From STEM to STEAM

How Early Childhood Educators Can Apply Fred Rogers' Approach

Hedda Sharapan

For many in early childhood education, *STEAM* is a new term. It began in this decade as *STEM,* an acronym for **S**cience, **T**echnology, **E**ngineering, and **M**ath. These curriculum areas have become a major focus in education because of the concern that the United States is falling behind in scientific innovation. The pressure is on educators to start early and provide learning experiences in these areas for young children. *STEM* is a buzzword even referring to preschool (Ashbrook 2010; Moomaw & Davis 2010).

Today, from what many of us see and hear, the term STEM is not even familiar to many people who work with young children. I also wonder if many early childhood educators feel uncomfortable and unprepared to address concepts in these science-related fields. With a new and familiar addition to the acronym, **A** (for the **A**rts), STEAM integrates and uses the arts in the STEM curriculum to help children express STEM concepts (NCES 2009; Piro 2010; Tarnoff 2010). Since the arts are a natural part of early childhood education, adding this element may help more teachers find ways to work STEM concepts into the curriculum. This new term STEAM can help early childhood educators to build the foundation of science-related knowledge, using the arts to encourage children to express their ideas in a wide variety of creative ways.

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A model and an approach to consider

Having worked closely with Fred Rogers for decades, I see how naturally and creatively he offered STEAM concepts, writing and hosting his highly acclaimed PBS program, *Mister Rogers' Neighborhood.* How much we can learn from his approach!

Most people think of *Mister Rogers' Neighborhood* as primarily about social-emotional skills. But the program addressed much more than that. Each program was a tapestry of learning experiences, often connecting the arts and sciences. Fred Rogers, whose background included

graduate studies in child development at the University of Pittsburgh, often described his work as helping children understand more about themselves, about others, and about the world around us. Some of the more familiar ways he nurtured an interest in the world were through the factory tour videos and field trips.

The everyday language of STEAM

I like to think of "understanding the world around us" as Fred's way of helping educators feel comfortable with all the basic elements that comprise STEAM. With his knowledge of child development and years of experience listening to and talking with young children, he was able to see STEAM concepts through a young child's eyes. To him, they were just part of our everyday language, not intimidating academic concepts. STEAM is much more about facilitating inquiry-based thinking and discovery than about teaching facts and giving answers. Here's how I've come to understand these STEAM terms:

Science. Science is about nurturing a sense of wonder and curiosity. It's about experimenting, encouraging investigation, and asking "Why do you think . . . ?" questions. In early childhood, science is about everyday experiences, like what makes shadows, how plants grow, why ice melts, and where different animals live and what they eat. When children tell you their idea of why something happens, that's a hypothesis!

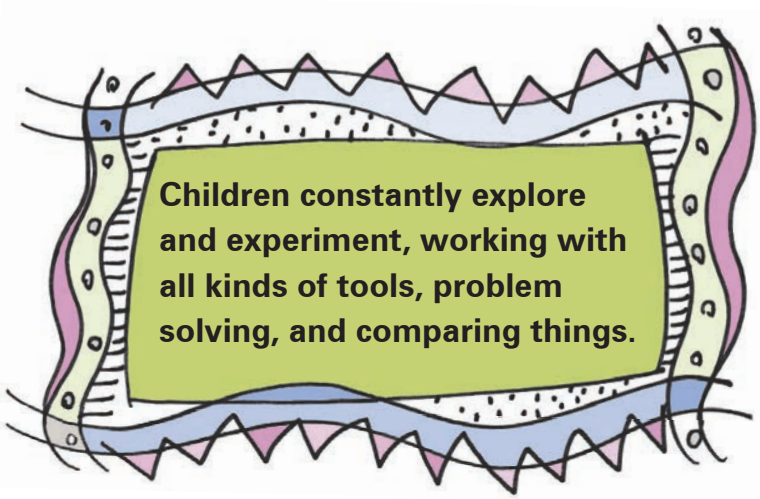
Technology. Technology is just a fancy word for *tools*. Adults tend to think of technology as digital equipment like cameras and computers or sophisticated machines in factories. But crayons and pencils are tools. So are rulers, magnifying glasses, scissors, zippers, and even dump trucks.

Engineering. Engineering starts with identifying a problem, then moves ahead to thinking about solutions and trying them out. All of us have seen children go through these processes when they're trying to figure out how to make a strong foundation so they can build their blocks higher or when they're working on a toy boat that will float in the water table or making a stable base so their clay figures stand up.

Art. Adding the arts gives children the opportunity to illustrate STEM concepts in creative and imaginative ways, express ideas about the world through music and dance, communicate with descriptive language, illustrate ideas with crayons or markers, create graphs, and build models.

Math. Mathematics is much more than counting. Mathematical thinking includes comparing, sorting, working with patterns, and identifying shapes. Language, too, plays a big part in math, for example, when we use comparison words like *bigger, smaller, higher, lower, farther,* and *closer.* Higher-level math thinking comes into play when we help children know that comparisons are relative—that something can, at the same time, be bigger than one object and yet smaller than another one—and that things can be sorted in different ways.

When teachers think of STEAM in these terms, it's obvious that for children the concepts are second nature. Children constantly explore and experiment, working with all kinds of tools, problem solving, and comparing things. That's why teachers can offer STEAM learning opportunities everywhere. In fact, some teachers may find that they already provide such learning experiences for children in lots of everyday ways.



Finding STEAM everywhere

Here are some ways I've seen early childhood teachers use Fred Rogers' approach to understanding the world around us for STEAM conversations, activities, and projects.

Build on everyday moments

On his program, Fred Rogers took advantage of everyday moments by talking out loud about what he noticed. He called children's attention to things in the world around them, whether he was walking a dog or looking at dinosaur skeletons at a museum or watching a child get a checkup by a pediatrician. When he let young viewers in on his thoughts, questions, and observations, he helped them be more aware of their environment.

Recently I watched an early childhood teacher doing just that, offering a STEAM conversation in an everyday moment. It was an exceptionally hot morning, and the young 3-year-olds had been out on the playground a while. When outdoor time was over, they came inside and lined up to be counted. That's when the teacher asked, "Do you feel a difference between the air outside on the playground and the air here inside the center?" They nodded but didn't say anything.

The teacher continued, asking a question that would help them think more specifically about the difference. "What is

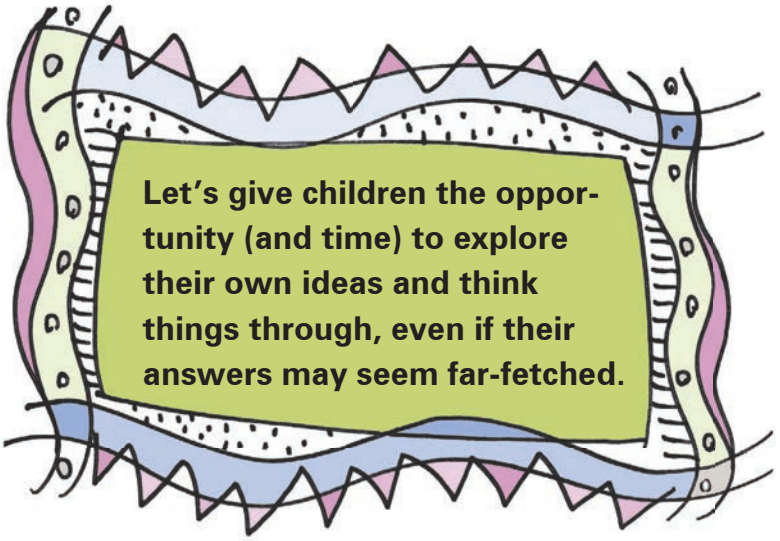
different? Is it hotter or colder inside?" She paused, giving them time to think (an important teaching technique!). A few children said, "It's colder." Then the teacher asked, "Do you know why it's colder here?" After a moment one of the children answered, "It's air-conditioned." The teacher added, "Yes. We have air-conditioning inside. That's what makes it cooler." When you turn an ordinary moment like this into a teaching moment, you're focusing the children's attention on a simple but meaningful science concept in their environment.

Now that I've been thinking so much about STEAM myself, it occurs to me that even an engineering concept could be added to the conversation. A teacher could say something like, "Someone must have said, 'There's a problem here. It's too hot in my house.' Then that person worked on figuring out a way to make the house cooler. Maybe it was a woman, maybe a man, who worked on a way to make air-conditioning. That's what engineers do: they figure out how to make things better."

As educators we can also ask children what other ways people keep cool or cool the air, like turning on fans or going under the shade of a tree. We could follow up with an art activity, making paper fans and showing children how to use them.

Expand on children's natural interests

Early on in his graduate work with children, Fred Rogers developed a remarkable ability to look and listen carefully to children's interests. That's what helped him build his series around simple but engaging childhood activities, such as playing at the sand table or sending a toy car down a ramp, and deal with themes, such as "up and down" and "fast and slow" and "making mistakes." Fred carried his themes over a full week of programs, because that made it possible for him to broaden an idea or take an idea deeper or expose children to different dimensions of the theme.



I've heard wonderful stories about long-term projects at centers that grow out of something as simple and everyday as digging a hole outside. Usually such a project starts with a child exploring a small hole, and soon the children want to work together to see how deep and wide a hole can be. They try out different kinds of digging tools and photograph the hole as it grows—that's technology. They want to know how deep they've dug—that's math.

Children might add water or discover and identify bugs in the dirt—that's science. They may build dams to control the water—that's engineering. They could draw a plan for the path of the water or draw pictures of the bugs or make up a song about the hole as they dig—that's the arts. And haven't we all found that there are fewer behavior problems when children are engaged in authentic learning that comes from their interest in something in the world around them?

Encourage and appreciate questions

Encouraging children's questions is an essential part of STEAM learning. We don't have to have all the answers. It's just as helpful to say "That's a really good question!" and so applaud the asking. An important follow-up could be the teacher's open-ended question, such as "What do you think?" or "How do you think we could find out?" Fred Rogers often said that our questions are more important than our answers! Let's give children the opportunity (and time) to explore their own ideas and think things through, even if their answers may seem far-fetched.

I know early childhood educators who have found a concrete way to show their appreciation for children's questions. They

have on hand an Ask-It-Basket. When children ask a question teachers can't answer at that moment (or at all!), teachers acknowledge it with interest and write it on a note placed in the Ask-It-Basket. Sometime later in the day or week, the teacher may be able to find the answer on the Internet or in a book or from someone in a child's family. Or maybe not, which is OK too! Fred Rogers reminded us in one of his songs, "when you're wondering, you're learning."

Invite a STEAM visitor for circle time

One of my favorite STEAM stories is from a center undergoing renovation. Imagine how fascinated the children were with the sights and sounds of the construction. Seeing this as a great learning opportunity, the center director asked the construction project manager to periodically come to circle time to talk about the process and answer the children's questions. He even brought blueprints that they taped to the wall. The teachers built on the children's interest, asking them such things as "What kind of building would you want to make?" "If it is to be a new classroom, how would you design it?" "What kinds of props or tools do you want to use for pretending to be architects or builders?" It was a great way to nurture curiosity, stimulate pretend play and creativity, and give children an appreciation of community.

Teachers can offer that kind of stimulation by inviting community and family members (parents or grandparents or other relatives) who can share their particular STEAM expertise with the children. For example, a carpenter can show how hinges work or a musician can demonstrate how the guitar strings vibrate to make music. Then teachers can follow up by providing props and activities so children can have their own real or pretend experiences with what is demonstrated. Remember how much we all learned from—and how inspired we were by—the guests in *Mister Rogers' Neighborhood*!

Create a meaningful context

Before showing a video of a working factory or taking young viewers along on a field trip, Fred always provided a meaningful context for the experience. I know a kindergarten teacher who uses *Mister Rogers' Neighborhood* videos in just that way in his curriculum.

First, he puts out on a table crayons of different sizes and shapes, giving children time to look closely at them. He uses the K-W-L (Know-Want-Learn) form by asking the children what they *know* about crayons and what they notice about them. After writing a list of their ideas, he asks what they *want* to know about crayons and if they have an idea of how people make them. He remains nonjudgmental, even when the ideas are outlandish, which they can be because young children are such concrete and magical thinkers!

Find *Mister Rogers' Neighborhood* factory videos, field trips, and full-length episodes to incorporate in STEAM teaching and learning. Over 50 full-length episodes and short video segments (including factory tours and field trips) are offered at **www.pbskids.org/rogers**.

Over 300 episodes are available through **www.amazon.com**. The program continues to be part of the PBSKids Saturday morning lineup in many locations.

Discover more information for professionals and parents on **www.fredrogers.org**.

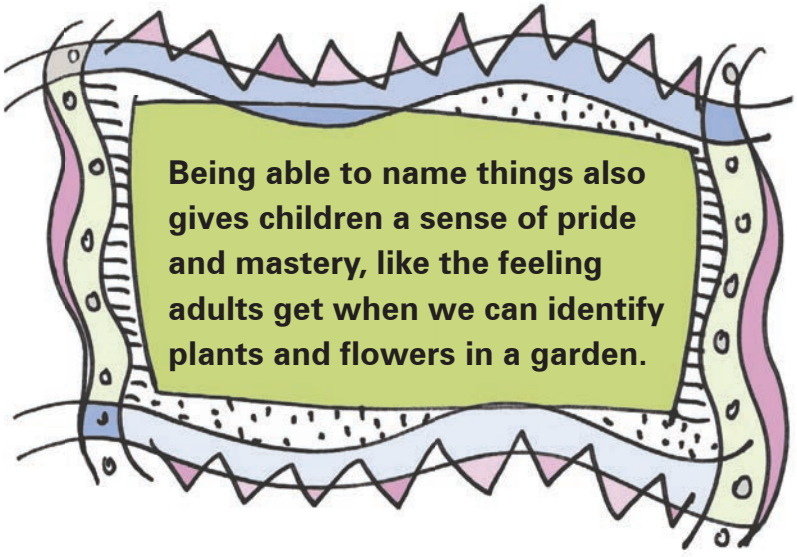
Second, the teacher plays the crayon factory video from the PBSKids website (www.pbskids.org/rogers). After the video, he asks what they *learned* and what else they'd like to know about crayons. Maybe they want to watch the video again. Each time, they notice new things. Third, after some conversation about possible activities with crayons, including melting them in molds as they saw on the video, he offers hands-on art activities that match the children's interests.

This kindergarten teacher's approach is very much like what Fred did on the program. He didn't just show a video about a factory or a field trip. He demonstrated or told something about the object or content. He made it meaningful in a broader context, before and after, helping children understand that things are created through a process and that it takes people to design machines and make them work. With those kinds of discussions and activities offered before and after the video, STEAM learning fits into a context that's both personal and relevant for the children.

Include nonfiction books

I know teachers who nurture children's curiosity by providing well-illustrated nonfiction books with vivid photos or beautiful drawings—books maybe not even written for young children. I also know teachers who are uncomfortable around bugs, spiders, and snakes, and who prefer to offer books on those creatures as a way to extend children's learning.

Nonfiction books can also boost children's science vocabulary. Fred Rogers knew how much children enjoyed using grown-up words, so, for example, he would identify a bird as a canary and use the correct names for the smaller rockhopper penguins and larger emperor penguins. Children amaze us with their ability to accurately identify dinosaurs by name or different trucks and construction equipment, such as earthmovers, forklifts, dump trucks, cement mixers, front loaders, and backhoes. They probably learn those names by looking at pictures and noticing distinct characteristics—that's a science skill. Being able to name things also gives children a sense of pride and mastery, like the feeling adults get when we can identify plants and flowers in a garden.



A new way for us to see the world: Through STEAM concepts

I've done some workshops and writing about STEAM concepts, and now I'm amazed to find that I'm looking at things around me through a different lens. The other day I stepped into an elevator with glass walls that let me see how the equipment works, and I found myself marveling at the engineers who designed this machine. I saw the raindrops on my car windshield and thought again how amazing it is that water holds together in droplets. I felt a jagged edge on my fingernail and reached for a nail file, realizing that it's a tool—that's **T**echnology. And when my granddaughter called asking to have a Skype visit, I was grateful too for this remarkable technology and all the people who used math, engineering skills, and creative thinking to make that happen! It has really become fun for me to look for, and appreciate, STEAM in my everyday life.

As early childhood educators, let's start thinking about STEAM in everyday language. We'll find these curricula aren't new after all. They've been around a long, long time, and they're everywhere, in *Mister Rogers' Neighborhood,* and in ours.

References

Ashbrook, P. 2010. "Preschool STEM." *NSTA Blog* (National Science Teachers Association). http://nstacommunities.org/blog/2010/03/01/preschool-stem.

Moomaw, S., & J.A. Davis. 2010. "STEM Comes to Preschool." *Young Children* 65 (5): 12–14, 16–18.

NCES (National Center for Education Statistics). 2009. *Highlights from the "Trends in International Mathematics and Science Studies"* (TIMSS). Rev. ed. Washington, DC: US Department of Education.

Piro, J. 2010. "Going from STEM to STEAM: The Arts Have a Role in America's Future, Too." *Education Week* 29 (24): 28–29. www.edweek.org/ew/articles/2010/03/10/24piro.h29.html.

Tarnoff, J. 2010. "STEM to STEAM—Recognizing the Value of Creative Skills in the Competitiveness Debate." *Huff Post Education*. www.huffingtonpost.com/john-tarnoff/stem-to-steam-recognizing_b_756519.html.