Program Detail for *Tinkering Together*

An in-depth summary of programming is outlined in this section.

Tinkering Together Podcast

THE *TINKERING TOGETHER PODCAST* is a three-part audio series that defines the tinkering approach and brings it to life by having early childhood educators describe their experiences with tinkering and STEAM learning. The podcasts and accompanying livestream fireside chat are hosted by National Public Radio education correspondent Anya Kamenetz.

EPISODE 1: THE TINKERING CYCLE

ERNESTO RODRIGUEZ

Early childhood educator

RYAN KURADA

Transitional Kindergarten Coordinator at the Sonoma County Office of Education

ANYA KAMENETZ

National Public Radio education correspondent

In the first of three podcasts exploring tinkering in early childhood settings, NPR education correspondent Anya Kamanetz introduces tinkering as an approach that is aimed at people of all ages. She describes a project called STEAM Starters, which both Rodriguez and Kurada were part of. This project invited early learning experts to partner with the Tinkering Studio to develop new tinkering activities that would be age-appropriate for young learners. As the podcast describes, projects highlighted the key elements of tinkering:

- **purposeful play**
- **learner choice**
- **collaboration**

Rodriguez describes in the podcast how his classroom began their tinkering by reading the book *Balancing the Birds*, which introduced mathematical concepts such as counting, balancing weights and measures, addition and subtraction. The children already had some familiarity with these concepts and naturally began applying what was happening in the book to real life. As they began asking questions, teachers brought out materials to start the purposeful play that would support their explorations.

As Rodriguez reflects, educators can use everyday materials that could be relevant to *Balancing the Birds,* such as paper towel tubes, boxes, cones, blocks, balls, bowls, plastic flower vases, cylinders, and tape. As Rodriquez says, “One of the things that really, really amazed me is that…you are just giving them materials, and they start using it and they come up with more ideas.”

Although every aspect of tinkering appears to be spontaneous, Kamanetz explains that it requires considerable planning. Adult facilitators must think about how to scaffold children’s exploration and then assemble materials that children might use. The podcast describes the Tinkering Cycle, as a systematic yet flexible way to implement the tinkering approach by going through iterations of

Tinkering is how you make children think and solve problems.

ERNESTO RODRIQUEZ

planning an activity, facilitating it for learners, observing and documenting the learning that happens, and reflecting on it in order to relaunch the activity in new and rich directions.

As the podcast describes, tinkering is more structured than it first appears. Adults use words and objects to help children explore their curiosity about scientific, engineering, or mathematics principles such as balancing objects. As Rodiguez describes, "We just put the materials on the table, and just let them see what they do. We just support them…We ask questions… What do you think about these? What are you doing next? We just ask them open-ended questions and see how their creativity goes. I think that was the most fun part."

In the podcast, Rodriguez reflects on how the tinkering approach aligns to how he runs his program. He reflects, "We really respect the kids, we respect their ideas. Our philosophy as a program is to let them be, you know, if a kid wants to build a castle, okay, let's build a castle. If a kid wants to make a meal for everybody, let's go, let's go. So we just let them explore whatever interests they have." But with tinkering, Rodriguez observes, adults must walk a fine line between giving children space to explore and providing structure to guide their scientific discovery. He offers some guidance for facilitators, "So adults, you know, it's fine to give words of encouragement. Definitely ask them questions. Make sure everybody stays safe, of course. And step in when you see those opportunities to take things a little bit further, pursue a child's question that comes up naturally, maybe offering a new material to try."

Rodriguez and Ryan Kurada, a teacher and STEAM instructional coach with the Sonoma County Office of Education, reflect in the podcast on some of the benefits of tinkering for children. Tinkering, they say, gives children opportunities to think like scientists and learn how to solve problems. Tinkering also has an important social component: as children generate their own questions, they talk to each other and share their ideas about what is happening. Rodriguez finds this dialogue helpful for language development, especially for students in his program who speak English and Spanish. Kurada observes that the open-ended nature of tinkering "leads to true engagement and true understanding of science concepts." Rodriguez agrees, remarking how his students experienced the staying power of big ideas learned during STEAM Starters: "They really, really embraced the concept. And they were using it in everything…they couldn't stop talking about it. They were talking about balance for months."

Tinkering also benefits the adults who facilitate it, as these educators demonstrate in their reflections. They discuss how they delight in children's problem-solving abilities and imagination and how they have gained new insights into how and why they are teaching in certain ways. Kurada also describes that a benefit of tinkering is to reduce the intimidation of teaching science that many early childhood educators experience. As Kurada explains, "[I]t makes it a little less scary [when] we're learning together with our students."

EPISODE 2: TINKERING & STEAM LEARNING

IHUOMA IHUEKWUMERE

Site Director of the Transbay Child Development Center in San Francisco

PAULA HOOPER

Assistant Professor of Instruction, Northwestern University

ANYA KAMENETZ

National Public Radio education correspondent

Ihuoma Ihuekwumere is a site director of the Transbay Child Development Center in San Francisco, which serves children 18 months to pre-kindergarten age. Her school collaborated with the Exploratorium's Tinkering Studio to develop the STEAM Starters project. This project invited early learning experts to partner with the Tinkering Studio to develop new tinkering activities that would be age-appropriate for young learners.

Early learning educators at Ihuoma's center were invited to learn how to engage children in tinkering activities. They learned about the tinkering cycle which involves teachers planning, reflecting and relaunching activities that explore phenomena related to balance, light and shadow and motion. A popular starting point to kick off the tinkering investigation was to read a story book related to a particular phenomenon. Then, the teachers and children use a wide variety of carefully chosen materials to explore questions that came up as they read the book. These materials are everyday household items such as cardboard tubes, hair dryers, balls, pieces of cardboard, or an orange.

If there's one rule of tinkering in early childhood classrooms, it's that tears are going to happen.

ANYA KAMANETZ

As Ihuekwumere shares in the podcast, the teaching philosophy at their school fits well with the tinkering approach. She explains, "We see the image of the child as strong, capable, and resilient. And we strive to support children in their interests to just learn deeper and wider as much as they can."

Also, since tinkering is open-ended, children are in charge of the exploration process. This self-direction includes the opportunity to make mistakes, and those mistakes happen often. Ihuekwumere describes the emotional ups and downs children experience during tinkering: "At first they start off, very joyful. And then when they make mistakes, they fall apart. And they regroup and they know that 'If I don't try more, I may not get what I imagined.'" She finds it amazing when children learn to accept failure as part of their tinkering process.

Ihuekwumere explains that tinkering activities help children develop social-emotional skills such as resilience in the face of failure. She describes tinkering activities as "frustration-rich," and explains that tinkering is "chock full of frustration. It is. And in my experience, whenever you offer tinkering activities to children, there's this very rough spot where it's all tears, because things don't work the way they're supposed to." As Ihuekwumere points out, however, children are resilient, and with skillful adult guidance they can persevere through their feelings of disappointment. That guidance involves supportive helpers who make it clear that it's fine for things to not work out perfectly, and who gently direct children to try to solve the problem in a different way.

Tinkering "takes patience from the adults, and also the child. Adults have to observe children and…really listen to what they're saying to you," says Ihuekwumere. Paula Hooper, assistant professor of instruction at Northwestern University, agrees. Hooper helps teachers think about, "how pedagogically can I make this situation, a place where kids are sharing their ideas... not afraid to grapple with their ideas, being excited about sharing their ideas." Much of her work focuses on making the classroom a safe place to experiment, to work out students' ideas out in public, and sometimes even to fail.

Hooper and Ihuekwumere discuss some of the social and emotional growth that happens when children tinker. After initially working alone, many children naturally begin to collaborate and share their ideas with each other. They often experience "a-ha" moments when they appreciate what someone else has done. Ihuekwumere says, "For kids at that age to be able to see multiple perspectives of others, to create their own understanding, is... it's really rich." She realizes it might be hard to believe, "but this is actually real and this is something that... it just happens naturally through their play."

The podcast explores how repeated failures and trying again that happens in tinkering also helps children approach conflict in relationships. Ihuekwumere has seen the problem solving skills children use during tinkering extend to other situations in their lives. She notes, "And so you find that it kind of spreads around is just... it pays, it pays forward. It pays forward into other areas of their lives, which is just pretty amazing."

EPISODE 3: TINKERING & EQUITY

IHUOMA IHUEKWUMERE

Site Director of the Transbay Child Development Center in San Francisco

PAULA HOOPER

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MELISSA MCCLOUD

In-home Child Care Provider

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ANYA KAMENETZ

National Public Radio education correspondent

In the final episode of the podcast series, NPR education correspondent Anya Kamenetz speaks with the participants from the previous two episodes, along with early childhood educator Melissa McCloud, about how tinkering connects to issues of equity, empowerment, and social justice.

Kamentz's dialogue with the speakers highlights how tinkering projects are designed to make science feel accessible, particularly to people who might not match the stereotype of a scientist or engineer. This accessibility, they said, often begins with the selection of materials and tools that allow for the exploration of phenomena like momentum or balance. They often repurpose everyday objects such as paper towel rolls or Amazon boxes.

Preschool teacher and STEAM instructional coach Ryan Kurada says everyday materials are essential because teachers

often feel that they don't have the resources to incorporate hands-on science activities in the classroom. But using materials that are on hand, such as the flashlight on a cell phone, shifts the focus away from science as "a grandiose, expensive experiment."

For Melissa McCloud, who lives on the Quartz Valley Indian Reservation in far Northern California, using everyday materials is practical and ties to Native American traditions. She says, "[W]e're natural gatherers, we look around to see what we have in our environment, or what is around us to use…we use what is there." For example, when her students were exploring lights and shadows, McCloud says, "We didn't think of lights and flashlights and stuff. We thought of the moonlight, the sunlight. That's what came into our mind at first."

Tinkering also reduces some of the gender barriers associated with science and mathematics. Before students at Ihuoma Ihuekwumere's early education center began tinkering, she had to get creative to interest her girl students in activities like blocks. With tinkering, however, the girls "took over the classroom" because of the staff's excitement and all the experimenting, laughter, and "aha" moments that were happening.

Early educator Ernesto Rodriguez has a bilingual classroom where students speak English and Spanish. His students range from two-and-a-half to five-and-a half years old, which means there is a big range in terms of their language development and social skills. Rodriquez has observed that tinkering promotes vocabulary and language development. He also notices sharing and interactions among students of different ages during tinkering. As he says, "the young ones learn from the old ones, and the old ones learn from the young ones."

For the speakers, another important benefit of tinkering is that it reduces the hierarchy that is common in the formal education system. Tinkering is inclusive. In a tinkering classroom or tinkering activity, everyone is invited, everyone is a collaborator, and there is no single, right answer. In these ways, professor of teacher preparation Paula Hooper sees tinkering as a vehicle to help children and teachers learn to value differences and understand their unique strengths.

Educators explain how the tinkering approach invited them to learn and discover alongside their students. Rodriquez has learned to navigate the new dynamics that come with tinkering. For McCloud, "It's exciting too, when the kids discover something that we weren't even thinking about." Tinkering also makes McCloud feel valuable as an educator even though she has not been formally certified. Describing her experience with the Exploratorium's Tinkering Studio, she says, "I didn't feel like I was right or wrong. I felt like if I tried, it was, it was good enough. So it really made me feel good and really made me... actually helped uplift myself to feeling like… just because I wasn't a certified teacher, that I wasn't... I wasn't any good."

We're in an interesting moment right now, where there's been a lot of work on multicultural education and white privilege and all these kinds of things that raise up the need for equity.

PAULA HOOPER