



Marty Klein

Marty Klein: [00:00:00] If you just give up, that's one thing, but there's also a support system I've made, where if you fail, people will cheer you on, maybe guide you to the next year and the next round. And so, there's this whole culture of learning and often learning through failure, which is just why I find this wonderful.

Annalies Corbin: [00:00:25] Welcome to Learning Unboxed, a conversation about teaching, learning, and the future of work. This is Annalies Corbin, Chief Goddess of the PAST Foundation and your host. We hear frequently that the global education system is broken. In fact, we spend billions of dollars trying to fix something that's actually not broken at all, but rather irrelevant. It's obsolete. A hundred years ago, it functioned fine. So, let's talk about how we re-imagine, rethink, and redesign our educational system.

Annalies Corbin: [00:01:00] This is Annalies Corbin, your host of Learning Unboxed. And I want to welcome us all back. We are once again on the road for this episode. We are in Boston, Massachusetts. And I'm very excited, as always, to be able to share some of the fabulous case studies and stories of amazing things that are happening in the world of teaching, learning, and the future of work from around the country and around the world. And there is a lot of that happening in Boston. And so, my guest this afternoon is one of my all-time heroes. With us is Marty Klein, who is, at this point, president of Martin Klein Consulting, but he has a back story that is one of legend in the world of deep water sciences, generally, in maritime archaeology and history, in particular, and in remote sensing, specifically. So, Marty, welcome.

Marty Klein: [00:02:02] Well, thank you, Annalies. It's great to be with you.

Annalies Corbin: [00:02:05] So, just a little bit of context, most of my listeners know that my backstory is a research scientist, as a maritime archaeologist and anthropologist, which is how I came to know Marty over the years and Marty's work. In my former life and hat prior to launching the PAST Foundation, my work was in training the next generation of maritime archaeologists. And as part of that work, we couldn't get very far in our teaching and learning without having to spend a ton of time understanding the work of Marty Klein.

Annalies Corbin: [00:02:40] And just to sort of set some more context pieces for our listeners, Marty did a lot of his work early on through his academic sort of journey at MIT and that is the MIT we're talking about here. And in his work at the highest level of science and engineering, tied to remote sensing. And the reason this story is so important for Learning Unboxed and in particular, for communities and teachers and learners looking to iterate is because you will find that part of Marty's journey was taking his scientific work and providing an opportunity for public outreach and engagement.

Annalies Corbin: [00:03:24] In other words, ways to take the real-world science and engineering he's doing and make it relevant to young people. And that's really the story that we're talking about today. So, as I digress a little bit here, one of the things that I'm sure that Marty is certainly proud of is certainly one that the rest of us in the profession are proud of was the fact that the National Academy of Engineering provided you with a citation for the development of underwater imaging systems that have contributed to the ocean exploration. And that's a pretty rare thing as a research scientist to have received, yes?

Marty Klein: [00:04:01] Yes.

Annalies Corbin: [00:04:05] So, Marty, for those who don't know, I don't want to get into high level details of the work that you've done, but one of my favorite stories of all time about you is as a graduate student, I believe it was, at MIT, walking into the office of a man by the name of Doc Edgerton. So, for folks who don't know, who aren't from this field, Doc Edgerton is one of the leading folks in a lot of early, early work around sensing, a remote sensing coming out at MIT. So, tell us about how you got involved in remote sensing, Marty.

Marty Klein: [00:04:38] Well, it all happened in a way by accident. My start in the field really started when I was a kid. People joke about that I was born with a pocket knife. I always like to build things and take them apart. And so, as a kid, I just like to tinker. And I would take every radio in the house and turn it into an intercom. And I would fix people's phonographs and I would fix their TVs. And it was the early days of electronics and I became fascinated with a device called the transistor.

Marty Klein: [00:05:17] It had just been developed in the 1950s by three guys. Bardeen, I forgot their exact names, but for some reason, I took a fascination with these things. And they were new and they were expensive. But I just read everything I could about them. And I could take my whole allowance and buy one for \$6. And so, I started building things. I started building little radios. I started building them intercoms, various electronic gadgets. And I also like to write. I come from—my father was somewhat of a writer and I liked to write.

Marty Klein: [00:06:04] So, as a kid, I wrote articles about what I was doing. And one of my first articles was about building a sophisticated transistor radio. It was called the Super 8. And you can't see me on TV here, but I'm a little guy. And I went into New York City and I met the publisher, the editor of a magazine called Radio Electronics. I was maybe 16. And went into this guy and I said, "I've written this article." And he looks down on me and says, "Sonny, did your father write that?"

Marty Klein: [00:06:39] I got very indignant. I said, "No, I wrote it." So, I had some articles in these magazines. And so, I like to build things. And so, I managed to get—it's kind of a story. My cousin had gone to MIT before. My cousin was like my big brother and he had gotten in MIT, so I wanted to go to MIT. And it was just a given that I was going to go into electrical engineering, which I did. He went into naval architecture, but I went to engineering. And as a senior at MIT, we had to do a thesis. And I didn't know what—they didn't tell you, you know, what to do, so I roamed around the halls of the school and I talked to people, I talked to professors, I looked at magazines.

Marty Klein: [00:07:29] And I was kind of lost. I did find a project that was very mathematical. Oddly enough, it was about image processing. But this is long before the days of computers and sophisticated electronics and microprocessors. So, that's what I was going to do. And I didn't really want to do it. It was a bunch of just equations and math was not my strong—my strong suit was building things. That's what I enjoyed, making them, more. So, I was kind of lost. And at MIT, as you said, I went into—there was a famous professor named Harold Edgerton. Everyone called them Doc Edgerton.

Annalies Corbin: [00:08:10] Yeah.

Marty Klein: [00:08:10] And he was quite famous. He developed strobe light. He's very famous for—he didn't invent it, but he perfected the strobe light. And so, pictures that you see of milk drops and bullets going through cards and all kind of iconic things, he made those pictures. He worked on strobes way back in the 1930s, at first, for industrial purposes, but then, he became one of the world's great photographers. And so, I asked him, "Doc, do you might have anything interesting to work on?" And my life that day changed and it's still—it changed radically.

Marty Klein: [00:08:57] And to this day, I became a student of Edgerton's, a protege of Edgerton's. And it was an amazing opportunity. He was literally one of the world's great scientists. He had all—he knew everyone in the world. It turns out Edgerton had been introduced to Jacques Cousteau, the famous oceanographer by the National Geographic magazine. Cousteau wanted to take pictures in the deepest part of the ocean and Geographic put Doc and Cousteau together. And Doc made for Cousteau an underwater camera and strobe light. And they took, in fact, the first pictures in the deepest ocean. It was very historic stuff and-

Annalies Corbin: [00:09:44] Classic and iconic. And we still benefit from it today.

Marty Klein: [00:09:47] Very much.

Annalies Corbin: [00:09:48] Yes.

Marty Klein: [00:09:48] Very much. And so, Doc, it turns out, to position this camera device, they had used a pinger. It was a converted Navy echo sounder and it made a precision ping. And they were able to—there was no wire in this connection, it was just a rope going to the camera. There was no electrical wire. So, they made a precise pinger and they could look at the pings. They would go down to the seafloor and they would also go direct to a hydrophone or an underwater microphone on the ship.

Marty Klein: [00:10:25] And using this apparatus, because the camera they had was down miles under the ocean, but it had to be, say, 10 feet above the seabed. And so, they figured out how to do that. Well, Doc noticed that his pinger, he was not only seeing traces, he was looking at some of the sub-bottom, the sediments below the surface. And he was an inquisitive scientist. He started working on a gadget he called the Mud Penetrator to penetrate the sediments of the—we're here in Boston, the Charles River and Boston Harbor.

Marty Klein: [00:11:05] And by accident, I walked into this thing and he said—he was very amazing, a man who's very warm, he was one of the world's great teachers. And he took me under his wing and he said, "Oh, Marty, I'm working on this thing, maybe you can help me with it." And so, I began working at his lab and working on this thesis and a number of things happened. For one, I met all kinds of people, being, including Cousteau, including Ed Land, the guy who started Polaroid, including many famous scientists, including professors.

Marty Klein: [00:11:42] And as I say, he knew the president. He knew everyone in the world. And I have some awards, but he has bigger awards. So, I started working, it turns out, because the equipment back then worked with vacuum tubes or as they say in England, valves, these glass things, nowadays, very primitive and the new technology was transistors and sort of by chance, I knew, because as a hobbyist, I had worked with transistors. So, I started working on Doc's instruments.

Marty Klein: [00:12:23] And a number of things happened. One is he taught me photography. He was an amazing photographer. He had a dark room in his lab and he taught us about, oh, a lot of things about photographic resolution, about dynamic range, a lot of things that to this day are very important in the field of photography, sonar. And he also had a rifle in the lab. And we, students, could—you could shoot bullets through. He loved to do experiments. He loved students. And he loved to get you excited and go out in the field and do something. He called them experiences.

Marty Klein: [00:13:07] And one of the things he did is give me a key to his laboratory, which became my most precious possession. Back as a student, I was a night bird. I would work in the middle of the night. You know, work odd hours. So, I would go into the lab and you become sort of a caretaker of the lab. And we do our experiments. Well, the traces he was getting on this pinger, on this Mud Penetrator weren't very good, they were fuzzy. And I didn't like it. I tend to be—you'll hear more of this about me, but I tend, as a person, to be not satisfied intentionally. I like to make things better. I like to come into any situation and improve it.

Marty Klein: [00:13:56] So, I didn't like these fuzzy traces. So, I went in. I actually literally work in the middle of the night and I'd tweak around, I'd add some capacitors or I chase some noise or the thing had isolation and noise and grounding problems. So, I just fiddle and fiddle. I had my soldering iron and I'd try it. I'd try this and I'd try that. And one day, one night, in the middle of the night, the traces, we were actually looking at the wall. We had the sonar on the table just looking at the wall and we would just take a sheet of plywood and walk back and forth in front of this transducer.

Annalies Corbin: [00:14:36] Very high tech.

Marty Klein: [00:14:38] Very high tech. And you could see the echoes. And they had been for these fuzzy lines, it drove me nuts. And all of a sudden—I don't know what time or day, all of a sudden, the lines were perfect. There were like pencils. They were just gorgeous. And so, of course, I was very excited. In those days, these machines had paper recorders-

Annalies Corbin: [00:14:59] Yeah.

Marty Klein: [00:14:59] ... that threw out this awful contraption paper recorders. So, I took this paper and just laid it on Doc's desk. And I wrote on it something like, you know, "Marche", and it works. I didn't know much French, but it's something like that. And he came in in the morning and of course, he was very excited. And we became friends and colleagues. And to this day, I think of myself—he's passed away a long time ago, but I still think I'm his student—myself as a student.

Marty Klein: [00:15:34] I still have things I want to prove to him. There are things I want to accomplish even though we joke about it, I'm supposed to be retired. So, he had this incredible curiosity. He would wake me up literally at 4:00 in the morning on a Sunday morning and say, "Hey, Klein, get out of bed. We're going to go see if the Sumner Tunnel and Callahan Tunnel are still under Boston Harbor." If Doc said go, you got up and went. So, he had a little boat at the sailing pavilion at MIT and we'd go out on the boat.

Marty Klein: [00:16:11] And sure enough, the tunnels were there. They're still there. But he would just do these exciting things and he would take me on trips sometimes. So, he started using this device of his. At some point, it was looking downward. It was looking at sediment. But at some point—in the lab, we had been using it looking horizontally. So, in the water, he started using it horizontally and he made what became a crude side scan sonar. And there's a whole long history about that. He didn't invent side scan sonar.

Annalies Corbin: [00:16:46] Right.

Marty Klein: [00:16:46] I didn't invent side scan sonar. He did, though, introduce it. He had a fascination with archaeology and he wanted to show whatever he did. Especially if you met him, he used to come to this SHA convention that we're at. And he would pass out postcards of bullets going through cards and milk drops. And they would—and he just loved to make friends. He loved to show off what he was doing. And so, with the pinger, he got to meet Cousteau, he got to meet Elisha Linder in Israel.

Marty Klein: [00:17:21] He got to meet a whole bunch of people. And he introduced this really nascent technology to the underwater world. So, I kept working. So, for about five years, I worked. He had a company called Edgerton, Germeshausen, and Grier. Their main job, as I mentioned, was just to time and fire the nuclear shots. So, half the company would be going to the Pacific Islands and blowing up an island or something. And at lunchtime, they showed us pictures of atomic bombs going off. And-

Annalies Corbin: [00:17:55] It was a different time.

Marty Klein: [00:17:56] It was a very different time. And, you know, there's a lot to be said and we all had top secret clearances, because I did some work for the Atomic Energy Commission. And yeah, it was very much a different time. But he had this little oceanographic department and he made these things. He made various devices. He made on—once he made those cameras for Cousteau, the company made underwater cameras and strobes and he made other sound devices, he made things called boomers that made a big noise in the water and could penetrate more of the sediments. He made sparkers.

Marty Klein: [00:18:34] They made a number of things for the ocean world. So, I worked in his lab for about, well, maybe six months or so. And then, he hired me to work in his company. And I worked right in Boston. In fact, a sort of a funny story there, I grew up in New York City and I was a fan of the New York baseball, Giants, a fanatic fan. And one day, they moved away. They moved to—the Giants moved to San Francisco and the Brooklyn Dodgers moved to Los Angeles. And I just wouldn't watch baseball for years.

Marty Klein: [00:19:13] And we literally—I worked in various places. The company later changed its name to EG&G from Edgerton, Germeshausen, and Grier, but we literally worked across from Fenway Park in Boston and I never went to a game. And I swore I would never get hooked on baseball again. Well, I did. That's a whole story. I became a Red Sox fan eventually. So, it's a separate story. So, I started my career. I was working with these Mud Penetrators and all the cameras, boomers. We were traveling, we did survey work, some fascinating survey work.

Marty Klein: [00:19:49] Among other things, we went to the Mississippi River and looked at—they tried to hold the river together with these concrete mattresses called revetments. And so, we did surveys on the Mississippi River. There's kind of a side story there. It was the first time in my life I had ever seen segregation and I was appalled. It's a whole separate story, which I won't get into much, but it took me to my core that people would treat other people like that and many startling—I went and sat on the back of a bus in New Orleans and the driver came and grabbed me by the throat and took me to the front of the bus and said in foul words that I didn't belong there.

Marty Klein: [00:20:36] And anyway, another side story. So, we worked on Mississippi River, we worked on the English Channel, on the English Channel Tunnel project. We did a survey—I lived literally in Dover, England, and we surveyed between Calais and Dover and we surveyed sub-bottom profiling with boomers and sparkers of the English Channel. And later, finally, it was built. And, you

know, there is a channel now. My mother used to say, "Marty, you built that tunnel." It's kind of a family joke. But as part of this fieldwork we did, I'd work on boats of all kinds.

Marty Klein: [00:21:19] And because I was an engineer, it was assumed that you could fix anything. So, on the boat, I worked on the echo sounder. I worked on the radar. I worked on the navigation equipment. We had some of the earliest electronic navigation equipment, a thing called the Decca Hi-Fix. And so, I learned a lot about many things going in the field. You learn about people. You learn about how to make do. You learn about how to get along, how to get a job done, how to be responsible.

Marty Klein: [00:21:55] If it's your—it's got to be done, you got to get it done. You can't turn to—you can't look on the internet. You can't. And so, I had a lot of challenges. And I could go on with some stories. And in this little town of Dover, our equipment wasn't working. And I had to find an oscilloscope. And I found a little place called The Radio Shop of Smye Rumsby. And Mr. Smye loaned us his oscilloscope and I was able to repair the equipment.

Annalies Corbin: [00:22:30] And all of those experiences, we say stories now, but the reality is that all of those experiences couched in, you know, your native curiosity as a young child, which and fortunately, you had a family that fostered that in you. And then, you take that and you pair with a great teacher and mentor, who also then recognize that same sense of curiosity and wonder in the world and provided just endless opportunity, clearly, for you to be able to grow in and turn your passion, your love of science and discovery and engineering by tinkering and building of things into not just a viable career, but ultimately, you spin off-

Annalies Corbin: [00:23:18] And just for the sake of our listeners because I do want to dig into the outreach and the school piece here, but ultimately, the backstory for our listeners is that Marty takes all of that, he spins and creates his own company, eventually. And that company, if you are in the fields of anything tied to side scan sonar, if deep-water sciences of any description, probably, you know, the use of sonar anywhere and not just even underwater, you know who Marty Klein is.

Annalies Corbin: [00:23:54] He is a legend in sonar technology sort of period. And in addition to doing all of those pieces and creating this company that then had a very long life and history of innovation. Like I said, everybody that I know who works in this field uses that equipment, trained on that equipment. And we've got our own story, is about, you know, those Klein side scans and the way they change over time as well. But ultimately, you found a pretty intriguing way and you didn't do this on your own.

Annalies Corbin: [00:24:29] And I know you're always cautious about you making folks think that, right? So, I'm going to be really careful and honor that, but you also recognize the value of the way you can take the work that was happening in the world and the deep-water stuff and then, the natural curiosity that people have about what's under there. You know, it's just like, you know, the questions about what's up there in space, right? What's down there under the water, under the oceans, because very few people get the opportunity to go there themselves, right?

Annalies Corbin: [00:25:02] But we have this amazing science and technology that coupled together allows us to be these great universal explorers. And so, Marty, you were involved in what today is a program called MATE. We'll come back around to that. But it didn't start out specifically sort of that way and what the program is today. That was really around taking the work of science in those very remote, hard-to-reach locations.

Annalies Corbin: [00:25:31] In this case, in deep-water science and turning it into an opportunity or a competition where teams could compete to build and discover and sort of launch from there as a way

to get a whole new generation of budding deep-water scientists and engineers to stick, essentially, right? And the reason I prefaced with this story is because a few years ago, there was a documentary film that came out called Underwater Dreams that was written and directed by Mary Mazzio and narrated by Michael Pena, who many folks know that actor, which is an epic story of how the sons of undocumented Mexican immigrants learned how to build an underwater ROV using Home Depot parts.

Annalies Corbin: [00:26:19] And then, they were able to go on and defeat a team of MIT engineers at the very competition that MIT created. So, tell us a little bit, Marty, about how all of that came to be. I'm most interested in the mechanisms by which you and your colleagues said, "Hey, we've got this amazing work that we do in the world and we can turn it into a thing to inspire others." And initially, it was an undergraduate or it was—or graduate teams, it was not intended for high school kiddos. And now, the preface is back. We've got elementary kids doing MATE. And we're going to come back to that. And you may not consider that your legacy, but I wish that you would.

Marty Klein: [00:27:07] Okay. Thank you.

Annalies Corbin: [00:27:08] Because it is one of the most powerful things I see. And PAST is involved in MATE. We're one of the—we run one of the big regionals, the Buckeye Regional MATE event. And we're really, really proud of that. And it's part of your origin story. So, talk to us a little bit about how that came to be, because I think that people who are contemplating, "Hey, should I get involved with MATE?" That's a piece of the story that's sort of near and dear. And I do encourage people to go see Underwater Dreams. It's streaming. You can get it. It's a very, really wonderful and inspiring story. How much of it is real and how much of it is Hollywood, I don't know, but I suspect you do.

Marty Klein: [00:27:48] Well, it's pretty real. There are actually two films. One, there is the spare parts, the Mary Mazzio, who's, by the way, an amazing woman. I don't know if you've ever met her.

Annalies Corbin: [00:28:01] I've not had the pleasure.

Marty Klein: [00:28:02] I'd love to introduce you sometime.

Annalies Corbin: [00:28:03] I would love that.

Marty Klein: [00:28:05] Well, we're going to have time, but she is incredible. Well, some of it, because Edgerton had helped me so much and my own parents had been so supportive and family and other friends and other people at the schools, even my science teachers in high school, I feel a—I sort of owe them something. I have to give back. And so, from the start, I'd like to share what I'm doing with the other people and young people. And so, I've done it over the years in various ways before MATE.

Marty Klein: [00:28:45] I've been involved for many years. There's a Sea Grant program at MIT. I'm one of probably the oldest member of their advisory board. And it's in there. Now, they're college students, but they have done incredible things over the years. They're really the beginnings of autonomous vehicles. The company called Bluefin spun out of MIT. And so, I've seen it at Sea Grant. We do research and we support research on all kinds of things, on fisheries, on environmental things, on marine biology, on acoustics, on economics, on many, many, many different things, and education.

Marty Klein: [00:29:26] They have a huge outreach of education to young people and older college people. So, I've also—for years when I had my own company, I'd go give talks. I'd go talk to the

Rotary Club and the Kiwanis Club and the Masons and I'd try to tell the world as Doc did. If you gave him or asked him to give a talk, he'd get on the plane the next day and go to somewhere. And he loved to talk about, I love to talk about what I do, because I'm still very excited about the ocean.

Marty Klein: [00:30:04] I feel grateful that I got involved in some of the early days of ocean exploration. So, I have sort of had that. I also have in my system not only to help young people, I mentioned being shocked at seeing segregation, one of my other shocks in my life is when in my class at MIT, there were something like hate women. And it horrified me. It was just—and oh, there's so many things I could go on a lot about. I'm a member of the Explorers Club, which used to not allow women.

Marty Klein: [00:30:42] There's this—you know, the world has finally changed. One of the reasons I'm so proud of someone like you and some of the other people I just sat with at the Advisory Council on Underwater Archaeology, more of them are just strong, enthusiastic, bright women. I just love it. I just sort of kick out. And so, I feel paternalistic to a lot of the people, because just watching, they just have a new president. This young lady, she's a professor. Ashley Lemke.

Marty Klein: [00:31:17] And so, I've been a proponent of including women. And so, this thing, this MATE thing comes along. And I went to MIT. There were various robotic—robotics competitions have been around for a while. And a lot of ones on land have been—there's some real famous ones. One is the first competition that was started by Dean Kamen in in Manchester, New Hampshire, and Woodie Flowers at MIT, a famous—he just passed away, unfortunately, famous professor of mechanical engineering.

Marty Klein: [00:31:56] And so, that's actually—it's a huge thing. They have millions of dollars of spend. It's a very different kind of program. But here, I find this thing and it's run by just a few amazing women. One of them who we talked about is this Jill Zande. And Jill fascinates me. She's one of my—you mentioned heroes, she's one of my heroes. She's kind of part-kid and part-adult. She's just enthusiastic about things. She knows everyone's name. She's a mentor to everyone, including me.

Marty Klein: [00:32:36] She has boundless enthusiasm and she's never had any real resources. She's gotten a little bit of money from National Science Foundation. Nothing made—the first thing as these big companies who back it up, including Dean Kamen, he's a very wealthy guy. He founded a company in New Hampshire that did medical, very sophisticated metal equipment. And then, he invented the Segway and a whole bunch of stuff. So, they talk millions of dollars, it's just very different. So, I meet these people and I just fell in love with them. They're just so amazing.

Marty Klein: [00:33:22] And what's amazing is all these young people there. And, you know, there's a lot of clichés. The world's going downhill and everything's wrong and kids these days don't do this and kids that. Well, here's these kids from all economic strata and all different backgrounds, some of them come from fancy schools like MIT or they come from fancy prep schools like here in Cambridge, there's Cambridge Rindge and Latin, but a lot of them come from inner city schools. And those are the ones I love the most, because they don't have any money and they have to be resourceful.

Annalies Corbin: [00:34:09] They're scrappy.

Marty Klein: [00:34:10] Yeah. And that's wonderful.

Annalies Corbin: [00:34:10] They're scrappy.

Marty Klein: [00:34:10] Because I did it as a kid.

Annalies Corbin: [00:34:12] Yeah.

Marty Klein: [00:34:12] I didn't have any money. I literally would go sidewalk, I'd call them the sidewalks for a scrap or hire or a tennis ball or whatever. And so, here's these kids who have to be resourceful. They're not given—in some of the programs, the kids are given a kit that's all made up and, "Here's your parts and here's your assignment." MATE isn't like that. The assignment is a task. You have a task. They'll come up with a scenario and they'll try to make it real, so they'll say, "You're looking at a ship on the bottom and you have to identify that ship and you have to take some fluid out of it and you have to find out what its cargo is. Maybe retrieve some cargo."

Marty Klein: [00:35:04] You have to do these tasks. And it's all sort of imaginary, because they'll put some plastic pipe on the sea—on the floor of a pool and say, "That's a ship. Well, that's an airplane." And everyone accepts that. And the kids have to do stuff. So, they make these, they want to make these underwater vehicles, remote-operated vehicles. And they're all different. They're wildly different. And some have a lot of money, so they can buy the latest fancy thruster.

Marty Klein: [00:35:38] Some of them can't, so they'll go buy a \$5 bilge pump at Home Depot or at whatever I used to—unfortunately, RadioShack has disappeared on us. And they come up with the most amazing things. For example, there'll be a task where, "Oh, you have to pick something up on the seafloor and swing it around", or whatever. And some kids will make a very fancy manipulator, an arm with several degrees of freedom and jaws that go in and out. Some of the kids will take a coat hanger and bend that coat hanger just right and they'll pick up the thing faster than the person with the fancy arm.

Marty Klein: [00:36:22] So, the kids come up with stuff and there's a lot of side things that happen. The kids get to know each other. And now, they come from all over the world. It's incredibly exciting. They're from everywhere. They're from Australia, they're from Germany, they're from—a lot are from the Middle East, from Egypt, from China, from Canada, from the UK, from Mexico. And they all get to know each other. And some of them can't speak English. Some of them barely speak English.

Marty Klein: [00:36:52] They'll come on the translator and they have to sort themselves into a team and they—one of the things Jill has tried to do is to get them into the—to learn about business, too. You don't just—if you build stuff, you got to go in the commercial world. You have to have a market for it. You have to satisfy a customer. And Jill has tried to teach them about that. So, they don't just form a team, they form a company, and somebody becomes the chief executive officer and somebody becomes the treasurer and somebody becomes the publicist or whatever.

Marty Klein: [00:37:29] So, they have different thing and they've got to work together. And watching these kids work together and it's just fascinating. So, I've been with MATE long enough and I'm kind of an old guy now, I used to be a judge for many years. So, I would sit in a room during the competition and do judging of the kids. And as a result of that, I missed a lot of the competition. So, the last couple years, Jill has given me permission to be the old man.

Marty Klein: [00:38:00] And I just wander around and meet the kids and talk with them and encourage them and root for them and share their—there's a lot of heartache because very often, they'll work for a month on this vehicle. They'll try it at home and they'll get to the pool for the big competition and the thing will just go glug, glug, glug or the motor as well or the TV won't work. And actually, I also give talks generally at this thing. Jill asked me to give a talk and I talk to them about failure.

Marty Klein: [00:38:34] I have failed a lot in my life. I've made a lot of things that don't work. Anyone who's ever designed things makes things that don't work. And failure is good if you learn from it. If you just give up, that's one thing. But there's also a support system at MATE, where if you fail, people will cheer you on, maybe guide you to the next year and the next round. And so, there's this whole culture of learning, and often, learning through failure, which is just why I find this wonderful.

Annalies Corbin: [00:39:04] And MATE is truly wonderful. And it's a program that I truly love. And for our listeners, you've heard me many, many times talk about the value of these very problem-based applied opportunities for kids and you've also heard me interview many people who have been involved in a variety of different robotics-based programs because the kids love them so much. And we see that great value. We've done several episodes that have about firsts and all of that.

Annalies Corbin: [00:39:35] So, you know, listeners are familiar with it. But with the MATE program, one of the things that I truly, truly love about it, which I think is—well, I guess there are two things, really, that sort of set it apart. And it's one of the reasons I feel so strongly that schools who don't have their own engineering programs in sort of the middle or high school sort of space, that's okay. You can do MATE. MATE is very, very accessible in ways some of the others are not.

Annalies Corbin: [00:40:07] You know, you have a teacher who's passionate and willing to learn, there are so many resources available. And the point of entry for MATE is much, much lower than it is for many, many of the other robotics programs that are competition-based. So, all that is as part of what I love about it, but the other thing, and I think this is the thing that truly, truly that I appreciate the most about it, is the fact that it's steeped in a real-world problem that you must solve.

Annalies Corbin: [00:40:36] So, it's a competition, but it's not a game. And that is a very, very different approach than some of the other programs take. And, you know, we host one of the MATE regional events. And we took this on. I can't even remember how many years ago now. And ours is still relatively small because, you know, in Central Ohio, right? And we have folks who come from about a five-state region. You know, we don't really think about underwater science to some extent, right?

Annalies Corbin: [00:41:09] So, it's been a bit of a lift. But we've got a very, very dedicated team to come year after year. And to your point, one of my—and I probably shouldn't say this, but one of my favorite teams, you're not allowed to have a favorite when you sort of oversee one of the regionals, but truth be told is there's a team from Detroit and we won't name them. That way, I don't get myself in too much trouble. But they know who they are.

Marty Klein: [00:41:35] Yeah.

Annalies Corbin: [00:41:35] And they come to our program to the MATE regional year after year. And they have one of their coaches and I use that term loosely, because they're really mentors, this teacher mentors to these teams, who I think he was one of the early ones getting involved in it. And these kids are, back to your point, they're scrappy. These are kids that don't come from a wealthy school. They have an old tool shed behind the school and that's where they work. And these kiddos come and, you know, English is not their first language in many cases and they are absolutely, absolutely dedicated.

Annalies Corbin: [00:42:20] And you have other teams there, again, with the fancy equipment and they were able to buy or 3D-print their parts, which is great, don't get me wrong, I love that, too, but these kids think outside the box in ways, you know, that you just don't see. And the minute they walked into the natatorium or the pool. We hold our event right now at the OSU, on pool, the

competition, deep water diving space. And, you know, those kids, they walk in there with confidence and every team turns and looks.

Marty Klein: [00:42:58] That's wonderful.

Annalies Corbin: [00:42:58] Like, "Here they come", right? And there's a legacy at that school of building and the other thing that's really wonderful that's happened not just with that team, with many of the others. And so, for our teachers that are out there who are contemplating had loved to get more of that technology robotics rankings, but I know how to do it. MATE is a low-entry point. And I don't mean to say that because it's less, or it's not actually, it's actually, in many ways, harder because it is truly solving real-world problems. And the minute, of course, as you well know, you add water into electric systems, stuff happens.

Annalies Corbin: [00:43:36] So, you have the added advantage of some of those disconnects, but the MATE program is one, I think, that it would be fabulous for it to be at many or all schools. It's absolutely remarkable. And, you know, I personally want to thank you, Marty, for having invested so much time, energy, and effort in seeing that program happen, because it's good for kids. And I've watched—and again, I go back to our team in Detroit, the number of kids who participated in that program and stuck with it all through high school who went on to earn engineering scholarships would blow your mind.

Marty Klein: [00:44:19] That's been—I keep in touch with a lot of the MATE kids. And that, to me, has been incredibly gratifying that they not only—because a lot of these things you done, you move on to the next thing, a lot of people from roommate have gone on first to stay with the MATE program, they've become judges themselves and mentors, but others have gone into the field.

Annalies Corbin: [00:44:43] Yeah.

Marty Klein: [00:44:44] And not necessarily ocean, but a technical field.

Annalies Corbin: [00:44:47] Yeah, all kinds of engineering. Yeah.

Marty Klein: [00:44:49] And so, I keep in touch with some of the kids and some were like family to me. I just had felt—won't mind a bit of a diversion, one of my favorite MATE kids was a young lady, who, when I was a judge, she was this—I hate to use these terms, but this very scrawny little girl with bright red hair and red shoes, it is just, you fall in love with these kids. But she came into the room. She had made a housing. She had machined a housing by herself. I don't know how old, maybe she's 15, I don't know. And she was holding it very proudly. And she kind of tiptoed into the room holding this housing.

Marty Klein: [00:45:31] And it's one of my high points in my whole MATE life. Well, I've kept in touch with this young lady. She's married now. She has a little boy. She works at NASA. And she's going to set the—well, you know, she's going to set the world on fire. She actually visited me recently, she has a six-month old baby and she visits. She and her husband came to Boston, visit me, and we talked about stuff. So, that's been fun for me that the kids go on and they're energized and they go on now to mentor other people and continue that progression.

Annalies Corbin: [00:46:12] Well, it's a remarkable story. And again, you know, I would encourage teachers, administrators, communities, after school, scouts, programs, 4-H clubs, if you are looking for an amazing opportunity, Google MATE's, we'll have the resource on our website for you. It's a fabulous, fabulous program. And I want to thank you, Marty, very much not only for joining us here today, but for all of your work over many, many years. We are indebted to you.

Marty Klein: [00:46:46] Well, thank you, Annalies. And since we have an audience here, I'll ask you to Google PAST also, PAST Foundation, because Annalies and what she's accomplished with an amazing group of people is just an incredible example in so many ways. So, check them out, too.

Annalies Corbin: [00:47:07] Thank you, Marty. Thank you for joining us for Learning Unboxed, a conversation about teaching, learning, and the future of work. I want to thank my guest and encourage you all to be part of the conversation. Meet me on social media at Annalies Corbin. And join me next time as we stand up, step back, and lean in to re-imagine education.