

Episode 2:Tinkering and STEAM Learning

Time • 21:20

SPEAKERS

Ihuoma Ihuekwumere, Paula Hooper, Child, Anya Kamenetz, Educator, Child 2, Child and Educator

Anya Kamenetz 00:00

Welcome to the second episode of Tinkering Together, a podcast miniseries from the Exploratorium's Tinkering Studio in San Francisco, California. I'm your host Anya Kamenetz, a journalist and author who's very curious about how children learn. And over these three episodes, we're exploring tinkering from different angles. Now, in this podcast when we talk about tinkering, we mean a pedagogy, a particular approach to teaching and learning, and it's for learners of all ages. One of the many places tinkering is practiced is at the Tinkering Studio, located inside the Exploratorium, the museum of science, art and human perception on San Francisco's beautiful waterfront, the Embarcadero. Last time, we went over the basic parts of the tinkering process. First, issuing an invitation to students to explore a scientific concept — maybe like balance or light and shadow. Second, opening up the focus exploration, so entering a space that's been thoughtfully and intentionally prepared with materials that have a high potential for exploring the concept at hand. Now children play, they generate their own questions, they cooperate to solve problems, and adults balance encouragement with stepping back. And then — this next part is especially for practitioners — documenting, reflecting and ultimately relaunching into a new cycle. And so in this episode, we're going to talk a little bit more about the tinkering classroom and how this pedagogy can not only be a way to explore science concepts, but also enhance children's social and emotional learning. Our first guest is Ihuoma Ihuekwumere.

Ihuoma Ihuekwumere 01:43

I think I come from a family of educators. And so, I gravitated to it. And it was something that I felt that children could, you know, I could make a difference in children's lives, because having a good teacher changes things for you. And I had good teachers growing up, school was fun, I love school! And so if I could share it with, you know, another child, that would be awesome.

Anya Kamenetz 02:14

Ihuoma is a site director of the Transbay Child Development Center in San Francisco.

Ihuoma Ihuekwumere 02:19

It caters to children 18 months to pre-kindergarten age. And we have a wide variety of families that come to us, low income, subsidized payments, and things like that.

Child 02:34

And Ihuoma's school took part in the STEAM Starters project with the Tinkering Studio. So STEAM you might know stands for: science, technology, arts, engineering, and math. And the STEAM Starters

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project, as we heard last time, included a few different tinkering cycles. So one dealt with balance. But if you balance two things with the same way it will be balanced.

Anya Kamenetz 02:57

Another one ramps and rollers. [Children speaking]. And the third light and shadow,

Child and Educator 03:06

Shadow, yes? No shadows! No shadows.

Anya Kamenetz 03:11

And in each case, the cycle started with a book that was kind of the invitation. Then the teachers and students were given a whole bunch of carefully chosen materials to explore. And all of this meshed really well Ihuoma's teaching philosophy at her school.

Ihuoma Ihuekwumere 03:25

We see the image of the child as strong, and capable, and resilient. And we strive to support children in their interests to just learn deeper and wider as much as they can.

Anya Kamenetz 03:39

And when I asked her about tinkering and about STEAM Starters, she highlighted the emotional aspects, both the highs and the lows.

Ihuoma Ihuekwumere 03:47

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.

Educator 04:04

Okay, you want to put one of the cardboards and then put a ball?

Anya Kamenetz 04:09

So in this video, a few kids are taking turns balancing balls on top of a flat piece of cardboard, on top of orange, on top of a vase.

Child and Educator 04:23

[Chatter]that wasn't even tricky.

Anya Kamenetz 04:24

that wasn't even tricky they say,

Child and Educator 04:26

Do you have another ball? Oops, that wasn't tricky. That wasn't even tricky. Good job well try again.

Ihuoma Ihuekwumere 04:35

We're so amazed at the outcomes we can get when we work with children that way. The problem solving, the critical thinking, is just very amazing, very robust.

Anya Kamenetz 04:49

And this is exactly what Ihuoma sees as so valuable about tinkering. It gives children a chance to experience frustration and failure...

Ihuoma Ihuekwumere 04:58

Because, the activities... I call them frustration-rich, and children... having those opportunities — like multiple opportunities — for them to fail at something and, you know, get over their failure quickly, like, to accept failure as part of their progress, is something really amazing.

Anya Kamenetz 05:30

Okay, so in this classroom, there's a little girl with long brown hair, and she's kneeling on the ground, she's really upset her friends are telling her

Child 05:38

[Children speaking and classroom background] take a deep breath, deep breath...

Anya Kamenetz 05:46

take a deep breath, take a deep breath. And she's taking these sort of gasping shuttering, sobbing breaths.

Child and Educator 05:56

Julie is a little frustrated, I think. Do you feel frustrated Julie? Child: Sad. Teacher: Sad? Why do you feel sad? [child indistinct] Teacher: because it won't do what you want? Child: Yeah. Teacher: that's yeah, that's kind of frustrating.

Anya Kamenetz 06:12

But even though she does that she stands up to go back to the table where they have these cardboard tubes and to try again. And that's actually good. Because tinkering has a bigger mission than just teaching science concepts. It's actually seen by practitioners as building a certain kind of disposition, like a whole way of being in the world.

Ihuoma Ihuekwumere 06:32

I think that's where the learning is. Because not only to have to be able to pay attention to what you're doing, you know, observe all the changes or the little... the changes you may make to create something new, and try out everything that you ever imagined, but you're also learning to accept failure.

Anya Kamenetz 06:58

And you know, this might seem strange, because maybe you just started listening, because you're interested in teaching little kids science. But the truth is that accepting failure and managing frustration, these are not just learning skills, these are life skills. In fact, it may seem like a strange endorsement, but one thing Ihuoma likes about tinkering is that it can make children cry.

Ihuoma Ihuekwumere 07:18

It's 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.

Anya Kamenetz 07:37

You know, this is something that there isn't a lot of room for in a traditional classroom. And especially as kids get older. Failure is something that happens at the end of a test, even the end of the semester, and you get branded with that big red "F", and it's not easy to go back and fix it. So it feels really bad to fail. And gradually, kids learn to play things safe and not take too many risks. But with tinkering, it's different, the materials are open ended. And that's really different from other toys that kids often get to play with.

Ihuoma Ihuekwumere 08:06

So when we imagine the toys or toys that they get from, you know, stores, toys that they buy, do certain things. And if you push this button, it will do this, if you you know, but tinkering activities, you just have these materials, where you're in charge of what goes where. So basically, you're the master of your own ship. So however you steer it, that's how it's going to go.

Anya Kamenetz 08:33

Yes, with tinkering kids are in the driver's seat. But they're on a closed course. And there's room to mess up. It's safe to mess up. It's actually good to mess up.

Child and Educator 08:45

Mila What are you showing me? Hey, how does that bead work? Can you try it? Let's try it. Test it? Let's try it. Let's test it. See, when you drop it in it bangs and then rolls back out. Is that what you want to happen? Teacher.. I'm asking a question, honey, look,

Anya Kamenetz 09:06

of course, there's an art to all of this. If the adult in the room just sits back and watches while the kid is getting frustrated or maybe even crying, that's not gonna end well. So tinkering people say there's an important role for the grownups in the room to play.

Child and Educator 09:20

When it rolls it bangs into the cup and then it... Oh, so you want it to go underneath the truck. Gotcha. Okay, so that's what you're trying to accomplish. Now, I understand.

Anya Kamenetz 09:29

And that is as a supportive helper who makes very clear that it's totally fine for everything to not work out perfectly. So in this clip, there's a spoon balanced on top of a cardboard tube. And the little kid is aiming a hairdryer at it trying to get it to spin. You can hear the tube fall over and the teacher says "don't worry, we'll try it again".

Ihuoma Ihuekwumere 09:56

What would you like to try next? Because where we're just trying things, right? So what would you try next? And they kind of get the sense that it's okay. Right? We talk about failure, it's okay to try something else to get the result that I want. And so they, and the teacher's just validating their feelings and saying, "hey, it's okay. It's okay, that it didn't work now, we'll try again and see if it works."

Anya Kamenetz 10:25

So if there's one rule of early childhood classrooms, no matter where you are: tears are going to happen. It's a place for strong emotions. But it's also a place for repair. So this is the same little boy from before he got a plastic tube with two paper clips. And then he's trying to balance it, he's got a hairdryer that is aiming at it, and then it starts spinning! What a thrill. And so there's a couple different lessons happening here. One is obviously about physics—balancing, spinning, momentum, force. But there's something else.

Ihuoma Ihuekwumere 11:03

the problem solving part of it also extends into other areas of their lives. Because you would think, "okay, I tinker and oh, I, I created this, you know, wonderful engineering concept," or whatever it is that they have on their mind. But you see it kind of spread to other areas of their lives.

Anya Kamenetz 11:27

So this is the beginning of the disposition of a tinkerer.

Ihuoma Ihuekwumere 11:31

Like maybe if they were to fall down, you know, they get back up and say, "Oh, it's okay, I'll try again." Or if they're not able to do something else that is not attached to tinkering. Skills kind of go over because it's become their foundation.

Anya Kamenetz 11:49

So I wanted to float up a few levels now to get a bigger picture of what is going on for children cognitively, in a frustration-rich context like tinkering. So I was really excited to talk to Paula Hooper.

Paula Hooper 12:00

My name is Paula Hooper and I am an Assistant Professor of Instruction in the Masters of Science and Education Program and Learning Sciences at Northwestern University.

Anya Kamenetz 12:12

And I asked her for help to define tinkering. She gave me a whole soliloquy.

Paula Hooper 12:18

Tinkering is both an old idea and a new idea. Tinkering is playing. Tinkering is building. Tinkering is making. Tinkering is figuring things out with materials. Tinkering is being creative with materials and tinkering is... and that includes the idea that the materials that you use are both the physical materials and the ideas that you bring to them.

Anya Kamenetz 12:51

Paula is a professor of instruction. That means she teaches teachers. And part of what she teaches them is how to make the classroom a safe place to experiment, to work students ideas out in public, and sometimes yes, to fail.

Paula Hooper 13:06

A lot of the work that I do helps teachers to think about, "okay, how pedagogically can I make this situation, a place where kids are sharing their ideas, not of being... not afraid to grapple with their ideas, being excited about sharing their ideas."

Anya Kamenetz 13:27

So Ihuoma told me a specific story about how she helped a kid figure something out and get past a frustration point without giving him the answer outright.

Ihuoma Ihuekwumere 13:39

This child had his flashlight, and he was using his fingers to, you know, make like puppet to be cast on the wall. And it did not work. He did not have a shadow. And so he he just kind of yelled out, "My shadow is not working!"

Anya Kamenetz 13:56

I think my first instinct as a grown up would be to say, "Oh, you're standing in the way!" In some situations, if the kids like really running out of patience, you might hand them the answer that way. But in this case, Ihuoma asked him what he thought.

Ihuoma Ihuekwumere 14:10

The question was: "Why do you think your shadow is not on the wall?" Versus giving him the answer. And then he said, "I have my flashlight here. And I have my hand here." So he had placed the light source, the flashlight in front of his hand. So he had all the right materials but he didn't have it in the order it was to create a shadow.

Anya Kamenetz 14:34

She was hopeful that this kid was willing to keep working on the problem. So here's what she did:

Ihuoma Ihuekwumere 14:39

And so, I asked him, "When you're outside where's your shadow?" He said, "it's on the floor." And where are you? He said, "I'm standing." I said, "and where's the light, that's the sun?" He said, "is up." So, I said, "so the light comes first, and you that's an object blocking the light source, and then there's your shadow." I said, "Okay. So, how do you make your shadow now?" He was like, "ohh," and then he moved his flashlight behind his hand. And then the shadow came up and the smile on his face was amazing. Like, it's just what I think about. I just smile, because something, it was just a little change that he had to make.

Anya Kamenetz 15:28

That smile. That is a moment where a child takes ownership over their understanding. There's so much joy in that it's like, you can see the light on — no pun intended. And you can bet that he's gonna remember it.

Ihuoma Ihuekwumere 15:40

We could have given him the answers right away. And, you know, "okay, let me just..." but will that knowledge stick with him for the rest of his life?

Anya Kamenetz 15:50

By the way, to respond to a kid's frustration in this way without taking over, that takes some emotional growth for the teacher, for the grownups as well.

Ihuoma Ihuekwumere 15:58

It takes patience from the adults, and also the child. Adults have to observe children and you know, really listen to what they're saying to you.

Anya Kamenetz 16:09

So all throughout this episode, we've been talking about one particular social and emotional aspect of tinkering. And that is dealing with failure and frustration. And in the exploration space for adults, how do you meet kids with patience, with emotional support, so they can stick with the question and get to their own conclusions? Being able to deal with things get uncomfortable when you feel a little bit out of your depth that is important for optimal learning, and mastering that can generalize to other areas of life, whether kids are learning to ride a bike or do algebra. It connects to a concept that Paula teaches about in her classes, which is the Zone of Proximal Development.

Paula Hooper 16:47

When you're interacting with people that, other people and other situations where there might be knowledge that's a little bit ahead of what you're you, you totally understand, that that creates a situation that draws you into making sense.

Anya Kamenetz 17:03

The Zone of Proximal Development comes from an early 20th century psychologist named Lev Vygotsky. And basically, the zone lies in between too easy, which is boring, and too hard, which is frustrating. And this is the best place to be in for a learner to construct new knowledge. The zone is like a slope, that's a perfect sledding angle, not too steep, not too shallow, so you can really get momentum and pick up speed. Vygotsky is a totally foundational genius in children's learning. And he was looking a lot at the importance of cultural and social context for learning, and how children co-construct learning with adults and with each other. Another social and emotional aspect of tinkering has to do with how children interact and collaborate.

Child 17:48

Tony. Hi, jelly.

Anya Kamenetz 17:54

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So here you got a girl balancing a piece of cardboard and cap with a ball on top of a vase. And this other girl comes in asks,

Child 2 18:00

Want me to help you?

Anya Kamenetz 18:02

Want me to help you? And then they do they take turns.

Educator 18:10

Okay. Tony's turn.

Ihuoma Ihuekwumere 18:13

And then you also see the teamwork that happens with... between children. Like it becomes this social experiment where at first they want to work alone in their tinkering, and then they see someone else has a great idea, and they they mosey on over to say, "Hey, how did you do that?" And suddenly, they're working together, creating bigger and better things.

Anya Kamenetz 18:40

Paula Hooper says sharing is important when the kids are exploring. And it's also really important when they come back together in the final step of tinkering to explain the outcomes of their experiments.

Paula Hooper 18:50

How can you shape and support focused investigations, and then some time for sharing understanding? And that can happen in lots of different ways. It can happen in kids sharing and showing what they've done and having conversations with each other. It can happen in kids creating some artifacts to represent what they've done.

Ihuoma Ihuekwumere 19:12

For kids at that age to be able to see multiple perspectives of others, to create their own understanding, is... it's really rich. And it's only when you see it in motion. Talking about it always feels, "eh, how could that possibly happen?" But this is actually real and this is something that... it just happens naturally through their play. When you try something and somebody else tries it in a different way, and you're like, this aha moment, like, "Oh, I really have to learn that trick from you, or what your process was."

Anya Kamenetz 19:51

Aha, that "aha moment" and Ihuoma says it's not only in the warmth of collaboration that children's social skills grow through tinkering. In the repeated failures and the trying again, that happens in tinkering, it also gives them a hand of how to approach conflict in relationships too.

Ihuoma Ihuekwumere 20:07

The students are now saying, "Oh, I'm sorry, I hurt you, what should I do next time?" Right, that now I'm thinking of next time, so I don't hurt your feelings. And that's the same language that they're using, you know, when they're working. It's like, Okay, next, time I'm going to put the ball over here instead of

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there. 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.

Anya Kamenetz 20:42

And this has been our second episode of tinkering together. Stay tuned for our final episode, where we're going to talk about equity and learning, and how tinkering can help promote it.

Paula Hooper 20:52

The cultural context in which we learn also is an influence to how we put our ideas together within ourselves and those in interactions with others.

Child 21:04

Thank you tinkering friends!

Anya Kamenetz 21:07

Thanks so much for listening. If you have feedback on the podcast, please go to tinkeringtogether.org. We're gonna have a forum for comments through April 4 2022. We'd love to hear from you.