PLIX Conversation Starter

Week 2 || Luigi & Katherine

Michelle: Welcome to Week 2 of our Facilitating Creative Learning chat. We are joined this week by Luigi and Katherine. Would you like to introduce yourselves, please?

Luigi: My name is Luigi Anzivino. I work at a science museum in San Francisco called the Exploratorium in a space called The Tinkering Studio. It's a space where we design and we offer to visitors hands-on activities that explore phenomena relating to science, technology and art. We offer the opportunity to build something tangible, manipulate some materials, have direct experiences with phenomena, and develop some understanding about the world in the process.

Katherine: And, hey, everyone, My name is Katherine McConachie. I'm a member of the PLIX team from the MIT Media Lab and also the Assistant Director of the Digital Learning and Collaboration Studio at the Media Lab which PLIX is a project of. My background is really in engineering and education. I've been working for the last several years thinking about how to design more creative and collaborative online learning communities as well as hybrid communities like PLIX where folks are learning together in online spaces and then going back to their local communities to implement exciting creative programming.

Michelle: Let's get started thinking about how to prepare workshops. Luigi, could you talk a little bit about how you do this at the Exploratorium's Tinkering Studio? How do you guys decide on how to frame a workshop?

Luigi: Definitely. Let me give a little bit of a background. So The Tinkering Studio is a physical space within the museum floor. It's a fairly small space, but we have full control over it, and so we can kind of design it and change it around to fit whatever exploration or activity we decide to offer. And we do this pretty often. Every few weeks we try a different type of exploration.

When we think about what we want to engage the visitors that come into the museum with, we have to think about a few things. One is that they are in the middle of a visit to a very exciting hands-on museum that has a lot of alternative, competing things they could be doing. So, there needs to be some kind of hook, some kind of immediate, engaging factor, otherwise they could just skip it and go do something else.

And the museum is already very hands-on, but a lot of the exhibits in the museum require you to try something, have a mini experiment, and then see what happens, try to learn or gather something from it. So we're trying to offer ways in which you can actually make a mark and change something about the environment that you're in, right? We design activities that are transactive, where you change the activity, and the activity changes you in some way.

And the way we think about them is that we're not trying to design an activity that's supposed to teach you a concept, but it's rather an activity that is supposed to provide an exploration space. That's the framing that we put around things. We try to design for an exploration space, so we start with a phenomenon or a concept or an idea and we think about how can we provide loose boundaries around this phenomenon that still allow a lot of agency and choice that the learners can have as they enter this exploration space.

Katherine: Yeah, and I love that idea of an exploration space, I think something related to framing learning activities, for me, that I'm always thinking about is: what are the right constraints to set for the learner and how can you set them in a way that doesn't make things too prescriptive? And, but at the same time, doesn't have things set so broadly that a learner might feel like a little intimidated to get started or feel overwhelmed by all the possibilities. So really finding that sweet spot, I think, is something is something that I think of.

And this really resonates with the idea of Seymour Papert, furthered by Mitch Resnick of low floors and high ceilings. Designing activities that have a low floor: they're easy for beginners to get started with. But, you know, they have a high ceiling: there's lots of places that you can take them. You're not just going to complete them right away and feel like "okay I'm done with this." There's room for that possibility space, that exploration space for you to bring your own ideas into the mix.

Luigi: Yeah, and we use that same metaphor all the time when we think about how to design for this exploration space.

A big idea that is important to us is that of "learner's choice". We try to design activities so that there are multiple ways and multiple points at which learners can make choices to pursue personally meaningful goals or results or outcomes. So one of the ways that we do that—and I think this gets to the low floor idea—is that we design for an accessible set of materials. Things that learners can easily get started with and have some initial success that kind of kicks in that initial engagement, right? and makes them feel like "Oh, I know how to do this, and I can now see ways to get deeper into the activity."

And another way is to provide many ways to get started with an experience, so that there is not just one way into an experience. That way learners that have different backgrounds and different interests that might connect with this activity, they have, immediately, a way to get involved with it. They can see themselves in it.

Katherine: Yeah, exactly! And that idea of like bringing your own interests to the table and seeing yourselves in the activity. Is really that additional sort of wide walls. So we have low floors, we have high ceilings, and we have wide walls. For me, I see that “wide walls / multiple pathways into an activity” as really connected to the passion “P”, of the four Ps.

We have projects, peers, passion, and play. And I think helping learners get started with the project that they're working on is part of this, but allowing them to bring their own interests and passions to that project in the way that that exploration space or those constraints are articulated I think is really... it's really important as well

And I love this idea of starting with the materials as the initial inspiration. I think many of our PLIX activities that we design have done some of the work of articulating some of those interesting materials that are great to create with. We love to see librarians and library professionals in our community then articulating the different types of exploration spaces that those same materials could be used with.

Yeah, and I think the last thing I’ll mention, maybe, is this facilitation tip that we have of “Framing activities to encourage creative possibilities.” Something that I'm always thinking about when trying to do this sort of prompt articulation is: how do you create that exploration space? I think one really concrete strategy for doing that is when you're coming up with an activity prompt to think in terms of like a theme that will nudge your participants to create within an area, for example, like: “make something that you would imagine being in an enchanted garden with Scratch and micro:bit.” There you've got your materials. There you've got a little bit of constraint to help you get your imagination going, but you can still bring all of your interests to the table.

Articulating something around a theme is one way that I think makes it easier to have those creative possibilities come to light, as opposed to articulating an end product, where everyone makes the same thing. There's just less room there for people to bring their own ideas to the table if you're telling everyone to “make a frog” or something like that — I think that’s the example we talked about frequently. Even though, like I could imagine everyone's frog turning out differently, I think it's just like maybe slightly too constrained.

Luigi: The idea of inviting people to explore a phenomena, instead of “make a product” is, I think, huge. We do that all the time.

We've been trying to figure out ways to engage teachers and parents and educators from home, in activities. One of the new things that we’ve tried is to invite people to play around with the idea of balance. When we think about how to structure these activities, we think about three main components:

- We think about what materials we're going to use or offer to play with.
- We think about what the environment can be that those materials show up in, and then
- We think about what prompt, like what do we say, how do we invite people into the activity?

It's tough to do this remotely...via Zoom, but we can ask people to collect materials, for example, that they could find at home that we've figured out through previous R&D sessions and prototyping on our own that they're probably interesting, good materials to use. These are things like fruit or kitchen utensils and chopsticks. And things to make connections, like clothespins, and things to put weights and play with weight and balance, like coins or washers. We don't have much control over the environment, but we can suggest a flat surface. We can suggest that they might gather some bases for balancing things on, like mason jars or wine glasses turned upside down and things like that.

And then we think about what do we tell people that we're doing today, and I think to your point, Katherine: a prompt that allows for multiple outcomes, where we're not so invested in the end product, but we're invested in kind of fully exploring the space and allowing for their personal interests and motivation to guide their exploration can result in a more open prompt.

To give a very concrete example: to explore balance, what we say right now is: “make a balancing sculpture that balances on a point, and moves in some kind of way.” So we found for now that this is a specific enough prompt that gets people started experimenting with balancing things, on a point, even though they might not end up there. They might end up becoming more interested in hanging balance and mobile type of exploration. But it's open enough that allows you to go in different directions.

Katherine: If you're thinking about running a learning experience, where you're encouraging folks to bring their own ideas to the table, take the prompt in a direction that's personally meaningful for them, as a facilitator you're creating an environment where, you know, not everyone is going to be working on the exact same thing. That's actually maybe a little bit of a challenge, or a

change in mindset. In terms of how you might think about helping people get started or helping people troubleshoot or helping people when they get stuck.

And for me, I think that diversity of outcomes for any learning experience is like a great check that I always am using for myself as like, “Did this prompt, when I ran it with a group of people, lead to a wide diversity of outcome projects? If so, I think that's one good metric for seeing how good your prompt was to start out with, since that's what we're striving for.

But when you have this “not everyone is building the same thing” or “not everyone is following the exact same set of instructions” rather they're bringing their own ideas to the table, they're leading their own exploration, I think, examples —rather than step by step instructions— are a great facilitation tool that you can have in your pocket to nudge people in the right direction, to give them a few ideas to start out with without explicitly stating them and allow them to have something that they can use as a resource to start playing around with, to start building off of.

Thinking of those example projects as just helping you as a facilitator, an additional resource that isn't you or your co-facilitator, for example. You can always point someone at an example project being like, “oh that's an interesting idea, you have! Check out that example! It kind of does something similar. Could you make it better?” Thinking about examples, rather than instructions in your learning experience space is like really going to help you as a facilitator to work towards living up to this idea of helping your patrons explore and encouraging creative possibilities.

Luigi: Yeah! I agree and, for us, examples serve a very important purpose, because we are asking visitors to engage in activities that are very unfamiliar most of the time with materials and prompts that haven't encountered before. So how do they even know what's possible and what's expected? What is the shape and the boundaries of this exploration space that we're creating? Examples go a long way, because they provide some possibilities both to begin with, to get started, but they also show the high ceiling examples, right?

We found that there is a balance to be struck in the type of examples that you offer in a space. We try to always stay away from being too product-focused. In the end, we think that it's the process that we invite visitors to engage with that's going to be interesting and that's going to stay with them. Oftentimes we even don't let people go home with their product at the end. But sometimes if you show examples that are very complete, very finished, and they look beautiful, and they look very attractive, it's easy for that to become the goal, right? I want one of those, and so what we start seeing, in that case, is visitors start copying and trying to reproduce those examples, because they just want that thing that looks really cool.

We do this intentional operation of vetting the examples that we have available and deciding whether they're too good to be out or they're at the right level of fit and finish. For us a good example provides an idea, gives a little bit of a suggestion for where to go, but it doesn't tell the full story. It's kind of like the opening paragraph of a book. It kind of sucks you into the story, but then you need to write the rest of the story for yourself.

It's also really good when examples do one thing, and they can be used like you said, Katherine, to kind of troubleshoot or help facilitate learners through difficult moments or moments where they get stuck. And that goes to: where does the expertise reside in the room? As facilitators we try to always sort of put ourselves not in the role so much of experts, as in the roles of co-learners and kind of curiosity guides for the learners.

It's really great when you can, as a facilitation move, point to an example that gets closer, addresses that part where the learners are stuck. Because then they get to work out the solutions for themselves, and that leads to a whole different feeling of agency and empowerment, which is ultimately what we strive for in tinkering, more than, if I as a facilitator just told them, like, “Oh, this is easy! You just move this over here, and the whole thing will work.” So they can serve those purposes.

The other end of the spectrum is that sometimes they also want to be inspiring, right? You want to provide the sense that if you stick with this activity, if you stick with these materials, you can actually go really deep and get to that high ceiling. So really beautiful, finished examples can serve that purpose. We struggle with this a lot because, again, they can invite copying, and so our solution is just put them far away, in a way, like: put them up high, put them behind glass, inside of a case so that they're not as accessible, and they communicate, like, “Look: these are aspirational, these are inspirational examples. The ones that are on the table that you can pick up, you can try out, and you can work out how they work: those are meant to be the ones that you begin with, and those are clearly unfinished.”

And something that I really love that you said is a good example for me is one where a kid can look at it and immediately think like, “Oh, I get what this is trying to do, but I have a better idea for it” and can immediately find an improvement on the example.

Katherine: Yeah, exactly, and I love that moment. As a facilitator or a designer of that learning environment, when you see a young person, be like “Hey, that's cool,

but what if it did *this*?", and can kind of set them off on that learning journey that's like such a it's such a wonderful moment as a facilitator to be able to set up that type of experience for someone. That's something that I'm always striving for when i'm facilitating.

I love, Luigi, the idea of sort of an example as the opening paragraphs of a book. Sometimes the way I think about designing examples is for them to be "thoughtfully incomplete". It is like a design challenge as a facilitator to think about: "What are the types of examples I want to include for this prompt?"

I think it's also one of those things that emphasizes that facilitation itself as a practice, because I feel like I'm always learning about how to design examples for various types of things, and I learn more and more, the more types of workshops that I facilitate.

We have a paper circuits activity as part of PLIX. When we were initially running this with some libraries in the Boston and Cambridge area, we were thinking about these example projects. Initially the set of examples that we created were both project-based but also some just basic circuit templates. Something that we didn't really think about initially was that they were all two-dimensional, flat, on pieces of paper. What we were seeing was that all of the participants in our workshop, for the most part, were also creating two-dimensional projects. There was a variety of them, and they were very interesting and exciting, but there was this "You can also fold paper! And you can do three-dimensional sculptures and origami!" That works really well with paper circuit material, but without us having included a 3D example, we weren't able to nudge the participants in that direction.

So I think that's a good example of sometimes the influence that an example you include in your workshop can have over, concretely, the types of projects that your learners will work on. It is important to be really thoughtful about that example space that you're carving out for people to, as you say, help articulate the boundaries of that exploration space.

Luigi: I think there is this beautiful combination of design and facilitation that is in the art of making and offering examples, like you said. Because you have to think about it when you're making or selecting examples: how are you going to use them as facilitation tools, not just as inspiration tools. And one of the things that a good example, can do: it can be a place to go troubleshoot things, right?

I realized, one of the things that we started doing— and I want to give credit to my colleague Sebastian Martin, who is an excellent facilitator. During workshops, we often invite learners into this activity we call Marble Machines, where you have to build a marble run with lots of kind of hardware store and household items on a pegboard board. So we use a very specific prompt for that—and, by the way, there's a good story about that here: we used to say to learners: "We want you to build a machine that will take a marble from the top, to the bottom, as slowly as possible." And we didn't really care for the length of time that the marble took but we thought that this was a good prompt to invite lateral thinking, because, in order to find ways to slow down a marble, then you start thinking about alternative uses for materials and ways to make the marble go uphill or ways to start a second marble, and so it just opened up a lot of possibilities so that's that's one thing about prompts they can do.

We realized that people were taking it too literally, and they were actually timing their marble. And they got into this competitive mindset which — there's nothing wrong with competition; we prefer collaboration as one of the goals that we strive for. And so we just changed it very slightly, and now we say "We want you to build a machine that takes the ball from the top, to the bottom, *slowly*" instead of "as slowly as possible." And that made a huge difference, and now we don't see this competitive behavior nearly as much. This is just to say that, just to be very intentional about the words that you use. Even small changes can have a huge impact.

To get back to the example and facilitation connection: Something that I've seen my friend Sebastian do is he would build an example to introduce the activity that was very short and intentionally try to make it so that something would fail. So that, as he showed the marble run down a couple of tracks and maybe try to jump off of a rubber band, something would go wrong, the marble would jump off the marble board. And then he would talk through what just happened and what he was thinking about changing. He would say "Oh, I noticed the marble just kind of went off over here on this side of the track, but I think if I just put a little bearing there, it would hold it in. We'll try that change it, and run it again and, hopefully, something different would happen."

That was a beautiful way to model using an example as a way to troubleshoot through a problem. It communicates so much through that. It communicates that mistakes are perfectly fine. It communicates that even the expert is showing the example can mess up, and there isn't a problem with that. It communicates how to troubleshoot and think about what the next step could be, and how you could shift goals to your construction, and shift strategies in order to get to the next step. That's another another role that examples can play.

Katherine: Yeah, and I love the work in that story you just shared. I love how it also is doing some work of situating

the facilitator as a co-learner in the space, and really underscoring that they're not just an expert who's going to tell you when you're doing something right or wrong, but they're actually maybe someone just working on their own project alongside you, like a peer, or a co-learner.

The nice thing also about highlighting examples as a way of giving people ideas or giving people resources to troubleshoot is that you have— in a typical workshop space—maybe you're surrounded by other participants, peers, who are creating their own projects. And those are examples that are in the works, projects in the works for that help, that troubleshooting, that inspiration!

It's nice as a facilitator, I think, to do that right off the bat: to showcase projects as a source of expertise or information or inspiration. Because it then makes it easier for you to point someone at a peer's project, or for a participant just to see someone across the room, making something interesting, and then want to go check it out and see what they did, in the same way that maybe they looked at a project. Or highlighting examples can also help you encourage peer learning, maybe, as the workshop continues to unfold.

Michelle: How do you set up the environment itself to make sure that those kinds of peer conversations happen? How do you place examples and materials? How do you choose materials to set up that learning environment, to facilitate those kinds of conversations?

Luigi: There isn't a place that clearly communicates "This is where the figure of authority, or the expert, sits." That means that we often we use round or circular tables where learners can see across the table to each other. And we place materials and examples in the middle of these big tables, so that you're forced—just the sightlines force you—to look at other people. It's in some cases we've seen some resistance to this.

Paying attention to how people are seated around—we typically use rounded shapes—people seated around them so that they can see each other, and they have to look at other people's work and examples and share materials. This is one of the ways that we encourage this peer-to-peer collaboration and relationship-building.

There's also kind of a resource management aspect to this where having enough examples to go around but not so many. You want the case in which two learners might have to share an example, or one has to be done and pass it on to the other. Because there are lots of opportunities in that to actually build a relationship.

Something that I really love to see is when kids, especially, start becoming and feeling that they're gaining expertise, and they now hold this role of being able to help others that are entering the space as slightly more novice learners. And so there's something really powerful in giving the kids themselves the ability to help others through what they're struggling with. Sometimes that can be as simple as, "Oh, hey, I think the example you have right now could help this other person here. Can you show them how that works?" So again that making the connection between using examples and facilitation moves together to further your goals.

Katherine: This idea of resource management is a really interesting one. It's like another tool in your toolbox as a facilitator. I think this is something that we've seen in the Scratch and micro:bit activity that we have as part of PLIX. I think it actually turns out better when not every learner who's participating has access to their own computer to work on Scratch and micro:bit just alone. There's something about sitting in front of a computer. It's designed for one person to use, so when everyone has their own individual computer, it's almost harder to get people to collaborate. But when we, from the setup, encourage small groups to form—maybe like two or three learners per computer and per micro:bit—it's just like you're setting yourself up right away in the learning experience to have people collaborating, have people teaming up and bouncing ideas around off of each other. So that's another variable that as a facilitator you can sort of play around with.

Luigi: There's something so nice about asking people to work in pairs. It does jumpstart collaboration, but they also get to talk to each other. Then as a facilitator, you have access to their inner monologue which otherwise would be completely silent. It gives you as a facilitator this tool, which is just because there's two of them, and they have to talk to each other, you know what they're thinking, you know what they're struggling with, and you can listen, you can decide when to intervene and in which ways

We try to stay away from artificially limiting resources. That serves a different goal, if you're designing an engineering challenge, for example, where solving a problem with a limited amount of resources is the goal, then it makes perfect sense. But, by and large, we would like everybody to not feel like they have to compete for resources. They don't have to hoard things so that they don't run out of them. That again gets you into a different mindset of competition versus collaboration.

We like materials to be plentiful—in terms of what you work with and what you build with—but we limit the types of materials that you have. We decide on a palette of materials. Once we've decided on that palette for each type of material, we will want to provide plenty, so that it doesn't feel like you're running out of marbles or you're running out of foam pieces or you're running out of wood. That's a process! You don't come to it right away. For us it

often means starting with too many materials, with too large a palette and bringing everything out when we're developing a new activity. Then, seeing, through reflection and documentation, what is actually rich for exploration, what is confusing, what takes the activity in a direction that we don't want to take.

As we say, we try to define an exploration space, and that means putting some boundaries on it. And then, what do you do when learners start escaping those boundaries and deciding to take this activity in a completely different direction? Well, for us, that means re-evaluating what are we offering in terms of materials? Why are they suggesting something other than what we mean this exploration space to be? Oftentime that materials that encourages decoration are especially tricky to find the right balance for them. It's easy for any activity to become a crafting / decorating activity. If you have enough markers and feathers and things that you can stick to other things. That's one of the trickiest of places, where your expertise and practice will guide you.

Katherine: Thinking about example projects when running a workshop with Scratch and micro:bit — something that I love about Scratch is that there is the ability for you, as a facilitator, to make an example project, for example, with Scratch and micro:bit, but there's also this wide community of people all around the world, making Scratch projects. You can do a quick search on the Scratch website for micro:bit, and you're going to find projects from all over where people have paired Scratch and micro:bit together. So there's almost a resource there of examples that you might choose to showcase in your workshop, or a place for inspiration for you to look for different workshop prompts that maybe you hadn't thought of yet or different example projects that you might want to make.

The other thing I love about pairing Scratch in particular with micro:bit is that when you do have an example project for your learners to look at, it's easy—it's built into Scratch—for them to sort of take a peek inside and see the actual code blocks that were used to make that project happen. And then there's the sort of wonderful remix ability. You can always, again— thinking about that low floor and high ceiling— maybe for someone who's never used Scratch before, that low floor isn't quite so low, starting with a totally blank canvas, a totally blank stage. You can drag any block you want even if you've never done it before: maybe that seems a little intimidating.

You can always start someone off with remixing a project that already exists. There's code there, it already does something, and then Scratch makes it so easy for you to just pull out blocks and see what happens. Change this, change that, and really start tinkering and building off of that. Then right away, again, you've got that low floor back. Depending on the learner, you can—as a facilitator, with something like Scratch and micro:bit—you can start your different participants off wherever their low floor needs to be.

Luigi: The beauty of Scratch is that it's designed to be low floor, high ceiling, and wide walls, and so those things are embedded in the way that the tool itself works. And we've been using Scratch on the floor of The Tinkering Studio a lot in the last few years. And we see that children are attracted to the tool. But like you said, Katherine, they need a little bit of scaffolding to see the possibilities, to open up the range of explorations that are available.

Oftentimes an example can do that because, again, you can have an example project that is like the opening paragraph of the book. It is not a complete sentence. It is not a complete story, but it invites to you to complete or to add your own: to change the character, to change or edit a character that you design.

Another feature of Scratch that I think is super-powerful is the idea of microworlds, which is where you can make a smaller group of tools available as you begin using the program. And that to me is equivalent to that curation process that I described, where you choose a palette of materials and tools to give to learners to begin with. It's that connection between facilitation and example or material selection, that I was talking about. We know that there are a certain types of explorations that tend to be most effective at the beginning of a project in Scratch, for example. But there's so many tools available that learners can easily get lost or get really fascinated ... by a color-changing command, that, while super-fun to play with, isn't really going to progress the exploration forward in the ways that we want. So we can remove that for a while, while learners get situated in the right exploration space and then add it back in to allow that personal expression and goals-selection and problem-posing that we really like to encourage.

I think the connection with micro:bit to me, is very important because we like to keep this idea: computer as tool, computer as material, something that you play with and you build with, but it's not the end result.

We found more and more recently that kids come into The Tinkering Studio, they see Scratch, they recognize it. They're experienced with Scratch—although it's been in school, as part of a code class, and it's been very regulated and structured. And when they see that through this tool that they're familiar with in this other context, they can connect with the real world and actually affect change in physical reality, their minds open in a way that I've rarely seen. They start seeing possibilities all over the place, and to know that this is then a tool that they can

have at home, is super-powerful because it's not something that you can only do in the special place at a special time at The Tinkering Studio. We've now given a key that they can take home, and with it open a lot of different doors.

Katherine: I also love pairing micro:bit with Scratch, because, similarly to what you said, Luigi, it just opens up a whole new exploration space of connecting like tinkering in both the digital and the physical world. And that sort of extension into the physical world, the possibilities are so exciting.

It's so easy to see an interesting example of a micro:bit strapped onto a mustard bottle that, when you shake it, it makes a little mustard splat on the screen. Just the delight that— an example like that, it is a very simple Scratch project–but the delight that an example like that brings to people is just, it's so inspiring. I think it's such a great way to invite people into using code, again, as just another tool to create with. I think that there's something about the way that Scratch and micro:bit pair and how they were both designed that really encourage them as materials to be used in that way.

Michelle: Right now I'm feeling so excited to go try out these tools and try to make some example projects. Maybe we could send off our librarian participants with a few words of advice. I really want to thank you for joining us today.

Katherine: Coming back to this idea of facilitation as a practice. I am constantly learning new ways of applying these ideas to different types of workshops, with different types of materials. I just get so much excitement and enjoyment out of thinking through these ideas. I would just encourage you to just think of this as a creative endeavor for yourself and to really know that you're going to learn and grow as you continue to do it and practice. And that it's okay to just position yourself in a workshop as a co-learner, during the workshop itself, but also as you're running it. You're learning as you go and you can improve, the more workshops that you run.

And I think it's always okay, when someone asks a question or something that you don't know, to be like "Huh! I don't know! Let's see if we can figure it out!" or "Let's ask some other people in the room!" Learning how to do that as a facilitator is sometimes not easy. But I think it's really important, and I think you've got these things like examples and the exploration space that you've set up as sort of things that are there for you as a facilitator, it makes it a little bit easier when you put those things in place in the prep stage for you to just be authentically a co-learner and a peer in the learning experience.

Luigi: In terms of parting words, I would say, something that we say in The Tinkering Studio to keep in mind is that "The big idea is their idea." "Them" being the learners. To remind ourselves that we want to keep the learners' ideas front and center and drivers of the experience all the time.

This connects with what Katherine was saying about positioning yourself as an educator, as a facilitator, really as a co-learner, and not so much worried about what kids are learning in terms of content and concepts relating to science, for example. But maybe shift the focus to thinking about what are the kids learning about themselves? What are the kids learning about how they learn and how they think? Build a sense of belonging, as scientists as artists as makers and and, eventually, you know empowering them to feel agency —right?– that confidence. That they can make choices, they can think independently, and they can take action on the world to develop their own understanding.

That is really the ultimate goal of the work that we do, and everything else follows from that. When you have empowered learners, they are empowered to pursue their own understanding to learn all the concepts that you want them to have, at the end. But if you don't have empowered learners, everything becomes more difficult. So the ultimate goal of tinkering, for us, it really is to create empowered learners.

Michelle: Well, Luigi, Katherine: Thank you so much for joining us today and sharing your depth of experience in this field, and I really thank you again.

Katherine: Yeah, thank you for having us.

Luigi: It was a pleasure. Anytime, right?

Note: This transcript has been edited slightly from the audio. Some pause words have been deleted for clarity.