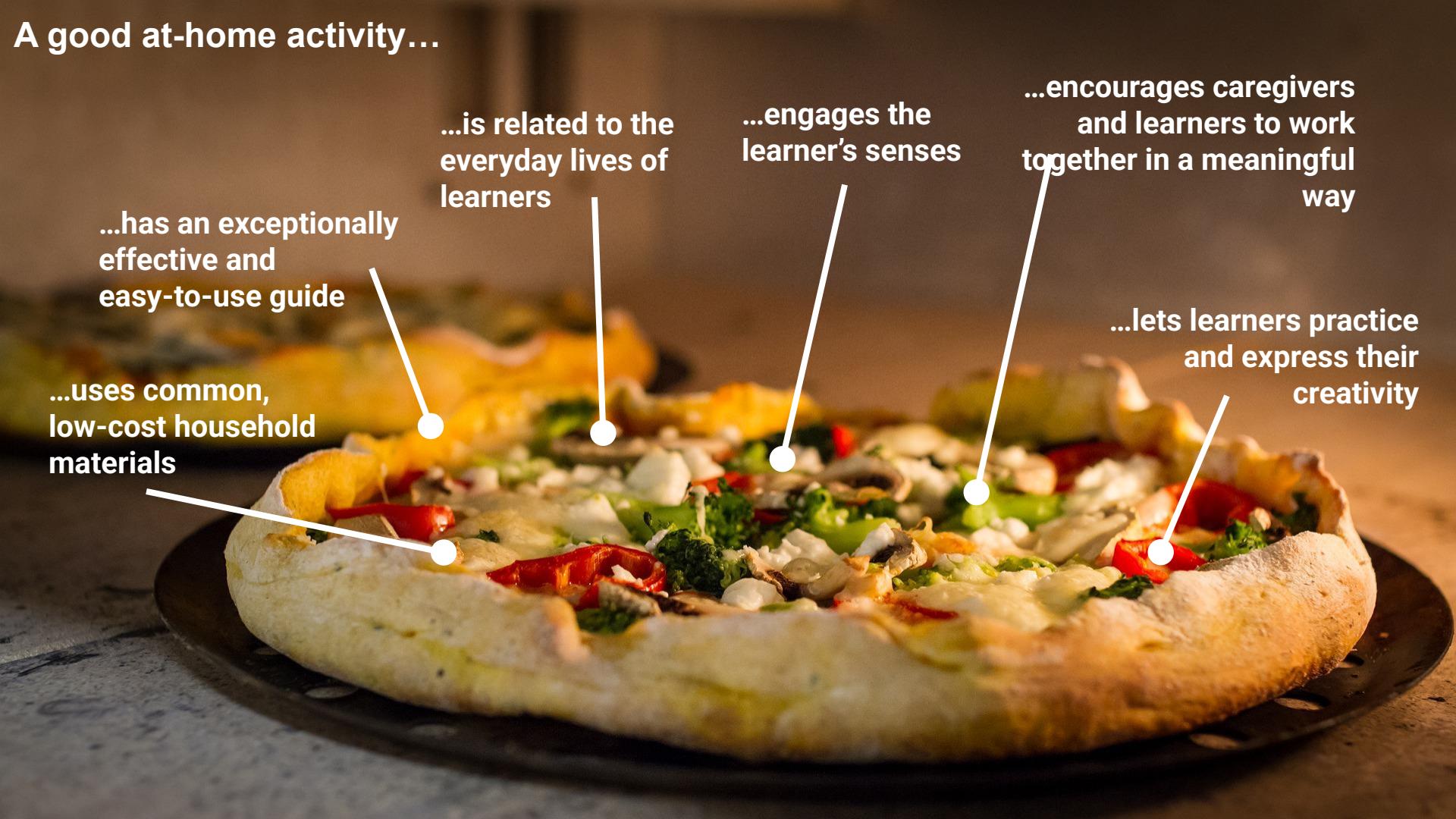
...uses common, low-cost household materials

...is related to the everyday lives of learners

...engages the learner's senses

...encourages caregivers and learners to work together in a meaningful way

...lets learners practice and express their creativity



What did we  
do with our  
new and  
very tasty  
framework?



SCIENCE  
MUSEUM  
GROUP

Find a way to make your smartphone speakers louder – no batteries required!

## You will need...



**Top tip:** If you have another phone, install a sound level meter app (free ones are available) and use it to measure how loud the sound is. If you can't do that, then listen to the sound and compare it with the sound of the phone on its own.

## Think and talk about...

- Which items make the best sound boosters? Why is that? And which ones don't work as well?
- Why do you think the sound is different when you use the boosters?
- Where have you noticed sound being amplified or muffled in your own life?

## Investigate...

- Experiment with different shapes and materials.
- What happens if you create a booster made of two materials (eg paper and glass)?
- Can you design a muffler for the sound – something that will dampen the sound instead of amplifying it?

## Follow these steps...



- 1 Start playing a song on your phone. Listen and note down how loud it sounds. Put your phone into the different cups and bowls and listen how the sound changes.
- 2 Try making a horn out of paper and attach it over the speaker of your phone. Does this boost the sound?



**3** If you have a card box or tube, cut a hole for your phone to fit inside it. Does it make a good tune booster?

**4** Try combining different objects and materials to make something a bit more complex.

## Science in your world



Loudspeakers are built into wooden or plastic cabinets that are carefully designed to make the sound louder and to make sure most of it comes out of the front of the cabinet, so less sound is lost at the back.



Consider adding a video walk-through of activity and photos of all necessary materials

**Include specific  
step-by-step instructions  
with pictures**

Include prompts on how the caregiver can interact with the activity and work together with their learner.

Include ties to observable scientific phenomena or daily activities that are accessible to the target age range

## Balancing Sculptures

Use materials from around your home and in the recycle bin, along with your own problem-solving skills and persistence, to create a sculpture that balances from a single point.

**Recommended Age:** 6+ years old



**Time needed:** 15+ minutes

**Link to the Video:**

[https://www.youtube.com/watch?v=\\_oklOkLxevk](https://www.youtube.com/watch?v=_oklOkLxevk)



### What You Need

- A chopstick, dowel, stick, or similar object; and a way to make it stand up
- String
- Scissors
- Tape
- Glue
- Assorted materials like: cardboard, corks, toilet paper or paper towel tubes, paper clips, yarn, toothpicks, paper, stuff from the recycle bin, toys like LEGO or TinkerToys
- Optional: A friend or two

### What You Do

- Figure out a way to make your chopstick stand up
  - Drill a hole in a block of wood and glue it in
  - Stand it up in a container of playdough or clay
  - Stand it up between 2 books or boxes, or inside a cup, and tape it in place
  - What else can you try?
- Now it's time to play around. Test a few objects to see if they balance on the end of your stick. What can you do to make them balance? Think about other structures you have seen that involve balancing—look at some photos and the video. How do YOU balance?
- Keep trying! Sometimes your sculpture will fall over, but that's OK. Try a few things and if you are working with a friend, bounce ideas off each other. Keep trying different techniques and materials until you've got a balancing sculpture you're happy with.



### Tips for Adults

- If you are the friend that is helping your child, be sure to let your child take the lead. You may see your child trying something that you know won't work, but just let it happen. Your child is learning!

- This activity can be frustrating. Model persistence and remember this is supposed to be fun! Laugh when things fall over, and encourage their next idea.
- To make this activity more simple, encourage your child to start by balancing two objects. To make it more challenging, encourage them to add more parts.
- As your child is working, ask them questions about their design, such as:
  - What is working well?
  - What isn't working? Why do you think it's not working?
  - Tell me about your design. What materials did you use? How did you put them together?



### Learning and Skills Connection

- **Persistence:** Focusing, sticking to it, learning from mistakes
- **Experimenting:** Making and testing predictions, trying multiple solutions
- **Working flexibly:** Incorporating and revising ideas based on new information, employing objectivity and acknowledging subjectivity
- **Collaboration:** Respecting, drawing from, and building on the ideas of others, working within a team



### What's Going On?

Balance means there is an equal distribution of weight. An object is balanced when it is stationary (not moving), and that happens when forces are equal on all sides. Imagine you are standing still. You are balanced. Now stand on one foot. What happens? You probably put your arms out to the side without thinking about it. Doing that shifts things around so that the forces pushing on your body are equal, and you can be still again.



### Doing STEAM with Kids

STEAM stands for Science, Technology, Engineering, Art, and Math. There are lots of ways you can explore these letters, apart or together. Ask your child to make predictions, describe what they see, and to imagine possibilities and solutions. Don't worry so much about the "right" answer. Developing curiosity, and problem-solving skills are important first steps to doing STEAM!



308 Congress Street | Boston, MA | 617.426.6500 | [BostonChildrensMuseum.org](http://BostonChildrensMuseum.org)



**The activity encourages caregivers and learners to work together in a meaningful way**



**Include specific step-by-step instructions with pictures**



**Label basic activity characteristics such as target age range and time required.**



**Add a short introductory question and/or description...STEM background information, in plain language.**

## DIY Bath Bombs

Recommended Ages: 4-12

Bath bombs come in all shapes, colors, and sizes, depending on their ingredients and molds, which make them great for trying at home. Ingredients can range from bath salts, fragrances, colors, glitter, and more!

### Materials:

- Bowl
- Spoon
- Silicon Mold
- Water
- 1 Teaspoon
- 1 Tablespoon
- 1 Tbsp Citric Acid
- 2 Tbsp Cornstarch
- 1 Tbsp Epsom Salt
- 1 Tbsp Baking Soda

### Optional Materials:

- Food Coloring
- Essential Oil/Scent
- Oil (olive, vegetable, coconut, etc.)



### Procedure:

1. Mix all of the dry ingredients into the bowl with the spoon.



2. If using any other liquid ingredients such as oil, essential oils, or food coloring, mix them with the water now.



3. Using your teaspoon, measure 1 teaspoon of water. Pour all of the water from your teaspoon onto one spot of your dry mixture. What is happening?



4. After observing, quickly use your spoon to press down on the wet spot in your dry mixture to stop the reaction. *Do not mix the wet spot with the rest of your ingredients until after the reaction is complete! You'll know the reaction has finished when the bubbling stops.*



5. Use your hands to make sure everything's combined. The mix should still feel pretty powdery, but hold together a little bit when you squeeze or pinch it.

children's science center Confidential and Proprietary Information

 **LAB**

## DIY Bath Bombs

Recommended Ages: 4-12

6. Fill your silicon mold with your bath bomb mixture and pack it in tightly. Leave this to dry overnight, or until hardened (you can also place it in the fridge to harden faster).

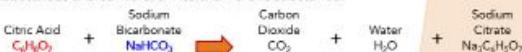


7. Test it out! Carefully pop your bath bomb out of the silicon mold. See if you can get your bath bomb out in one piece. If not, that's okay! Use all of the pieces in your bath to see how it fizzes and bubbles.

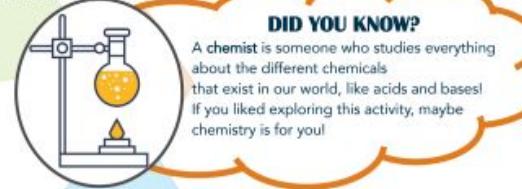


### What happened?

When you added the bath bomb to water? Baking soda and citric acid are responsible for the fun fizzing in your bath, as a result of the chemical reaction that happens. A chemical reaction is a process in which one or more substances are converted into a different substance.



This is an **acid-base reaction**. You may have tried mixing together baking soda and vinegar, to explosive results! When a weak base, in this case baking soda (sodium bicarbonate ( $\text{NaHCO}_3$ )) meets a weak acid, a gas is produced to make bubbles! For bath bombs, instead of using vinegar as the weak acid – because no one wants their bath to smell like vinegar – we use citric acid ( $\text{C}_6\text{H}_8\text{O}_7$ ). The gas that is produced is carbon dioxide, the same gas you exhale when you breathe out. When that gas is released in the bath, it pushes up through the water to create fizzing bubbles!



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 **LAB**

**Include step-by-step instructions with pictures. Learners should not have to read between the lines for challenge steps.**



**Use common items found around the home or recycled materials.**

**Do not require expensive materials or materials that can't be found locally.**



**Include sensory elements such as vibrant colors, rich sounds, interesting textures, and tasty treats.**



**Add a clear introductory question and/or description, complete materials list, and accessible background information to support STEM content.**



## Make a Masterpiece

### Rolling Action Art

See this activity on our YouTube channel.

This unusual "action" technique of painting with marbles or balls combines physics, art, and your own movement. It offers the perfect combination of creativity, experimentation, and observation for young children.

#### Suggested Materials:

- Pie tin, shallow box or box lid, or any container with a lip
- Marbles or balls
- Tempera paints
- Bowls and spoons
- Paper
- Tape



#### What you do:

- Tape a piece of paper onto a pie tin or box top
- Pour a small amount of tempera paint into a bowl
- Drop marbles or balls into the bowl and roll them around covering them with paint
- Next, drop the paint-covered marbles and balls onto the paper
- Roll them around and create unique designs



**Tip:** This "action" painting can be a full-body experience! Encourage children to make their painting by moving the pie tin rather than picking up the balls. Let the child's movements, and the marbles and balls, do the work to create their masterpiece.



#### Things to Try:

- Experiment by dripping paint onto your tray first, then adding the marbles. Do the unpainted marbles give a different effect?
- Create a larger work of art by using a kiddie pool and a variety of balls of different sizes and textures.



#### Things to Think About:

- What's happening in your container?
- How do the marbles/balls move when you tilt the container?
- Can you move the marbles/balls slowly? In a circle? All the way across the container?
- What's happening to the colors when you dip the marbles in several different paint colors?

Find more at-home activities at <http://discoveryacton.org/discovery-home>.

978-264-4200 • 177 Main Street (Route 27) • Acton, MA 01720 • [discoveryacton.org](http://discoveryacton.org)

YouTube Search

Hi there. It's Natasha from Discovery Museum. Today I'm going to be painting with marbles. This

Paint with Marbles

181 views • Feb 9, 2021

1 DISLIKE SHARE ...



Include sensory elements such as vibrant colors, textures, sounds



Provide suggested questions for caregivers to ask learners.



Add creative pathways for learner to repeat activity



Add a video walkthrough of activity



### Squishy Soil



What makes up the soil?

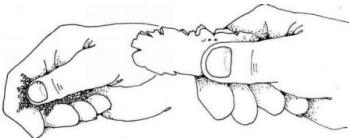
**What makes up the soil under our feet?** Soil contains living and dead organisms, plant material, water, air, and minerals.

**The sediments in soil can be grouped by texture, and most soils have a combination of all three.**

- **Sand** is the largest of the three sediments. Sand feels gritty when you rub it between your fingers.
- **Silt** is much smaller in size. When dry, silt feels similar to flour in texture.
- **Clay** is very fine. When wet, clay is sticky.



The amounts of sand, silt, and clay in your soil affect how much water and air the soil can hold and how well it can support plants and animals.



### Soil Test - Ribbon Technique



**What you'll need:**

- Dirt/soil
- Water

**Here's what to do:**

1. Hold a small handful of soil.
2. Add enough water to the soil to make a ball. If you can't make a ball, the soil is very sandy. How can you shape it?
3. Feel the ball with your fingers. What is the texture like? Is it gritty (sand), silky (silt), or plastic/sticky (clay)?
4. Roll the dirt into a ball again. With your thumb, gently press it out over your forefinger to make a hanging ribbon.
5. If you can make a short ribbon, your soil texture is more loamy, a mixture of sand and clay.
6. The longer the ribbon, the more clay is in your soil. Try this technique again with the same soil or with a different soil sample. What do you notice?



**Explore further:**

Find a local farmer and ask what they do to test their soil! What combination of sand, silt, and clay is best for planting their crops?



**Related to everyday  
lives of learners**



**Common, low-cost  
household materials**



**Creative pathways to  
grow the activity**



**Multiple languages**

# POLLINATOR PLAY



Build a bee hotel and fill it with friendly bees. Take a buzz around outside and pretend to pollinate.

## What You Need:

- Cardboard box
- Colorful tape or paint
- Cardboard tubes
- Yellow, black, and white pipe cleaners

## What You Do:

1. Decorate the cardboard box using colorful tape or paint. The box will be the exterior of your bee hotel.
2. Fill the box with cardboard tubes.
3. Make a few pretend bees. Twist together one yellow and one black pipe cleaner. Wrap them around your finger to create the bee body.
4. Cut one white pipe cleaner in half. Thread it through the bee body and shape it into wings.
5. Play around with your bees. Have them fly back and forth between the bee hotel and flowers or plants in your yard or garden.
6. When you're done pretending, set your bee hotel up outdoors to attract pollinators.

**Did You Know?** Many species of bees are solitary. They live alone and not in hives. They don't have a queen and don't produce honey. Solitary bees lay their eggs in small holes. You'll know that solitary bees are using your bee hotel if they cover the opening to a tube with mud.

## Words to Use:

- Pollinator: Insects or other creatures that transfer pollen to flowers or plants so that they produce seeds.
- Solitary: Single or alone.
- Pollen: A fine powder produced by flowers, which is carried by the wind or by insects to other flowers of the same type, making them produce seeds.

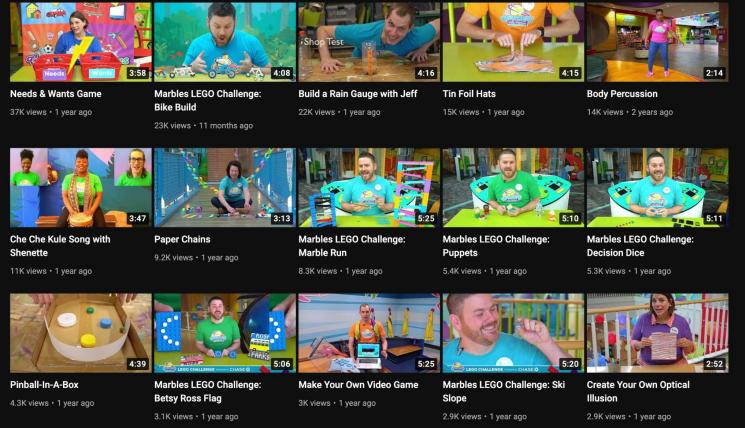
## Change It Up:

- Add additional plant material to your bee hotel. Fill the area not occupied by the tubes with sticks, pine needles, or leaves.
- Build a more permanent bee hotel. Find out how here: <https://www.nationalgeographic.org/media/build-your-own-bee-hotel/>





Marbles Kids Museum  
1.39K subscribers



Needs & Wants Game  
37K views • 1 year ago

Marbles LEGO Challenge: Bike Build  
23K views • 11 months ago

Build a Rain Gauge with Jeff  
22K views • 1 year ago

Tim Foil Hats  
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Marbles LEGO Challenge: Marble Run  
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Pinball-In-A-Box  
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Marbles LEGO Challenge: Betsy Ross Flag  
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Make Your Own Video Game  
3K views • 1 year ago

Marbles LEGO Challenge: Ski Slope  
2.9K views • 1 year ago

Create Your Own Optical Illusion  
2.9K views • 1 year ago



Consider different entry points to this exhibit and set play scenarios at each.



Include specific step-by-step instructions with pictures



Creative pathways to grow the activity



Add a video walkthrough of activity

# Let's break into groups...

1. **Reflect on the framework** with session leaders
2. **Identify some components** that could be added to your current activities or new activities you could create.
3. **Discuss methods and choices** with the group (e.g. how to make a how-to video, take photos, or add language about caregivers, etc)
4. Add notes to your **At-Home Worksheet**





## New Collection

(over 300 activities added to howtosmile)

[howtosmile.org/topics/athome](https://howtosmile.org/topics/athome)

We want to know about your activities!



# Project Survey Results, Final Thoughts

## *Extent to which participants found value in Howtosmile project activities*

- Reviewing and identifying your organization's activities for the at-home collection
- Filling out your organization's cataloging plan
- Revising activities

## *Extent to which participants thought project activities were important to overall professional growth*

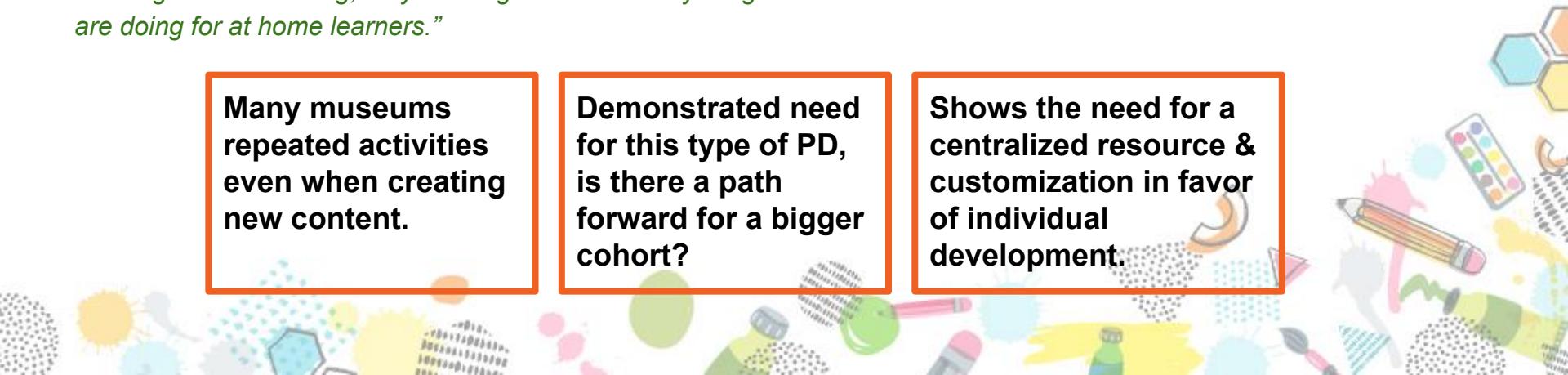
- Identifying and discussing the needs of at-home learners
- Learning about essential components of hands-on STEM activity guides

*“Great project! Collaborating with other institutions was an excellent experience and the meetings were amazing, very well organized and very insightful of what other institutions are doing for at home learners.”*

**Many museums repeated activities even when creating new content.**

**Demonstrated need for this type of PD, is there a path forward for a bigger cohort?**

**Shows the need for a centralized resource & customization in favor of individual development.**



# Thank You!



This project was made possible in part by the Institute of Museum and Library Services  
#CAGML-246996-OMLS-20.



**The  
Lawrence**

