Infant and Toddler Explorers: Building STEAM Skills from the Start

Sarah Lytle: Good afternoon, everyone and welcome to BabyTalks. We're so pleased to have you join us today. BabyTalks is a series of webinars for teachers, providers, and home visitors working with infants and toddlers, serving Early Head Start, Head Start, and child care programs. These webinars will introduce you to some of the research behind the Head Start Early Learning Outcomes Framework, or the ELOF.

I'm Sarah Lytle from the National Center on Early Childhood Development, Teaching, and Learning. My colleagues and I are from ILABS, the Institute for Learning and Brain Sciences. And we will be presenting these webinars. ILABS is a partner organization in the NCECDTL Consortium. And we're one of the leading infant research centers in the country. Before we begin, I'd like to go over some information about the webinar. We will be using some of the Adobe Connect features to help us interact.

At times, as is the case with the lobby question you've already responded to, we'll ask you to type into the chat box located to the left of the PowerPoint slides in response to specific questions. If at any time during the webinar, you have questions related to the presentation or other topics, you can also type your questions there. We'll be monitoring that box throughout the webinar.

Supporting documents for this webinar, including a PDF of the presentation, can be found in the Supporting Documents Box on the bottom, left-hand side of your screen. If for any reason you get disconnected from the webinar, you can use the same link that you used previously to rejoin the webinar. We want to let you know that the session will be recorded today, and it will be posted on the ECLKC website.

Finally, following the webinar, you will see a link to an evaluation form. We request that you complete the evaluation as we will use this information for improving our webinar presentations and also for planning for future webinars. Upon completion of the evaluation, you can download a certificate of completion for your participation in today's webinar. If you're viewing the webinar with colleagues on one computer and only one person is registered for the webinar, please forward the link to your colleagues who also viewed the webinar, so that they can complete the evaluation, and they can receive their own certificates of completion. So with that, I will turn the presentation over to Beth Zack, who's gonna take us through infant and toddler explorers.

Beth Zack: Hi everyone. My name is Beth. Thank you for joining us today. Today, we're going to be talking about infants and toddlers as little explorers and scientists trying to make sense of the world. We'll also talk about the ways we can support them in building STEAM skills. So what is STEAM? Just want to take a moment and look back at some of the chat box responses from the lobby question. For those of you who missed it, it was think of a STEAM skill that you used this morning.

So there are a lot of great responses in there of some examples of doing STEAM with children, such as experimenting with what sinks or floats, building with sticks and Play-Doh, planning

activities with shadows and magnets, gardening, listening to music, and even some great examples of some things adults do with STEAM, too, such as boiling your water to make coffee in a French press or planning a schedule. Now let's jump right in. STEAM is a way of thinking that involves observing, questioning, testing ideas, and creating. Science includes the use of inquiry skills, such as observing, asking questions, exploring, making predictions, and analyzing information to understand how the world works, so maybe characteristics of living objects, or non-living objects and earth materials.

Technology refers to any type of man-made object, not just cell phones and computers. It's using tools such as pulleys, wheels, levers, a magnifying glass, and creating and problem solving. Engineering is using materials, designing, crafting, and building structures and products. It helps us understand how and why things work. The arts refers to activities that require creativity and imagination, such as drawing, painting, music, and pretend play. Math is number and operations: counting, sorting, measuring, using patterns, understanding geometry, making comparisons, and spatial sense.

Because STEAM topics encompass a large group of skills, they make up a large portion of the Early Learning Outcomes Framework, or ELOF across multiple domains, the largest being cognition. STEAM skills are also found in the approaches to learning, social and emotional development, and language and literacy domains. As you listen today, we invite you to think about the connection between young children's exploration and the knowledge, skills, and concepts described in the ELOF. Today, we're going to spend some time talking about the STEAM-related abilities young children already have at an early age, and what we can do to support them as they build these STEAM skills.

After this webinar, you will be able to identify ways infants and toddlers naturally engage in inquiry, reasoning, and problem solving, understand how STEAM is for everyone, and children use it every day. Explain at least three ways to support children's STEAM skills and thinking. In this webinar, we will cover what STEAM learning looks like in infants and toddlers, and how to support children's natural inclination to be explorers and scientists. Today, we will talk about STEAM and the inquiry cycle. We'll also discuss some of the research on young children's early STEAM abilities, and how those skills are connected to the ELOF.

Also, learn about and have you share strategies with your colleagues that you use in your work to support children's STEAM skills and thinking. So let's say that you have a lamp that you go to turn on and nothing happens. The light doesn't turn on when you flip the switch. What do you do next? So I'd like you to take a moment and think of some possible reasons why the light isn't turning on, and type your response in the chat box.

Sarah: Lots of serious responses here. Lots of people saying it might not be plugged in, the light bulb might be burned out, bad connection, wiring issues, using the wrong switch. So lots of people kind of uniting on these themes here.

Beth: Yes, fantastic, and I also saw a new one I hadn't seen before, which was not having paid your bill, which is also an excellent possibility. Great. Fantastic everyone. So ... I want to start

with this activity because this is a scientific method, or inquiry cycle. You naturally use this cycle or process of inquiry to think through a problem.

So first, we observe, notice, or question something about the world. In this example, my lamp isn't working. This led to our question: why doesn't my lamp work? Next, we made a prediction, or hypothesis, about what we think will happen, or what the reason was. A hypothesis is simply your best guess for saying, I predict that X will happen right before doing Y. Remember, it doesn't matter if your hypothesis ends up being right or wrong. Then you do various investigations, or explorations, based on your hypotheses.

So you might check to see if the bulb is loose. Maybe, you check to see if you paid the bill. If the bulb is not loose, maybe it's burnt out, or you tried plugging it into a different outlet to see if something else is valid, to see if the outlet is working. Finally, reflect or think about how your findings relate to your prediction. So, you may say, "Hmm, these bulbs keep breaking. I wonder if I should try a new brand," or "I guess this one random plug in my house just doesn't work. I wonder why."

Reflection on your findings often lead to more questions. For example, why doesn't that plug work? All the others work just fine. Hence, the cycle of inquiry. But even though we call it an inquiry cycle, the real application of the scientific method is not so linear. We move back and forth through the steps, because we might notice something new, or realize we have a different question after exploring further.

So in the lamp example, the question, "Why is the lamp not working?" was key not just exploration of a random lamp, although exploration was essential in us coming up with the question. Just as we were working like scientists to discover why our lamp isn't working, young children are working as little scientists to explore the world around them. The lamp experiment shows that you don't have to be a scientist doing work in a laboratory, or even feel like your good at science and math, to use the scientific method. It's really the things you do every day.

The inquiry process is at the heart of not only STEM, but STEAM. You use the scientific method naturally, and so do children. Inquiry builds critical thinking skills that support problem solving and independent learning throughout life. You might be wondering, why the change from STEM to STEAM? Well, art is creativity and imagination. Children engage in painting, pretend play, music, drawing, and crafts. And art was added for a reason. A creative mindset is critical for STEM subjects. Scientists, technology developers, engineers, and mathematicians need to innovate and solve problems creatively.

Importantly, the STEAM fields all use inquiry as a useful thinking tool to reason out problems. Inquiry-based learning is an approach based on curiosity, exploring, asking questions, and making observations, just to name a few. This is a picture from the Cherokee Nation Early Childhood Unit in Oklahoma. In this picture, a toddler is making art with feathers after learning about the importance of feathers to tribal communities. What STEAM skills is she using? Quite a lot, actually. For example, she's learning about the property of an object. The feather feels soft to the touch and is lightweight, and glue is sticky and can be used to connect objects together. The feather won't stick to the paper without the glue.

Although she's now yet able to verbally ask questions, or use the inquiry cycle in the same way an older child or an adult might, she's still making observations and predictions, exploring her world, and using STEAM skills. For research and cognitive science, we know that young children have a sense of wonder and natural curiosity about their world. Each of the STEAM fields share this common mindset, including curiosity, creativity, and critical reflection. From infancy, young children also have core scientific abilities. They explore the physical characteristics of objects, as well as cause and effect. For example, an infant will use his mouth and hands to better understand the objects around him. And an older infant or toddler may repeatedly drop his cup from a high chair to see what happens, experimenting with gravity.

Children begin developing everyday science skills and concepts from birth. In many ways, scientists and children share the same job. They're both trying to figure out, to the best of their ability, just how the world works. Scientists learn about the world by looking for patterns, asking questions, doing experiments, and then learning from their results and from other scientists. Children operate in the world in pretty much the same way. They learn through experience and exploration by finding patterns in the world, and collecting data about everything they see and touch.

For example, a little boy in the photo when he plays with snow outside he might realize it doesn't melt if it's cold out, so that must be a rule about how water acts in our world. Teaching science, engineering, math, art, and technology skills is as simple as helping harness the incredible curiosity that young children naturally have. The foundations of scientific reasoning developed during the infant and toddler years. Children play an active role in their cognitive development by exploring and testing the world around them. In preschool, using scientific reasoning and problem solving are key skills for school readiness. STEAM skills stretch across the domains of the ELOF.

The ELOF provides language to help teachers, family child care providers, and home visitors understand child development, and what children should know and be able to do to succeed in school. The ELOF informs teaching practices, such as how to set up the learning environment, plan learning experiences, and engage in nurturing and responsive interactions. It can inform home visitors as they support parents in these areas, too. For example, it can help home visitors plan learning experiences that promote a safe, nurturing, and a responsive learning environment ripe for STEAM exploration.

For infants and toddlers, science knowledge, skills, and concepts that we know are attainable for young children are primarily found in the cognition domain under the sub-domains exploration and discovery, memory, and reasoning and problem solving. For example, infants and toddlers develop memory skills that enable them to recognize similarities and differences between familiar and unfamiliar objects, actions, or events. As they explore, they encounter problems and learn to use a variety of strategies to solve them. And let's look at another example. If you look at the photo of this caregiver sharing a maraca, this caregiver may readily interact with this infant and this maraca.

She might point out the sound it makes and its shape. Quickly, that infant becomes familiar with the maraca and may seek it out, wanting to hear its sound or feel it. The infant may see the maraca lying next to him on a blanket, and think, "Oh, I want to play with that. How can I

get that?" To solve this problem, he may decide to roll over or crawl over and reach for the maraca. If this interaction occurred between a caregiver and a child, the home visitor could encourage the caregiver to describe the maraca and how the infant interacts with it.

Other areas of development connected to STEAM learning include essential domains, approaches to learning, social and emotional development, and language and literacy. The approaches to learning domain includes executive function skills that are crucial to STEAM exploration like initiative and curiosity, creativity, and cognitive and behavioral self-regulation. And by using both language and non-verbal communication, such as eye gaze and gestures to express interest and talk about what they observe, children are using skills found in the language and communication domain.

Teaching children about their home language is an important part of connecting STEAM skills to their culture and developmental goals. You can further support children, who are dual language learners, or learning a travel language, by describing what the child is observing, and providing key terms in English and their home language. Next, I'm going to share some research that shows just how good young children are at making observations and collecting data to learn about the world around them. We'll discuss some of the STEAM-related abilities they already have at a young age. Children are born prime to explore STEAM concepts as they learn about the world.

What do you think babies understand about physics? Quite a lot already. They might've fallen, tried to walk, dropped toys, or banged a cup on the table and recognize that objects have solidity. Their experiences in play have already taught them quite a bit. They develop expectations about how things work. So when something unexpected happens, it draws their attention.

Researchers have found that babies will look longer at, and want to play with a toy, that seems to violate what they already understand about physics. So let's explore that a little bit further. In one research study, researchers showed children a simple scene, a car rolling on a surface. Some children thought that a toy car pushed off the side of a table hovered in midair, something a car clearly cannot do. This seemingly impossible trick violates what young children already understand about gravity.

And when given a chance to play with a car, what do you think children did with it? Babies who saw the car hover in midair tended to drop the car when they were given a chance to play with it. They seemed to be testing out their understanding of gravity and whether or not it applies to this toy car. Other children saw a magic trick where the car looks, to the baby at least, like it rolls down a ramp right through the solid first wall, also impossible. This violates what the baby expects to see based on what the baby already understands about the solidity of objects.

So when these babies were given a chance to play with the mysterious car after watching it go through the barrier, they tended to bang it against the table seemingly to test out the solidity of the wall. The babies changed how they explored the car based on how the car behaves. Babies who saw the car hover in midair tended to drop the car, whereas babies who saw the car go through a barrier tended to bang it against the table. One-year-old children learn physical rules through observation and experimentation, and when they saw something that violated typical,

physical rules, they were more likely to explore it. Infants and toddlers have already learned so much about the world around them. They've established theories about the ways things work, and just like scientists use observations and predictions to test their theories. A theory is like a guess or a possible explanation for something.

Babies use this information to help them focus their attention on what to learn. In other words, when things don't happen as you expect them to, this offers insight that there is something to learn there, and this is the crux of the scientific method. With our broken lamp, the knowledge violation was that the lamp didn't turn on when we flicked the switch, we then used that as a cue that there's something else to learn there. We may have learned that not all outlets work as they should, or that bulbs are only good for so long. This unexpected behavior of our lamp, it not working, prompts us into the cycle of inquiry, making predictions, asking questions, and testing our predictions.

And this is exactly what babies do. This research, among many other studies, shows us that infants and toddlers engage in scientific reasoning and are observing, predicting, and figuring out explanations. Babies not only chose to play with the toy that violated their expectations of physics, but the little experiments that they conducted, or the things they tested, depended on their observations. Young children, even as infants, use the scientific method to learn. Importantly, we can take advantage of children's natural interest in the unexpected by exposing them to novel materials and places, and by letting them follow up on their own curiosity, if they observe something unusual.

Let's take a look at some more research. In this next experiment, we'll look at early math, probability, and scientific reasoning skills in young children. Children build theories as they try to make sense of the world, and this can be a challenging task. In this study, researchers created a special machine and marble dispenser to look at whether ... How young children can keep track of cause-and-effect relationships, and use this data to form theories about relationships that aren't always reliable.

In this study, children saw a machine with two blocks, shown on the left and a marble dispenser, shown on the right. When the researcher placed the block on the machine, it always activated the machine to play music. In addition, it would sometimes, but not always, cause the marble dispenser to release the marble. The child could then put that marble in a separate marble run, which is something they love to do. So when the researcher placed their red block on the machine the first time, it activated and the marble dispenser released the marble. The same thing happened the second time the researcher placed the red block on the machine. But the third time, it didn't work. No marble was released. Each child watched the researcher try six times.

The marble dispenser, shaded in yellow, show that only four of the tries resulted in a marble being released. That is a success rate of two-thirds, or 67%. Next, the researchers switched to a blue block. The blue block made the marble machine release a marble two out of the six tries. That is a success rate of one-third, or 33%. Then, the child got a chance to put one of the blocks on the machine to get a marble. Which block do you think she chose, the red one or the blue one? Take a quick second and use the chat box to guess whether you think the child picked either red or blue to make the marble machine work. We have universal agreement about red,

it looks like. Oh, I see at least one blue. So most people are saying red. Maybe a few blues here and there. Absolutely right, children went for the red block, the one that was more likely to make the marble dispenser work. And these are some amazing logical skills. But sometimes things just don't always work the way that we think they're going to. Imagine a baby trying to learn what is and is not a light switch.

There are some that twist, some that are buttons, some that are levers, and some that don't seem to turn on any light at all, but they're still light switches nonetheless. So how do children make sense of this sometimes messy world that we live in? Can children keep track of how likely it is that something is going to work, even if it doesn't work all the time? Can they use something as sophisticated as probability to solve problems and make things work? This research we just talked about shows that, yes, they absolutely can. Even young children have this amazing ability to work their way through this problem. They understand probability at this fundamental level. Even when a block doesn't make the marble appear 100% of the time, children keep track and they're able to pretty quickly tell which block is more likely to make the machine dispense the marble.

Studies like the one we just examined show that young children used inquiry and powerful reasoning early on. Helping them continue to develop and engage these skills is the goal of early STEAM. It's amazing what young children are learning in the data they are collecting even when it may not seem like it. So let's look at another research study that focuses on the "A" in STEAM. It turns out that young children are learning a lot just from being exposed to the music in their environment. In one study, researchers looked at how infant brains respond to different types of music. Four-month-old babies listened to either guitar or marimba sounds for 20 minutes a day for one week.

At the end of the week, they came to a research lab and researchers used special, non-evasive equipment to measure how the babies' brains responded to guitar and marimba sounds. They found that babies who listened to guitar music before their lab visit showed larger brain responses to guitar sounds. And babies who listened to marimba music before their lab visit showed larger responses to marimba sounds. These findings show that the brain is learning about music as children listen to it in their environment.

And researchers haven't found any evidence that one type of music is better than another. So play music for babies in the language of your culture, or make your own music. You can fill plastic bottles with rice to make great shakers, or flip over buckets or pots or pans to create drums. Even though children are natural scientists and explorers, they need the support from teachers and parents to encourage and expand their STEAM skills and thinking. Adults can help children build on and expand their existing knowledge and interest in the natural world through both free play and supportive exploration.

Now that we've talked about what the research tells us about how young children develop STEAM knowledge, skills, and concepts in early childhood, I'd like for you to take a couple of minutes to think of specific ways you already support young children's STEAM learning. Use the chat box to share your ideas. For example, if you have a sensory table, you might type something like, we have a sensory table with wheels and funnels and an outdoor play area. So

just to repeat that the prompt is to think of specific ways you already support young children's STEAM learning, and share them in the chat box.

Sarah: We've got lots of people typing here. Some of the early responses are ... So Lisa says that she presents materials with, "I wonder" kinds of questions. Other people are also mentioning questioning behavior, a few magnetic tiles, cooking behaviors, a mud kitchen outside, a garden in the classroom That's great. Blocks and music, bubbles.

Beth: Filling sensory tables with other types of things. Lots of fantastic – fantastic ideas. You guys are clearly doing lots of STEAM already. You can go a few more minutes to keep typing.

Sarah: Yeah, some art and music mentioned here. I love Regina talks about mixing paint colors.

Beth: Yes, I just saw that one. I was gonna say the same. You're doing a little bit of science there, too, not just the art. Incorporating natural materials with other activities. The magic of hand soap, I like that Connie.

[Laughing]

Sarah: Some people mentioning movement and singing and music. Those are great ideas.

Beth: These area all fantastic. Thank you so much for sharing. It looks like there's ... We got different sort of categories of things we're touching on, like providing certain types of materials. Obviously, touching on different aspects of STEAM. Adult support in some of these, so modeling possibilities and actually giving them different types of materials to explore. So these are all fantastic examples of ways that you can support STEAM learning.

In the next section, we'll talk about some strategies for incorporating inquiry in STEAM into children's exploration and play, and give you the opportunity to practice finding STEAM during everyday activities. You guys are fantastic. People are still typing and sharing. These are great, we can't wait to go back and have a chance to read through them all later. I'm gonna move on to the next section. The framework for effective teaching practice is known as The House. It has been revised to include parents and families at the center of the framework. The House Framework helps us think about all the important elements needed to support children's preparation and readiness for school. We'll share a link to The House Framework at the end of the webinar.

And it's also included in some of those supplementary files that are available for your download. This framework represents five integral components of quality teaching and learning. We created categories of ways to support STEAM learning based on the foundation of The House. Nurturing, responsive, and effective interactions and engaging environments. Nurturing, responsive, and effective interactions and engaging environments are the foundation for all learning in early childhood settings. And children and families benefit from interactions and environments that are culturally and linguistically responsive.

We need to create high-quality, early learning environments to support early STEAM thinking and skills. We divided strategies to support STEAM learning into three categories. The first, engaging environments. This includes using materials that stimulate children's STEAM thinking and skills. Next, providing nurturing, responsive, and effective interactions to support children in their exploration. And third, designing learning experiences and activities that encourage

independent exploration, that include engaging materials that provide opportunities for you to explore together and provide support, when needed. And you certainly touched on all of these things in your chat box comments. Developing an engaging environment requires using your observations about what children say and do to learn about their interests and current abilities.

Create an engaging physical environment that is stimulating, interesting, and encourages experimentation. Home visitors can help caregivers find everyday materials around the house, such as empty jars and lids, or even curlers as shown in the photo on the top-left that allow for open-ended exploration. In selecting and arranging materials, remember that children actively explore, investigate, and observe. They will not be taking in knowledge in a passive way.

So provide open-ended materials. These are materials that can be used in multiple ways and allow for creativity, investigation, and problem solving. A sensory table can be filled with water, sand, or even paper, and I think I saw someone mention pine needles in the chat box as well. And a sensory table isn't even necessary for these experiences. In your classroom or home visitors can suggest parents fill tubs, buckets, or bowls with varied materials, too. And use a variety of materials. Select materials related to children's interests. Engage the senses with materials of different textures, smells, tastes, sounds, and sights. In the bottom-right image, a home visitor encourages a mother to talk about the texture of homemade clay as she and her daughter explore it with their fingers.

And consider the developmental level of the little scientists with whom you are working. For example, older preschoolers can verbally share what they think might happen, or help record findings using post-its or drawings. Whereas, toddlers may respond by pointing to one of two options. And infants can respond with eye gaze or even kicking their feet in excitement. Also, make sure materials are accessible to children. Place those materials in a location so the children may have independent access. And make sure tools are their proper size and constructed of appropriate material for young learners. When appropriate, adapt materials to ensure that children with disabilities, or suspected delays, can participate as independently as possible.

Some possible modifications include placing materials in an optimal position, stabilizing material, providing adaptations to make tools easier to grasp, and making materials larger or brighter. Warm, nurturing, and effective interaction lay the foundation for children's discovery, and create opportunities for them to share their findings. Create an engaging social environment. Interactions with peers and adults facilitate the development of STEAM knowledge, while developing children's social, language, and communication skills. It's a collaborative inquiry process.

Teachers and children become scientists together. Home visitors can help parents see how they can be scientists with their child, too, simply by exploring together. Here are four specific ways to think about how to provide nurturing, responsive, and effective interactions to support STEAM skills. One, use scaffolds. Second, introduce basic inquiry skills. Third, speak the language of STEAM. And finally, invite children to communicate. These strategies can be used to support children in the classroom, the home, or in the context of a home visit. So let's talk about each of these a little bit more. Scaffolding is a term that describes techniques adults can use to support and help children in their learning. Scaffolding is offering the right level of

learning support and structuring the environment to take a child's knowledge to the next level. Just as a scaffold supports construction of a building, adults can scaffold a child's experience as they are learning.

Scaffolding can help children engage in more complex thinking and problem solving. To scaffold an experience, adults can provide assistance like queuing, prompting, questioning, modeling, discussing, and telling. Using these tools, adults can stretch children's learning. For younger children, or children with disabilities or suspected delays, scaffolding might include simplifying the activity by breaking it into smaller steps, or reducing the number of steps in the task. Pre-teaching vocabulary using the tools and materials for exploration will help dual language learners make connections between the objects and English labels for those objects. Scaffolding is a balance. If we don't offer enough help, the child can struggle and become frustrated and give up. But if we offer too much help, the child is missing out on an opportunity to stretch her learning.

To find the just right spot, we have to pay attention to what the child is doing. Give children the opportunity to investigate and figure things out before jumping in with the answer or taking over an exploration. As we talked about, the inquiry cycle, or scientific method, is at the heart of STEAM. Adults use the scientific method naturally, and so do children. We can introduce basic inquiry skills to help children think about STEAM during everyday play and activities. This helps children become critical thinkers and problem solvers. Adults can foster this problem-solving approach in their conversations with children. Asking questions can help children reflect on what they are trying to do, whether what they have tried has worked or not, and how to plan their next move.

And it doesn't matter if the child is too young to respond verbally. By asking questions, you are modeling a questioning mind, exposing children to new language, and giving infants and toddlers the opportunity to respond in different ways, by pointing, vocalizing, or maybe responding with an action. Here are some useful questions to encourage problem solving with young children. Some of these are also included on your handout. For example, you can ask about a child's observations, like what do you see or hear, how do they sound or smell? Or ask them to make a prediction, so what do you predict or think will happen? These questions are the scientific method of problem solving, and action.

They're related to learning indicators found in the ELOF, in the scientific reasoning, cognition, approaches to learning, and language and communications domain. Also, speak the language of STEAM. Speak STEAM by incorporating problem solving in STEAM-rich language in all types of activities. Use key vocabulary words, such as observe, predict, compare, and investigate. to encourage STEAM-thinking and skills. Listen to children or watch what they're observing, then provide scaffolds when appropriate. Use language to describe the objects or events the child is observing and exploring. By providing words or labels that connect the objects, concepts, and experiences, you are helping the vocabulary and concepts become concrete and meaningful to children.

The use of language expands and enriches scientific experiences, and reinforces the growth of STEAM-content knowledge. You can further support children who are dual language learners by describing what the child is observing, providing key vocabulary words in English and their

home language. Invite children to communicate. Your interactions during everyday routines and activities with infants and young toddlers contribute to their cognitive skill, and develop the foundations for scientific reasoning.

When we use self-talk, describe events, and verbally label objects and actions, we are providing the language input that helps children put words and experiences together. Inviting children to communicate will look different depending on the age of the child. Infants and young toddlers may respond with gazes, gestures, or some basic verbalization. The more attention we pay to the ways they communicate about their exploration, the more responsive we can be to their communication attempts.

Then, we can adjust experiences and encourage behaviors to meet the children where they're at developmentally. Older toddlers are still learning language, but they are better able to provide simple verbal responses. To support their scientific reasoning and language development, continue to model using advanced vocabulary, labeling objects, and helping children make connections between the new vocabulary and familiar words and ideas. We can help them use their expressive language skills and make the new vocabulary their own by modeling and encouraging them to describe their observation, develop a question, make prediction, and notice similarities and differences.

Home visitors can look for opportunities to help caregivers notice and respond to the subtle ways infants and toddlers often communicate. For example, if an infant babbles and looks at her parent, then to an object on the floor, you might point out to the parent how the infant was communicating with them through their eye gaze and babbling. You can then encourage the parent to describe what the child is interested in. Talk with children and ask questions to guide their observations. For example, when playing at a water table, you could ask, "How are you making the wheel spin?"

Model for children, share with children what you observe. Maybe, the more water you pour the faster the wheel spins. Describing observations is a great opportunity for all children, including dual language learners to build their vocabulary. You can also have toddlers document their observations through drawings or adding stickers to a chart. For children with disabilities, or suspected delays, teachers might consider offering visual supports to provide the children with another way to communicate, instead of relying on verbal communication. An important way to support STEAM learning and skill is through the experiences and activities you plan in the early education setting, and encourage families to do at home.

Design hands-on STEAM activities based on children's questions, and observing what they show interest in throughout the day. What type of STEAM skills could you use to teach with a basket of fruit, such as avocados and bananas, as shown in this picture? I invite you to think of ways you can support different types of STEAM learning, as infants and toddlers explore avocados and bananas. Either by work that you do directly with children, or how you help support families on home visits. For example, you could support math development by comparing and contrasting the shape and size of the two fruits. So please take a couple minutes and share your ideas in the chat box. Again, the prompt is to think of ways you could support different types of STEAM learning as infants and toddlers explore avocados and bananas?

Sarah: So I've already got a couple people talking about the different textures of avocados and bananas. Different colors, shapes, smells. Connie is suggesting to paint with them, which is kind of fun.

Beth: Oh, that is fun.

Sarah: People talking about how they taste.

Beth: Yeah, absolutely.

Sarah: Somebody mentioning that avocados have a seed in the middle, so you can talk about the presence of a seed or not in fruits. Squishing them. I like that, Vicky. [Laughing]

Beth: Yes, another way to explore texture. Ah, singing a song about them. Incorporating the "A" in STEAM, that's great.

Sarah: Ooh, which one weighs more. I like that.

Beth: These are all fantastic. Thank you everyone for sharing. What will we need to look inside? That's a great suggestion.

Sarah: I like Jennifer suggestion taste testing, but then also voting, so which one did you prefer, perhaps. And maybe you could even make a graph about that.

Beth: Making a sink or float experiment. I hadn't thought of that one.

Sarah: Yeah, these are great responses, and they're still coming in.

Beth: They are still coming in. There's a lot of people on the webinar, so thank you all so much for continuing to share your ideas. I just want to ... I'm gonna move on to the next one to talk about some of the things one teacher actually did during this activity. And you've touched on a lot of them, and I apologize if I missed some of these that you mentioned. So the teacher asked the children to make a prediction, so asking them what they thought was inside the avocado. And toddlers who are more verbal may not know many scientific concepts, but as we talked about they still can be encouraged to observe, think, and hypothesize. One thing these children were doing, they were rolling the avocado a lot, so she was just describing their explorations, and how the avocado's round shape is what enabled it to roll. She asked the children if bananas were the same or different than avocados.

Talks about where they grow and what their seed looks like, and someone mentioned the seeds in there. She talks about the texture, so that was mentioned a lot. And she also talks about the different types and parts of bananas, and provided new vocabulary in both English and Spanish, as you can see in this poster that she made. So she provided visual cues to help children match images and concepts to the new vocabulary words. And those were just a few of them, so these were all fantastic. Thank you.

STEAM can be found in many everyday experiences and activities. Books are a great way to open the world of STEAM to children. You can use both fiction and non-fiction books to introduce STEAM topics and make connections to the real world and children's experiences. Studies have shown that books encourage interest in science in the early years. In the photo on the left, a home visitor supports a father as he reads aloud to his toddlers. The home visitor

shows the father how she used the book, "The Very Hungry Caterpillar," to support math concepts, such as matching printed-out pictures to the pictures in the book and placing them in order, as well as counting the items in the book to learn about one-to-one correspondence. You can also use books as a springboard for other activities.

After reading "The Very Hungry Caterpillar," you could ask children to create their own caterpillar out of different materials, such as balloons, paper plates, or sponge tape, or you could look for a caterpillar or a butterfly on a nature walk, or count how many different foods the caterpillar ate in the book. Shared book reading is a way for adults to draw attention to STEAM vocabulary and concepts, and it boosts children's science vocabulary. You can use real objects, photographs, or illustration to support dual language learners in acquiring the English words for key vocabulary and concepts.

The photo on the right shows teachers engaging children in finger play and song. You can use music and songs to foster STEAM learning, through counting out loud, pattern recognition, and singing about STEAM language and concepts to expand thinking and vocabulary. Nature also provides one of the best environments for children's spontaneous exploration, play, and STEAM learning. A park, a field, a walk around the block, any outdoor space is beneficial. Outdoor areas provide opportunities for STEAM exploration that are not available in the classroom, including problem solving, observation, and a variety of sensory experiences.

Children can observe different textures, smells, tastes, and sounds when they're outside compared to inside. They can compare living and non-living things. This encourages informal learning as children explore and make discoveries. Diverse materials, such as plants, stones, and sticks can be used to count, build, and create, facilitating imaginative play. Researchers have found a positive relationship between outdoor nature experiences and outcomes in preschool. I hope we've shown you that you don't need science materials, or typical science materials, to think scientifically. STEAM is about how you explore the world, not which facts you know. Activities should encourage exploration and curiosity rather than facts. And children can use any old material to explore STEAM.

It doesn't have to be a typical science material like a beaker or a test tube. Open-ended and everyday materials, such as empty jars and lids, or even leaves, allow for boundless exploration, and they can grow with the child. And the world is your classroom. STEAM is everywhere, especially outdoors. Because STEAM is for everyone, and children start using STEAM skills at such a young age, there is a great opportunity to tailor STEAM activities to what is culturally relevant to children in your classroom, at home, and in the community. It's never too early to teach and support STEAM skills. Today, we've talked about infants and toddlers as little scientists and explorers, discovering the world through observation, problem solving, and experimentation.

And STEAM is not just for scientists. You and the children in your care are doing it already. Adults and children naturally use inquiry as a tool for learning about the world. We also talked about strategies for supporting infant and toddlers STEAM skills and thinking. There are many ways we could support children's natural inclinations to explore, to build, and to question. Some ways to set the stage and foster STEAM learning include creating engaging environments and learning experiences, and providing nurturing, responsive, and effective interaction. Finally,

we discussed everyday activities that are rich with opportunities for STEAM interactions. STEAM is all around us ready to be discovered by our willing, young explorers. I think this quote from E.B. White sums up how to support STEAM skills well. "Always be on the lookout for the presence of wonder."

Because teaching STEAM skills is as simple as helping harness the incredible curiosity that young children naturally have. In this last part of the webinar, we talked about strategies for building STEAM skills in young children. I wanna do one last chat box activity. How are you going to take what we've learned today and apply it to your work with children and their families? And what additional tools or information might you need to support your work? Please share your thoughts in the chat box. Again, the questions are how are you going to take what we've learned today and apply it to your work with children and their families? And what additional tools or information might you need to support your work?

Sarah: We've got a couple of comments from people saying that they're hoping to take this information back to colleagues, in some cases home visitors. I like that Anne suggests that she's gonna try to let STEAM happen naturally instead of manufacturing those opportunities for STEAM.

Beth: Fantastic.

Sarah: I saw somebody say that they're gonna ask some open-ended questions.

Beth: Give parents handouts on STEAM at home and materials, like incorporating materials they already have, which is also a great idea, remembering that materials are everywhere.

Sarah: Lots of people talking about bringing these things, this information, to families. So I think Anne mentioned something about bringing, or using messy materials with infants and toddlers. I'd love to know a little bit more about what you mean by that, and we'll see if we can address it in some of the question time that we have here.

Beth: And using natural materials, which is I mean, STEAM materials are all around you, so you can pretty much use anything and make it into STEAM. Thank you so much for all of these thoughtful responses.

Sarah: Yeah, that seems to be the take-home that a lot of people are coming away with, so that's good.

Beth: Great. Fantastic. I will continue on here just to show you some of the resources, if you want to follow up more. So these are from the Early Childhood Learning and Knowledge Center, or the ECLKC, on STEAM and early childhood. These are all in the ... There's a PDF of this PowerPoint, and the file is available for you to download, so these are all there for you to access. And then these are a list of general resources on the ECLKC that we talked about, including the ELOF and The House Framework, as well as links to resources to support children who are dual language learners, and children with disabilities, or suspected delays.

Sarah: All right, wonderful. Thank you Beth, and thank you all so much for listening and participating. We hope this information will be valuable to you as you help programs consider

ways to enrich the experiences for the children and families they serve. If you have additional thoughts that you'd like to share about how this relates to your work, or questions about any of the content we covered today, we've got about four more minutes here in our time together. And we can open it up to questions and comments. And, Beth, I don't actually see the link to the survey here in this last slide. Do we have the link to the survey?

Beth: Sorry about that.

Sarah: So, we're gonna put this ... Oh, the survey link is in the chat box. We'll keep posting it there. So hopefully you can complete this evaluation. And once you complete the evaluation, you will be able to download a certificate of completion for your participation in the webinar. And again, if you're viewing the webinar with colleagues on one computer, and only one person is registered for the webinar, please forward the link to your colleagues so they can also complete the evaluation and get the certificate of completion. So with that, let's see if we've got any questions and comments. Somebody's asking about the links page again, and we should, I guess, reiterate that the PowerPoint file is available for download. So you can have your own personalized link page to take with you.

Beth: Right, and then the links are most of them are also repeated in the handout and at the end of the Discussion Guide, and those downloadable files as well. I'm scrolling back up to find Anne's further explanation here. So she said that she wants ... So she was talking about messy materials. She wants to have a basket of crayons and paper on a shelf for children to pull, but then they bring into the kitchen and color on the dishes or the chairs and so on. Some things, I guess, you probably can't have as readily accessible with others like for the types of situations. For slightly older toddlers you could use chalk, which is more easily wipeable. Does anyone else have any thoughts on some crayons, pens, that's a tricky one? [Laughing]

Sarah: My immediate thought, I mean, crayons are obviously better than pens and markers for little ones. But then I think also having not just the crayons, but also having really great and engaging materials for them that it's OK for them to color on, having that right there as well. I think that's always is a good trick. All right. Well, thank you so much, Beth. And thank you everybody for joining us today, and thank you for the wonderful activity in the chat window. We really enjoyed it. So I hope you have a good rest of your afternoon. We'll see you for the next BabyTalks. Buh-bye.

Beth: Great. Thank you everyone. Buh-bye.