

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Lindsay: Hi, I'm Lindsay.

Marshall: And I'm Marshall. Welcome to Tumble, the show where we explore stories of science discovery.

Lindsay: And today we're going to learn how to make an invention.

Marshall: Oh man, I really need that because I've been working on bird jackets for some time.

Lindsay: Bird jackets?

Marshall: Yeah, I just need to apply for a patent.

Lindsay: Well, you're in luck because we're going to learn the five steps to a successful invention with help from a real life inventor.

THEME MUSIC

Marshall: Ok, so you literally just said there are real life inventors, but... like, really? Are there? Is that a job people have?

Lindsay: To find out what it takes to become an inventor, I talked to one named Josh Miele.

Josh Miele: My name is Josh Miele. I am a scientist, and what I do is I invent cool stuff for blind people, and I'm especially good at it because I'm blind.

Marshall: Alright, well, so I guess you're bringing me real life proof that there are real inventors, and one of them is named Josh, and he's a scientist who happens to be blind.

Lindsay: Yes, Josh works at a technology company right now, and he's worked in science labs in the past. But he's always wanted to do one thing.

Josh Miele: Really my heart is in designing cool stuff for blind people, and really everybody to use. I like to make things, I like to make things easier.

Marshall: So what things has Josh invented?

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Lindsay: A bunch of things! For example:

Josh Miele: The audio description platform for YouTube.

Lindsay: That's the way that blind people can watch YouTube.

Marshall: Oh that's great.

Lindsay: And he invented a new way to use something called a smartpen, to help blind people get more information about the things the pen is touching.

Marshall: Wait, a magic talking pen?

Lindsay: Basically! And here's one more that you'll probably really appreciate, Marshall.

Josh Miele: I've invented a braille code system for chord charts. Braille is a writing system that lets blind people touch letters.

Marshall: Okay, that's super cool. So like, chord charts are a way of writing music down -- like, if someone wants to learn to play a song on the guitar, they'll just read the chord charts. And braille is also a way of writing. And Josh figured out how to combine them!

Lindsay: It is pretty cool. Josh told me that his disability makes him a natural inventor.

Josh Miele: One of the things about people who are blind or people who have various kinds of disabilities is that we always need to invent stuff.

Lindsay: Josh's ability to invent started young, when he had to invent ways to participate in school and sports.

Josh Miele: I would have to come up with ways of, you know, "How am I gonna throw a shot put and make sure that it goes to the place I want it to go?"

Lindsay: Josh said that's a common experience for people who have a disability.

Josh Miele: Like whether or not we actually call ourselves inventors or have jobs that say that we are inventors, a lot of us are always trying to figure out, "Okay, like, I can't do X, Y, or Z. I use a wheelchair, or I can't hear, or I can't see. What am I gonna do?"

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Marshall: That makes a lot of sense.

Lindsay: Totally. So, being a problem solver his whole life, just by necessity, put Josh on the path to becoming a professional inventor. And he told us that every invention takes just five steps.

Marshall: Just five steps? Oh, wow. Okay. What's the first one?

Lindsay: Here it is.

Josh Miele: In inventing, the first step is always to identify a problem that you wanna solve.

Marshall: Alright, well, so the problem I want to solve is that birds get cold sometimes. Figured that out. Next step.

Lindsay: Okay, let's actually work with a real example of a problem that Josh had that led to one of his favorite all time inventions.

Marshall: I don't know, birds being cold is a real problem.

Lindsay: No, it's not. (laughing) Okay, Josh's problem was that he needed to know where things were in his neighborhood.

Marshall: Huh, so wasn't there like some kind of way for him to get that kind of information?

Lindsay: Well, there is a pretty popular invention that most blind people use. A cane.

Josh Miele: I have a cane that I use to check out the ground in front of me. And I also hear the sound of my cane. That sound is a sound that bounces around in the world, and I can hear it bouncing off of buildings and trees and stuff like that.

Lindsay: And when Josh is gathering information with his cane, he'll learn where certain things are, and use those things to learn where other nearby things are.

Josh Miele: So I use my cane, for example, to find things that I want to use as landmarks, right? If I know that there's a newspaper stand on the corner, just a

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

little bit up from a restaurant that I want to go to, then I'll use that newspaper stand as sort of a landmark.

Marshall: Wow, so like with his cane, Josh is building like a mental map in his head using these local landmarks.

Lindsay: Right. And THAT's how Josh recognized the problem that he wanted to solve. He and most other blind people have to build maps in their own heads. There were already some maps that blind people could use, but they weren't street maps. They were things like maps of things like countries or continents. That can help you learn some things... but it can't help you learn your way to the supermarket.

Josh Miele: I invented this system because I wanted more information about what was out there in the world.

Marshall: Okay, so that's a problem Josh wants to address: There was not a way for blind people to get geographical information. That seems pretty basic, like that should be made accessible to everyone.

Lindsay: Exactly. Which means we're ready for Step 2 of Inventing!

Josh Miele: The second step is to make sure you understand the problem that you wanna solve.

Marshall: Okay, so in my case, I do understand that birds get cold, but it sounds like Josh also understands his problem pretty well already because he's lived it his whole life, so why can't he just go right to solving it?

Lindsay: Good question.

Josh Miele: It's not enough to just invent the technology. The technology has to work in the entire system of people's lives.

Lindsay: To help us understand why this is so important, Josh told us about one invention of his that failed because he skipped this step. He wanted to invent gloves that could help blind people use their fingers as a keyboard.

Marshall: Braille gloves?! That sounds super cool. But why didn't it work?

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Josh Miele: You know, people don't wanna wear gloves.

Marshall: Yeah, I mean, I guess I don't want to wear gloves. (laughs) That's accurate.

Josh Miele: So the idea was a good one, but bringing the idea from the lab into the real world to make it a product was actually a real challenge.

Marshall: Okay, so it's not just figuring out a solution to a problem, it's figuring out whether your idea will actually be something people want to use.

Lindsay: One hundred percent. That means that you have to actually talk to the people you're inventing for.

Josh Miele: In the context of disability, that means talking to people with disabilities. If you already are a person with a disability, it means talking to other people with disabilities to make sure that you really do understand that problem.

Lindsay: So that's why, even if Josh thinks it would be cool to make maps for blind people, he needs to talk to the people he wants to use the maps.

Josh Miele: The first thing to do is find out, do a little bit of research, be a scientist, ask the person that you think it might be useful for. "Hey, I thought of this idea. Do you think this might be useful for you as a person with a disability?" And if they say no, then do a little bit more research, find out why wouldn't it be useful? What would be useful?

Marshall: Okay, so like Josh would say, like, "Hey, this would be useful for me, would it be useful for you too?"

Lindsay: Yes. He needed to find out when and how they'll use the information, how they'll want to carry it around, just everything about how it could fit into their lives.

Marshall: And so, did Josh learn that other blind people also wanted more information about how to get around their neighborhoods and cities? I feel like they would, right?

Lindsay: Yes, they did. And he was realizing that he wanted to invent a map that blind people could read. The people he talked to just loved the idea.

Josh Miele: And so people were very excited.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Marshall: Well that's awesome! But it's kind of crazy they didn't have maps already? Was it because no one thought about it before?

Lindsay: Well, Josh told me that actually... a lot of scientists didn't think it would be possible for blind people to use maps.

Josh Miele: And I knew as a blind person that that wasn't true.

Lindsay: So now he needed to figure out how to make these physical maps possible.

Marshall: Okay, so I get the problem, I think. It's like, maps are completely visual. Whether you're looking at a map on your phone or a paper map, you have to use your vision to get the information. How do you translate that for someone without vision or has a hard time seeing?

Lindsay: Well, Josh knew he could find a way.

Josh Miele: A hurdle, a challenge for people to realize that while vision is really cool, I'm not knocking, being able to see, but it is not the only way.

Marshall: I really like how Josh thinks. So... what other ways did he think of? And did people like it? Or did they try it and say, "Eh, forget it?"

Lindsay: We'll find out how Josh took the next steps to invention, after we follow our maps to this quick break.

BREAK

Lindsay: We're back! We're mapping our journey through the process of invention.

Marshall: Nice one.

Lindsay: So we've gone through steps one and two. First, identifying the problem, and second, making sure you understand the problem.

Marshall: Alright so I assume after step two it's step three, because that's how it usually works.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Lindsay: You're right. (Laughs)

Marshall: Right. So what did Josh do after he understood the problem?

Josh Miele: Then the next step is to explore options for solving that problem. You wanna make sure that you think about lots of different ways that the problem could be solved and be creative about it. And then you take those options back to the people who understand the problem the best.

Marshall: Okay, I got it. So you make a list of lots of ideas of how to solve your problem, and I, on this sheet of paper, have jackets. For birds. Because they're cold.

Josh Miele: And you talk about the various options, what's good and bad about these different ideas for solving this problem.

Lindsay: Josh's favorite option for his problem was something practical. He wanted to create tactile maps.

Marshall: So, tactile means something you can feel, right?

Lindsay: Yes. Blind people use what's called tactile graphics - images and models that you can touch to get information about things like pictures, charts, and graphs. Things that typically are thought of as being only visual.

Marshall: Okay, so like if you can touch a picture, or a chart, or a map, your fingers can help you build a picture in your mind.

Lindsay: Exactly. So Josh wanted to take that idea and use it for maps.

Josh Miele: So tactile maps are maps that you touch and feel, and so you can feel the lines on the paper that are raised up so that you can feel them. And then, each one is a street.

Marshall: Oh that's so cool. So you can journey through the neighborhood or city with your fingers first.

Lindsay: Exactly.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Josh Miele: So that I could have maps of neighborhoods and maps of cities that I wanted to visit, or that if I wanted to go to a new place, I wanted to be able to look at a map.

Marshall: Okay honestly this sounds like a really simple idea.

Lindsay: The idea was simple. But there was one big challenge: figuring out what technology to use to make it. Josh wanted to make tactile maps that anyone could download off the internet - just like we do with everything these days. So when Josh was deciding on a solution to try out, he thought of a tactile map that uses the same technology - and printer - as braille.

Josh Miele: Braille letters are made of dots. So are these tactile graphics.

Marshall: So a map could use braille, but in a map shape instead of letter shapes.

Lindsay: Exactly.

Marshall: Do you just, like print out braille from a printer or something?

Lindsay: Well, since the dots are raised - you need a special kind of printer to do it. That kind of printer is called a braille embosser.

Marshall: I like that word, "embosser." It's like you're printing, but like a boss.

Josh Miele: If you have a braille printer, instead of printing braille characters, it can use the dots, like it would use ink to draw pictures for a sighted person.

Marshall: Cool, so then Josh had to figure out how to use the braille technology to print out the map instead of printing out letters?

Lindsay: Yes. And that's when he realized exactly what he would need to do in order to create his invention.

Josh Miele: There were so many steps that needed to happen. I needed to get all of the information about the streets and where they are. I needed to figure out how I was going to put labels on the maps and how I was going to... So there were just all kinds of things that I needed to do before I ever got to printing out a map.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Lindsay: And now, it's time for Step 4 of inventing:

Marshall: Oh, where you give the birds their jackets?

Lindsay: No! Step four of inventing is, Experimenting!

Marshall: Oh, you see if they like denim.

Lindsay: Oh yeah.

Marshall: 80s are back, man.

Josh Miele: And then once you find the best idea, then you start experimenting with how to make it happen, how to put that idea into practice.

Lindsay: So that means you have to build a prototype or a model of what your invention will be.

Marshall: Okay, so a prototype is like the first example of a brand new invention.

Lindsay: Right. So for Josh that meant creating a computer program that would take the information he gave it and turn it into a map.

Marshall: Okay, so like he's combining braille technology and computer programming.

Lindsay: Yep. And when he finally had a version that he was ready to try out, it was time to turn it on and test it for the first time. This step is called a smoke test!

Josh Miele: They call it a smoke test from back when you would build things with electronics and wires and soldering irons, and when you turned it on, if it smoked, you knew that you had done it wrong.

Marshall: Oh gosh. So did Josh's tactile map start to pour smoke out of its... um, like its latitudes and longitudes?

Lindsay: No, but the smoke test did not start out smoothly at all.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Josh Miele: I hit that button, and the braille embosser made all its braille embossing noise, and it came out of the embosser. And I looked at it and it was—it was total garbage. And I was just like, oh, I was so disappointed. It was like, you know, seeing the smoke come out of the device that you had spent years building.

Marshall: Oh no! What did he do? Is this step five where you panic?

Lindsay: No!

Marshall: Hit it with a baseball bat? And trash the whole thing? Is that what it is?

Lindsay: No! You solve the problem! And Josh was able to figure out where he had gone wrong.

Josh Miele: I realized that I had made a mistake in my programming. It was a very simple mistake. And I just went back into the code, I changed a couple of lines, and I pushed that button again, and out came a beautiful map of downtown Berkeley. And it was, um, I got chills.

Lindsay: This was an incredibly rewarding moment for Josh.

Josh Miele: I realized that I was holding in my hand the first example of a tool that blind people had been wanting for probably centuries and would now have access to, because I had taken the time to figure out how to do it because I knew that it was needed. Anybody could have done it before I did it, they didn't know that it was an important thing because they weren't blind.

Marshall: That's really incredible. So now blind people everywhere could just print out maps whenever they wanted one?

Lindsay: Not yet. There's one more step!

Marshall: Oh yeah, I forgot there's FIVE and we're only on number four, aren't we. Uh, so what's the fifth?

Lindsay: Get people to use your invention.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Josh Miele: Once you have that solution, how are you going to make sure that people can actually get it and use it? If it's a great idea, but nobody's gonna be able to find it or use it or get access to it or afford it, that means that's not a great idea.

Marshall: Well, so I have to say all the birds wearing jackets outside our house is a good sign. This is taking off.

Lindsay: I didn't realize you were already in production with this.

Marshall: Oh, I got a couple prototypes. So what did it take for Josh's tactile map to get used by people?

Lindsay: Well, people who have their own braille embossers, can just print out the maps at home, but Braille embossers are actually much more expensive than inkjet printers. So you have to make sure that places that have embossers for other people to use, like libraries and schools, know about the maps and can help people access them.

Marshall: So did Josh do that?

Lindsay: He did. And once people started using the maps, they realized Josh had solved an important problem.

Josh Miele: They were suddenly getting access to information that they had never had before. It's a very powerful experience to see a place that you know laid out in front of you in detail. And some people would cry. Some people would get very emotional about finally being able to look at, to experience, to feel the streets that they knew so well.

Marshall: I love that. It's like... getting let into a room in the library that you were never allowed into before.

Lindsay: Yes. And Josh not only proved that making maps for blind people was possible... but that it's possible and useful for blind people to use maps.

Josh Miele: That shows that people can use tactile maps and that they can learn from exploring stuff with their hands. That was not very well understood before. That has a huge impact on the future of blind people's access to information.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Marshall: And now these maps are making it easier for blind people to find their way around their neighborhoods.

Lindsay: Exactly.

Josh Miele: It's making life easier for blind people, and that's worth doing.

Lindsay: And that's why Josh is still inventing.

MUSIC

Marshall: So what problem do you want to solve? And is there an invention that might help?

Lindsay: Is there a leak in your boots so your socks get wet when you're trying to play in the snow?

Marshall: Did you spill glitter all over your room last month? Which I totally did. It's such a mess. And you'll never be able to clean it all up.

Lindsay: If you follow all five steps of Josh's invention process.

Marshall: First, identify the problem you want to solve. Do some research to make sure you understand the problem. Explore different ways you could solve the problem. Experiment and build a prototype and figure out who needs your invention and how you can help them get it.

Lindsay: What can you come up with? We'd love to see or hear about all of your inventions. Email us at tumblepodcast@gmail.com with your experiments.

Lindsay: Thanks today to scientist, inventor, and MacArthur fellow Josh Miele. Grown-ups, if you want to learn more about the blind experience of disability, accessibility, and invention, you can check out Josh's memoir, *Connecting Dots – A Blind Life*.

You can also use Josh's website to find his invention, TMAP, if you want to get a braille map of YOUR neighborhood.

Tumble Science Podcast for Kids

TRANSCRIPT: *How to Be an Inventor*

Marshall: Hear more from our interview with Josh, on the special bonus interview episode that's available to Patreon members who pledge at the \$1 level or higher at patreon.com/tumblepodcast.

Lindsay: We'll also have more free resources on our website, at sciencepodcastforkids.com. And if you want to ask a question for our show, email us at tumblepodcast@gmail.com.

Marshall: This material is based upon work supported by the National Science Foundation under Grant Number # 2148711 - Engaging Blind, Visually Impaired, and Sighted Students in STEM with Storytelling through Podcasts.

Lindsay: Special thanks to the team who helped with this episode: Dr. Peter Walters and Dr. Cary Supalo, and the rest of the team at Independence Science.

Marshall: Also thanks to Dr. Kelly Reidinger, Dr. Victoria Sellers and Dr. Martin Storksdieck at Oregon State University's STEM Research Center.

Lindsay: Jason Strother did the interview and research for this episode. It was written by Michal Richardson. Sara Robberson Lentz is our managing editor and designed the episode art. Chad Chenail is our assistant producer. Gary Calhoun James is our engineer and mixer. I'm Lindsay Patterson and I'm the editor and executive producer of this show.

Marshall: I'm Marshall Escamilla and I made all the music. Tumble is a production of Tumble Media.