Fran Poodry (00:01:50):

Hi Fran.

Fran Poodry (00:01:51):

Hey Mark. Nice to be here.

Mark Royce (00:01:53):

I'm glad you're here. We're excited about today's conversation and also Matt. Hi. How are you?

Matt Greenwolfe (00:02:00):

I'm very good. How are you Mark?

Mark Royce (00:02:01):

I'm doing well. Thanks. Well you know, this is kind of unusual. I've only done a couple of episodes where I have more than one guest at a time. And, I'm excited about this conversation. Before we dig into our topic of the day, I just want to ask you a couple of things. Fran, I saw that you're into some Chinese movies or something, is this an interest in the Chinese culture or just Chinese movies?

Fran Poodry (00:02:33):

I've started watching Chinese dramas on Netflix. There's a whole bunch of them. They have some that are quasi historical in that they dress everybody up in these long robes and they have long hair and they wave swords around, and it's pretty escapist and fun. I guess I'm becoming slightly more interested in Chinese culture because of it, but I wasn't originally. I had a recommendation for one from a podcast that I listened to. And so now I've started to get into it.

Mark Royce (00:03:06):

There's one ... I think it's called "Untamed".

Fran Poodry (00:03:09):

That's the one I started with.

Mark Royce (00:03:10):

Yeah, it's amazing. I could go on and I know that's not our... We're off topic, but I gotta tell you, my daughter has been-- my younger daughter who is 30 now-- has been interested in Chinese culture for years since she was a young teenager. And so she's been introducing us to all kinds of stuff around that. And she actually was in China for eight months at a language school learning Chinese. And she introduced us to Untamed and some other ones too. So anyway, just a little connection. Hey, Matt, you mentioned to me that you're involved with this thing and very excited about a thing called the USAYPT first explain what that means. I don't know, maybe some, a lot of our listeners do, but for those of us who don't go ahead and explain it and tell us about your involvement.

Matt Greenwolfe (00:04:05):

Yeah, well, first of all, it's evidence that, physics teachers are not great at advertising and promotion and making up acronyms. So we've got the world's longest, most awkward, acronym, but it's the United

States Association for Young Physicist Tournaments. And there's history on this going back and it actually started in the Soviet Union at Moscow University. If you're interested, I can deal with that, but let me tell you what it is first. Every year they give us four truly difficult physics problems to solve. Now, these are not problems like you've got a homework problem, and you're going to sit down and write a few lines of math or half a page or something. And come up with the answer. These are research problems, generally college level stuff. And they're very open ended. Each one is about a paragraph. The standard that you have to meet is really set by the high standards of the schools and the students who come to the competition. So you go experience it and you realize, Oh, that's what I have to do. You have to design an apparatus. There's no instructions. So you have to figure out what in the world apparatus you're going to build. You have to build it. You have to take data, you have to research the theory, which is generally stuff that's not taught at the high school level. And you have to get it to agree with some good error analysis and you have to prepare a presentation and the competition itself is a debate tournament. And so you go and you present your solution to an opposing team, and then you have to field questions from the opposing team members. And there's a deep conversation between the students about their approaches. And you can imagine since it's very open-ended, there's a variety of different approaches to every problem, theoretically and experimentally. And so you get the students to have a deep conversation as if they were at a seminar presenting their professional work. And so from beginning to end, the students are experiencing the whole research process from initiating an idea and asking a question to designing the apparatus through to a publication and a presentation. And I just think it's a unique and incredibly valuable experience. And yeah, the first year we got last place and I looked at the team and I said, we'll come back here every year. And if all we can do is get last place, I'm going to keep doing it because it's so valuable. And last year we won the whole international tournament and that,

Mark Royce (00:07:00):

That will stoke your enthusiasm.

Matt Greenwolfe (00:07:05):

fight COVID and virtual learning. The kids are fired up and they're driving the whole push to be ready for this year's tournament.

Mark Royce (00:07:14):

Well, that kind of dialogical engagement that the students have sounds a lot like it's related to what you're doing with modeling.

Matt Greenwolfe (00:07:21):

It is the perfect extracurricular add on to modeling science instruction. Yeah, that's really terrific.

Mark Royce (00:07:28):

Well, you'll send me links for more information for those who are listening, who want to know more about it, because you might really tickle the ears of some of our listeners and that would be great. So, yeah. So yeah, that's cool. So Fran, tell me how you got introduced and involved with modeling. Tell me that story about how you bumped into it.

Fran Poodry (00:07:50):

Okay. That was a long time ago. I first heard about it on one of the old listservs that we used to have. I don't know if they still exist and I don't remember which one it was, but I'd heard a little bit about it. And then I was at a summer, AAPT meeting at University of Maryland, and I bumped into Jane Jackson and Jane's specifically, you know, is, "Oh, Fran, I was meaning to talk to you. I think that you should apply for this workshop." So in 1997, I found myself driving out from Philadelphia to River Falls, Wisconsin, to do my first modeling workshop and learn from Rex Rice and Dave Braunschweig. And that began it all.

Mark Royce (00:08:42):

That was when, what year?

Fran Poodry (00:08:46):

1997.

Mark Royce (00:08:48):

Wow. Yeah. Cool. And you were already a teacher. So how did it change you? I mean, was it a good thing? Did it inform you at a different level than you'd been exposed to?

Fran Poodry (00:09:01):

Absolutely. So I had been a physics major in college and kind of had it in my mind that I was going to be a teacher, but I wasn't, you know... I did my practice teaching with someone who is just a regular traditional physics teacher. I didn't really know how to innovate. I had not had much practice with literally having students collect data and create mathematical models. It was always like, okay, this is Newton's second law. Okay, let's do this experiment in which you will find out that this stuff matches up to Newton's second law. So my first surprise when taking the modeling workshop was that I still had physics to learn, which was embarrassing, and vital. And then the second thing I learned was this whole magic of graphing data and creating mathematical models, which I don't know how I ever did physics before that. It was, it was a revolution in my mind and it was amazing. And it just made me fall in love with teaching even more.

Mark Royce (00:10:15):

Wow. That's wonderful. So, Matt, same question. How did you get involved, and when, with the modeling instruction ideologies?

Matt Greenwolfe (00:10:25):

Well, I got involved in it in about 2000 or 2001. I can't remember which, and Patty Blanton who may have taken a workshop with Fran, I don't know if you know Patty, but she would have taken her modeling workshop about the same time that Fran did. And she had brought the idea back to North Carolina. And they were holding workshops at Appalachian State. And at my new school, I had just moved to North Carolina. Everybody is required to take physics. And so I had a new teaching responsibility, which was to teach the class for, you know, the lower level intro class, for students who might not have chosen to take physics if it had been an elective. And I didn't want to just do the same old, same old, so I looked for what programs were out there that would help me make this intro class vital and different and exciting and fun for these students. After researching everything out there, I signed up for the modeling workshop and had no idea what I was getting into because it totally flipped all entirely the way that I teach and ended up infecting all of my classes at every level. Like Fran said,

revitalizing my interest in teaching and my commitment to a career as a high school teacher, which I was not totally committed to that at the time. And that modeling workshop was pivotal. I'll echo everything Fran said from, despite my PhD, learning new physics in the workshop itself, which, in and of itself convinces you that the method is effective. But, also just the dialogue, the way that it put the students at the center, I had been studying physics education research and everything that it said and the activities. And I believed in that, but I was trying to implement them in the midst of a teaching model, to use the word, the way that I taught was still very traditional. And I was trying to bring in this activity and that activity from physics education research. Modeling, reinvisions the entire practice to make it centered on sound physics education research practices. And I still bring in stuff that I learned from physics education research community, the broader community, but now I'm bringing it into modeling, which provides that matrix. And the main thing it did is it put the students at the center and got me to step off the stage. And I spend way more time listening to students now in deep, interesting ways, because I'm asking them open ended questions and listening to them think their way through stuff and listening to their presentations. As they try to explain their own reasoning without an example from me to follow. And so I have a much better idea of what they're actually thinking, and then it's tremendously fun to create activities, to help them overcome their misconceptions and revise the way they're thinking in a creative way that allows them to do it rather than me telling them.

Mark Royce (00:13:52):

Awesome. So is there something specific that you wish you knew before you learned about modeling as a teacher?

Matt Greenwolfe (00:14:03):

For me, I can remember it. See, it feels very foreign now after 20 years of doing this, but I remember that I was very scared about whether my students would talk. So that tells you what was happening in my classroom before modeling. I'm up there lecturing and I turned to the class and I ask a question and nobody responds, or one person responds, or, you know, I don't, you know... Will they really have these discussions among themselves about physics with me stepping back? And I was very scared. It felt like jumping off the high dive into the deep end, what would happen? I remember posting that on the modeling listserv my first year before I, well before my first day of class. But they will, they are much more capable and even eager and interested in expressing their own ideas and exploring for themselves if you create the environment for them to do that and let them do it. It was really just a great experience to watch that happen and then become comfortable with it. And now I have no doubt that they're going to do that because it's happened every year, since.

Mark Royce (00:15:19):

You're both seasoned teachers, you guys have been at it for awhile. Would you share your number one tip on teaching or modeling to our listeners who may not have been doing it so long and say, here's the one thing you got to know. Fran, let's start with you.

Fran Poodry (00:15:38):

The one thing that has just really made the difference for me is just acknowledging that I'm human and I have a sense of humor and students are human and we all deserve to be respected. It's just above and beyond any pedagogy, that when you're a teacher, you have to believe in your kids and you have to respect your kids and you have to let them know that you've got things in common. That, that to me is the most important thing,

Mark Royce (00:16:15):

Matt.

Matt Greenwolfe (00:16:15):

Well, I can remember in my first few years I spent three or four years wondering whether I was doing it right, or whether I was really doing modeling. So one thing I wish I had known is there's not -- there's probably as many different modeling practices as there are modeling teachers out there. There's not one way to do it. It's not that I needed to do it right or needed to worry whether I was doing it just how my modeling instructor would have taught the class. But if you dedicate yourself to it, you learn and grow as you listen to your students and try to develop better activities and find better ways of asking Socratic questions and guiding them. And it just sets a seed. And the way that you do it will be different from the way that anyone else does. And I shouldn't have wasted that time wondering whether I was really doing it or whether it was right.

Mark Royce (00:17:14):

That's awesome. I come from a music background in production and performance and, you know, music I've always felt is very individualized. You got to know music and the language of music, but you are an individual artist and how you engage with music and present music.--And you're saying the same thing about being a teacher, you know, and that's really awesome.

Matt Greenwolfe (00:17:40):

There's a famous article in the modeling community it's famous anyway, by David Braunschweig, modeling the jazz approach to science instruction. That was one of the articles that we were asked to read in my modeling workshop makes exactly the point you just made.

Mark Royce (00:17:57):

Wow, cool. I'll have to check that out. Yeah.

Fran Poodry (00:18:02):

Yeah. I don't think he'd written it by when I was taking the workshops from him.

Mark Royce (00:18:07):

Yeah. But that was a long, long, long time ago. Well, let's dive into our topic for the day. And Fran, for those who haven't read the bio yet, is not only a physics teacher, but she also, or currently works with Vernier and is _ what is your title? Are you like a product specialist?

Fran Poodry (00:18:32):

My actual title sounds more exciting than it actually is. I'm the director of physics. Which sounds all high and mighty, but it means that I have to get, you know, people like Dave Vernier and John Gastineau to agree with each other on things which ...

Mark Royce (00:18:50):

"Referee"

Fran Poodry (00:18:52):

Yes. I write the agendas for the meetings and I try to get people to get stuff done.

Mark Royce (00:19:00):

Okay. But I assume you're pretty familiar with the products.

Fran Poodry (00:19:03):

Yes. So I also, as part of that role, I do a lot of support, hands on myself, including leading workshops and webinars, including answering phones and emails and chats. As well as writing lab experiments and developing ideas. We wear the most hats in our, in our group.

Mark Royce (00:19:27):

Wow. Yeah. And, and Matt, you've been involved for several years with very interesting work with developing tools and ideas and adapting things to work in the classroom. And that, and that's why I got the two of you to talk with me about tools that are available currently for teachers in the classroom. And especially in this time of distance learning and where everybody's trying to figure that out. I'm sure some of the tools we'll talk about many people are familiar with, but some may not be. And so that's kind of where I want to dive in with our conversation. And so let's-- well, why don't you each just share some of the tools that you are interested in presenting to our listeners today? Matt, let's start with you.

Matt Greenwolfe (00:20:20):

Okay. Well as soon as we went to virtual learning, AMTA had a bunch of seminars that I took and I looked for other resources and the number one thing on my mind is the modeling pedagogy, which I love. And I, it would, I would hate to teach. any other way. I just wouldn't want to shift. It's so lab centered and it's lab centered and in, in, in the students running the labs and doing the modeling that Fran talked about and, and coming up with their own conclusions and how was I still going to do that? There are lots of tools out there, but after investigating many things, I centered on this program and, and set of video labs, called Pivot Interactives,

Mark Royce (00:21:20):

Hey, Fran might know a little bit about that.

Matt Greenwolfe (00:21:22):

Yeah. Right it's now sold by Vernier. They didn't just videotape labs, which is what I had started out doing. As soon as we went virtual for my students. I videotaped myself doing labs and have the kids watch the video basically--but they're creating a video lab. They're videotaping each individual data point, not just a sufficient set that you could take, but each individual data point that a student might think to take and they're organizing them. So it's easy to select and pick. And when the students say, choose their independent variables for a lab, they choose them. And they get a video of exactly how that particular data point ran. And they can take measurements from the screen and and start recording their data. And so aside from actually going over and grabbing the equipment and setting it up on the table, it got as close as one could imagine to them actually doing the lab. And the second thing that struck me was the incredible high quality, of their offerings, the cinematically, just the camera work and the lighting and everything. The presentation of it, the way that they framed the story of the lab and presented the information, there's almost no sound in any of their videos. Nobody's talking over it or telling you what to think. They're just presenting what happened. You know, multiple camera angles, composite it into a single video and all sorts of other creative things going on to make it possible to take

really accurate data and not get distracted by all sorts of other stuff that I've experienced in video labs. So, that was really helpful in allowing me to stick with modeling despite going virtual.

Mark Royce (00:23:29):

Fran, why don't you talk about since it's come up, talk about pivot a little bit from your side of things.

Fran Poodry (00:23:35):

Sure. Some people may know this, but Pivot Interactives was, is a company that was started by Peter Bohacek, in Minnesota. And it started with his direct measurement videos, which were a series of videos that were put on the Carlton website that were free and available. And like one of the ones that went around a lot was Carl on the surf board. And it's the classic physics problem where the boy on the surf board walks from one end of the surfboard to the other. And as he's walking in one direction, the surfboard, because it's on the surface of a lake, goes in the other direction. And in the classic problem, you have to figure out, okay, how much does the center of mass move? Where is the center of mass? How far does the surfboard move if the boy moves this far and they're this mass and that mass? So he made that into a video and physics teachers across the country just loved that video. Peter wanted to keep doing it, but he had all these ideas and it was just going to get too expensive. So he needed to figure out how to make it so that he could continue his dream of making this available to teachers as widely as possible and as inexpensively as possible, but still continue to be able to make them, I mean, all of those professional quality videos mean high quality cameras and high quality lighting setups. And the he's got all kinds of amazing equipment to make sure that these things work properly. Some of the bicycle wheels that he has, where you have a mass that is on a string that is wrapped around the bicycle wheel, some of those bicycle wheels are really expensive. So he came to Dave Vernier, and started having conversations with Dave Vernier about a cooperation between pivot interactives and Vernier, and that came into Vernier being the vendor for pivot interactives. We've also supported them in terms of getting some small business grants, and, you know, in terms of letters of support. And we also support the marketing of pivot interactives. We've brought Peter into conferences that we attend such as NSTA and AAPT, and AACT, wherever we can bring Peter to that, he can also show off how amazing pivot interactives is. And now that, you know, we're thrilled to be able to offer pivot interactives at this time when all of a sudden it has become very necessary as people do struggle to figure out how do I do a lab when all of my students are distance learning, how do I get them to have that experience of creating an experiment? How do I get them to have the experience of deciding what to measure and when to measure it? So we're very glad to be able to do that. We are supporting teachers as much as we can. We're answering everyone's pivot tech support questions, and how do I get pivot? How do I sign up my students? We feel glad that we're able to help teachers in this way.

Mark Royce (00:27:03):

Well, I've heard about pivot interactives quite a lot recently, and it seems like it's kind of blown up a bit with the modeling and other science communities. What can you tell us about the direction that Vernier and pivot interactives is taking and what we might see coming in the future? Can you give us any hints in the development?

Fran Poodry (00:27:28):

Sure. We are continuing to develop the content, or rather Peter and his crew are continuing to develop the content they're working on increasing the number of biology experiments that are available. So that especially for AP biology, there will be a full set of AP biology experiments online, I believe by

September. And we're also continuing to add in additional experiments in chemistry and physics. There have been some earth science slash environmental science activities added. There are several on the greenhouse effect. There's a couple on using a thermal camera and looking at how thermal energy is transmitted by different gases, which is really cool. And we're also getting some more in for more advanced topics. So I know there are already some for some more modern physics topics and there will more advanced topics in chemistry as well.

Mark Royce (00:28:36):

Very cool.

Matt Greenwolfe (00:28:37):

And also in other directions, he designed in from the beginning, the ability for teachers to create their own activities, make their own videos, create their own activities. And that's what I dedicated myself to this summer. As soon as the school year was over. How could I make physics videos that approach the quality of what I saw on pivot and what would be the process of creating my own activities? So I did a few this summer of creating my own. And, then, sometime in like late July, early August, after some conversations on the modeling listserv, a teacher from Wisconsin, Minnesota, Janelle Hollingshead contacted me and said, can you show me how to use pivot and what this is about? And by the time we actually had a Zoom meeting, there were six people. And then the next week she had brought in like a dozen more. And all of a sudden we had this large group of teachers from the modeling community who were not just interested in using pivot interactives in their classroom, but were interested in creating their own based on their own ideas. And, based on gaps they saw in the offerings that they would need to run their full curriculum. Peter was very enthusiastic about welcoming a community of creators as well. And so that's an additional direction, I think,

Mark Royce (00:30:16):

Is that content that's being created, is there an archive or someplace where everybody can share it, and how does that work?

Matt Greenwolfe (00:30:26):

Well they have a pivot interactive library, which is their professionally created stuff. And then there's a community library, where people can put, if they've created something, they can post it to the community library where it would be available to anybody else using pivot interactive.

Mark Royce (00:30:45):

Okay. So if they, if they have pivot interactives, they can find that library pretty easily. Yes. Okay. So it would require a, I don't know what isn't an account.

Fran Poodry (00:30:57):

Yes. So instructors would need an account in pivot interactives. Uh, and the easiest way to get that right now is to sign up for the instructor free trial, which you can find at the top of the page, if you go to pivotinteractives.com and then it says instructor trial, right at the top, just click on it and fill out the form. But yeah, in the community library, there are lots and lots of experiments. You have to kind of know what to search for. There are filters that you can use, so you can filter for biology or for chemistry or physics. But a lot of schools are sharing activities, for example, by using the school name as part of it, uh, as part of the title, so that it's easier to filter. And one thing that pivot is working on and will be

implemented at some point, unfortunately, I don't have a timeline, but there will be the opportunity to create shared libraries so that teachers can share a specific library of activities with other teachers, whether that is because you're all teaching the same course in the same school, or whether that's because you're in something like the modeling community and everyone wants to use that collection.

Mark Royce (00:32:08):

That's awesome. I really like the idea of that kind of collaborative community is wonderful. So, what's the relationship, if you don't mind me asking between Vernier and pivot? Are you guys one of many retailers or is Vernier an exclusive thing, or what's the deal there

Fran Poodry (00:32:29):

Vernier is the sole source for pivot interactives. We are the vendor.

Mark Royce (00:32:34):

Cool. Now I was wondering about having you talk Fran about the, some other tools that are becoming really important and finding their way in this time of distance learning and social distancing and all that. Are you finding as Vernier, some other things that are becoming popular and in demand?

Fran Poodry (00:32:55):

Sure. One of the things that we've got is a piece of software called Vernier video analysis, which is primarily used in physics. We've got also some of our biologists doing some sport science experiments with it. Vernier video analysis is cross platform and does video analysis much like logger pro, however logger pro cannot be used on a Chromebook or an iPad or a phone, whereas Vernier video analysis can work on any device with a browser. It's got a whole bunch of cool features, including a vector display feature and auto tracking. And we've got some replay in there. You can see that the dots appear on the video as the data appear on the graph. We've had a lot of people asking about that recently, and Vernier also is making available a sample data library where instructors can give the data from an experiment to the students, and then the students can do the analysis on the experiment. We're working on expanding that and also providing videos of experiments to go along with it,

Mark Royce (00:34:19):

Just to give you a unabashed plug, you can talk about some of the other traditional products that Vernier offers too, if you want to real quick.

Fran Poodry (00:34:28):

Sure. We're we have always been a sensor company, so we still sell lots of sensors in all subject areas for science. One of my favorites currently is the go direct sensor cart because that's just a wonderful tool for physics.

Mark Royce (00:34:45):

I see Matt nodding his head on that one.

Matt Greenwolfe (00:34:47):

Oh yeah. we use it all the time. And will, again, as soon as we get back in the lab .

Fran Poodry (00:34:56):

And another one of my favorites is the good direct three access magnetic field sensor, because, you know, from the beginning of starting with Vernier, one of the things that I wanted was a three axis magnetic field sensor, because that would just be much more fun than our regular single access magnetic field sensor. And it indeed it is, it also looks like a little wand, so I can, you know, practice my "Leviosa" or whatever with my magnetic field sensor as well. Our sensors, one of the things I really like about the Go Direct ones is that they also work on any platform. You download our free graphical analysis software, and you can use it on your phone or on your Chromebook or on your, you know, souped up Windows gaming computer, whatever you've got a, you can go ahead and connect those. And honestly, I feel that it kind of to the point where it doesn't even matter what company you're going with in terms of the sensors, because if the sensor says Vernier on it, then you go ahead and fire up the Vernier software. And if your sensor has some other company's name on it, you fire up their software. And it's not, you're not having big prohibitive costs like, Oh no, we have to have everything match. If you want things on the same graph they have to match, I guess. But, you know, if you, if you want to mix and match sensors, I don't think that's as much of a problem as it used to be.

Mark Royce (00:36:21):

So, Matt, what are your thoughts about tools? They don't have to be related to Vernier but,

Matt Greenwolfe (00:36:27):

um, well, first of all, I'm going to have to check out that three axes magnetic field sensor. Cause I still only have the old ones. I didn't even know it existed, so that one slipped by me. Another thing that happened once we went virtual, is the another key feature of modeling was just the dialogue that happened. All the, the student to student conversations and stuff that was such a central part of modeling instruction. And that is so much harder virtually, and I am not faulting my students when I say this; the same thing happens to me. Just like everybody else I've been in, who knows how many, zoom conferences and meetings. And it is so much easier to become passive and tune out and just listen. And you get mental fatigue. And so the same thing is happening to my students. And even if they're trying really hard, just like I am in my meetings, it's still difficult. To be present and to engage and jump into the conversation and have some back and forth. And so how are you going to do this? And one of the things I realized is that this was throwing me into a situation that had been encountered by university physics instructors. They were constrained because they had large lectures. So they had a size constraint. I was constrained by being virtual, but they had developed some solutions. There's one researcher, Eric Mazeur from Harvard who was very famous. And he developed this clicker question system. And at the time he developed it, you had to buy a system, in order to do this, but he could ask questions of a large lecture and really quickly get feedback from the students on their level of understanding, and then respond to that in real time by addressing some of the concerns or something like that. So I've been using this thing called Nearpod, but I'm sure there's a dozen other ways to do this where I can, even on the fly in the middle of class quickly create a question and have students respond by drawing a diagram or answering a multiple choice or typing a few things. And those answers will come to me, I can display them anonymously. And so I cut off the talking head. The other thing is you can't talk for a full class. It's true, even in face to face class, but it is more so true. Now, if anything, I should be talking for fewer minutes and fewer minutes at a time than I usually would, and that takes real willpower. So this interrupts, it gives an interactive thing that involves everyone. Everybody has to respond. I can tell somebody didn't respond. It can be a quickly drawn graph on a little digital whiteboard, and I can pop all of them up and flip through the class' answers and say, well, this one is really good because of this. And so this brings up an issue that I saw on a lot of that, you know what I

mean? I can quickly page the class, and do that. So getting me to talk less and putting in place some things that give me that feedback that creates that dialogue is really helpful.

Mark Royce (00:39:49):

Tell me the name of that program. Is it like a plugin that integrates with Zoom or something? Or how does it,

Matt Greenwolfe (00:39:55):

It's a, it's a separate standalone thing. It's Nearpod. They have lessons, which is what I think they thought it was designed for. I'm not using it for a whole lesson. I create a quick question and I give them a link and a code for that particular lesson. And the students put the link on their browser. They enter the code and it comes up and they start responding. And I immediately start seeing their responses and browsing through them. And we're back to Zoom or whatever, where I'm going to have a discussion based on those responses.

Mark Royce (00:40:31):

So, Matt, I know you've been involved in the development of a robotic kinetics apparatus of some kind, and I know you've done some things with improving classroom communication and dialogue, and those are not the software tools, but those are some interesting tools too, would you like to share what those things are?

Matt Greenwolfe (00:40:52):

Well motivation for the kinematic robots came one from listening to my students because I had learned modeling instruction and really paying attention to their struggles with learning the vocab, the graphical vocabulary that describes motion and how to interpret it and having this philosophy of wanting them to discover it and put pieces together for themselves. But it also came because years ago when my daughter was in a Montessori preschool classes, I went and visited her class. And these three to six year olds were quiet in a flow state, engaged in their work and focused. And I looked around and I said, these folks are doing better with their preschool kids that I'm doing with my high school seniors, how are they doing this? And so I started reading all the theory and research about Montessori stuff with great fascination and comparing it to physics education research, and there's a lot there. But the one thing that led to the kinematic robots was this idea of control of error. That's the Montessori term: control of error, which is inherent in the apparatus. In other words, because of the way the apparatus is constructed and built, the student knows whether it's right or not. If it's wrong, it has a sense of incompleteness. That is part of what draws them in and gives them that focus because they have to figure it out. It also includes a limitation in the scope of the apparatus so that they're by natural design focused on one dimension or one aspect of what they're trying to learn. And so I thought, what would a physics apparatus look like that had this property of inherent control of error? And that led me to developing this kinematic robot. I wanted a robot that I could draw a graph. The student -- not me -- a student could draw graph on the computer and send the graph to the robot. Now in between there there's a, you know, a textual programming language and assembly code and all sorts of stuff. The student is programming the robot by drawing the graph and pushing a button and sending it to the robot. And I wanted robot to produce that motion so reliabl and so precisely that it would serve as a control of error. And they would know whether they were right or not, without the intervention of an instructor. The apparatus would tell them. I checked out all sorts of robots. I started building my own and realized how difficult it would be, narrowed in on the technical requirements that it would really

need to do this. And finally found one which is made by parallax incorporated, out in California that had very precise wheel encoders. They built it for an entire other purpose than physics. And so their motor driver wasn't sufficient. So I had to learn assembly language and reprogram the motor driver in the robots' assembly language to do physics motion.

Mark Royce (00:44:22):

In your spare time.

Matt Greenwolfe (00:44:24):

It was, it was a killer. Yeah, and one aspect of that is now the software, by the way, it did it, it did all of that. And there's more to say about it. But now the software is eight years old. The number of platforms that runs on is rapidly reducing as the platforms update and it needs new work. And it's a daunting task to think about putting in that much time and effort as I did that initial time when I was so excited about this brainchild. And so I've been looking for support and you know, grant support or, or commercial support or something so that I can develop this to run on modern platforms,

Mark Royce (00:45:05):

it sounds like it would be a real help in the classroom for a lot of teachers. And, but it's gotta be made affordably, but yeah. Yeah. Well, if there's anyone listening that has connections with grant writers or that kind of people get ahold of Matt, you can find his info on the website. So.

Matt Greenwolfe (00:45:25):

I would love to have some collaborators and not just be an individual effort so that it doesn't take, it took a lot to make the original project that, that was, that was a real effort.

Mark Royce (00:45:34):

Wow. That's cool. So Fran, you're not in the classroom at all now you're full time with Vernier. So, what are you hearing in the last couple months? Cause everybody's been scrambling trying to figure out how to do it well, and a lot of angst, a lot of anxiety. And what are you hearing? Cause you connect with a lot of teachers and you're hearing the stories and what would you share from your seat about how things are going and what you're learning?

Fran Poodry (00:46:09):

I am just continually and always excited by the physics teaching community and how everyone was really eager to share and collaborate and come up with creative ideas of what to do. I'm pretty active on Twitter. I follow a lot of people, a lot of whom are physics teachers and some of whom are just scientists and everything, but I just really love seeing the, Oh, Hey, I'm doing this. Oh, you know, here's a place where you can find this resource I've come up with, I've found this awesome thing that you should try out, you know, check this tool out. I'm seeing collaboration on Desmos. The calculator app, I'm seeing people coming up and sharing resources on spreadsheets, people sharing their PhET, that Colorado collection of simulations. Lessons for those, I love the creativity and the willingness to share. And that's something that I've always loved about the teaching community and everyone has stepped up. So that is a thing that is absolutely wonderful to see.

Mark Royce (00:47:29):

Yeah. That's awesome. Uh, Matt kind of same question. What are you hearing in your circles?

Matt Greenwolfe (00:47:37):

I think one thing is that we have to be really flexible. We have no idea what's going to happen next. It's kind of thrown out the door. The idea of having a plan for the year and detailed lesson plans. You want to make sure that what you're doing is productive and learning and that you and the students are not getting too stressed out in an already stressful time. So from some teachers I hear there are pressures. They still have to conduct lots of testing. Their administrators are pressuring them to cover all the curriculum still or that sort of thing. Other people are in a more comfortable environment. So teachers are recognizing, we have to be flexible. We have to adapt. We have to keep students' wellbeing and quality learning of whatever amount foremost. But not everybody is in a situation where they're comfortably allowed to do that. And so that's really a focus of a lot of the conversation.

Mark Royce (00:48:47):

That's why I think right now more than ever, it's always been an important thing to have clear collaborative communication, a sense of community, sharing of ideas. So I would ask you guys send me when we're done the links and things that you're aware of, where people can connect that you guys are connected to or aware of. And also the different things we've talked about, Send me all the links to that. And it'll go on the website on your interview page. There will be a dedicated page for interview, and it will include anything you send me plus stuff that I've already collected. Cause you guys have a wealth of understanding with your years in the, in the teaching community and also the modeling community.

Matt Greenwolfe (00:49:34):

And I'll put a shout out. This is a really... It's almost a technology anachronism now, but the modeling listserv ties the community of modeling teachers together and still does. Now, there's lots of modeling folks on social media who have Facebook pages or blogs and people connect in all sorts of ways and listservs are not really that common anymore, but the modeling list serv ties the entire community together and is still the main focus that brings everybody there. So if you're not there, join AMCA and get on the list serv or take a modeling workshop, which will automatically get you a year's free membership and, and get on the list serv. And there's just a lot of rich discussion that goes on there that connects you to that community of teachers. And I don't know why this particular technology has survived and is robust. It is still the way that this community prefers to connect, but nothing has replaced it.

Mark Royce (00:50:46):

Right Yeah. AMTA is committed to moving forward with that technology and developing a more easily accessible approach to the listserv, but it takes funds. And honestly, AMTA is a grassroots organization that doesn't have a income stream that's standard. So I just want to encourage people consider joining and then also consider donating and you can designate it for development of a social media or whatever.

Matt Greenwolfe (00:51:22):

And if I can, yeah. If I can put in some history there, I was on the founding board of AMTA and several years later was president of the organization for awhile. And the thing that made me drop out of being on the board was I got this brainchild of the kinematic robots -- can't do too many things. I contributed there for years and when we founded it we looked at the history, going back to the 1960s, there had

been some great reform movements in science education and great enthusiasm around them. And they penetrated the community of teachers to a certain extent. And we looked at those things and we looked at why, and one of the weaknesses is that there was a founder or a founding institution or university or something. And it was centered around a particular textbook or set of curricular materials. And as those things became outdated or people retired, the support fell apart and, and teachers who were using this retired and the next generation of teachers wasn't picking it up. And we said, us teachers as high school teachers had better organize ourselves. If this is going to have staying power for the longterm. And in fact modeling itself, when it was created, it was influenced by all those prior attempts,

Fran Poodry (00:52:59):

Project Physics and PSSC, and all those great things

Matt Greenwolfe (00:53:04):

and modeling wouldn't exist without them. But we realized we needed an organization that was the teacher's organization for the teachers. We organized ourselves and we kept this thing going that we believed in. And yes, it needs help. It needs more funding. But it's still a going enterprise 2015, some years later. And it's doing the job that it was created for

Fran Poodry (00:53:31):

Yeah. Mark. Did you know that you were inviting two past presidents of AMTA on this podcast?

Mark Royce (00:53:37):

I did not know that. Your names were given to me from other significant people who recommended you as good conversation, but I didn't know that, that you were both past... You know, that's kind of exciting. I'm really glad that serendipity happened because I started this podcast--we launched in January--and I saw the amazing transformations that were happening in people that adopted these approaches. And I thought, you know, we need to create something that helps people connect and see and understand what it is. And that's why we created the podcast. Fran, what's your relationship with AMTA been over the years?

Fran Poodry (00:54:22):

At one point in the early two thousands, I was invited to run for vice president of the board. So I did thinking that this would be a way that I could do some good for the community. So I spent four years being the vice president, president-elect, president, and past president of the board of AMTA. And I'm still a life member. I pay attention. I meet up with people, to me it's a very important organization that we need to keep going.

Mark Royce (00:54:56):

So did you know each other before? Matt, how did that happen if you did.

Matt Greenwolfe (00:55:00):

Well so we had a common friend named John Burke who teaches at a boarding school in Delaware, and he had this idea to organize what he called the physics teacher camp which, it's a sort of a playful name that gets at the spirit of what he wanted to do. It was professional. It was a summer professional develop meeting for teachers, but very different from the formal organizational meetings you go to. He

would just invite teachers that he knew had creative ideas, and we would all sit in the lab and, you know, be asked about physics stuff and ideas we had, and we would get out the equipment and tinker and talk about teaching ideas and work on things, work on creative ideas. It's a great thing. I missed it this summer, for obvious reasons. And so I would love to get back to it, but Fran was also invited to one of those early physics teacher camp meetings, where we sat down and worked on stuff.

Fran Poodry (00:56:06):

Yeah, it was really fun. I remember, that was when I started really learning about standards based grading. So I started doing that with my classes. I had also started making some videos, some constant velocity carts, and then I actually had to get in touch with Peter Bohacek because he had developed his overlay that you could overlay a video of a stopwatch essentially over the video. So it would count frames and advance the time so that you could basically make it your own direct measurement video. So yeah, there's connections all the way. You can be in touch with people and, you know, being involved with people and it's amazing what we can all do together.

Mark Royce (00:56:52):

Yeah, it is. I thought you, when you said about the physics playground or what'd you call it.

Matt Greenwolfe (00:56:57):

physics teacher camp,

Mark Royce (00:56:58):

physics teacher camp,

Matt Greenwolfe (00:56:59):

summer camp for physics teachers where you just go have fun in the lab,

Mark Royce (00:57:03):

I thought you might be talking about maybe the origins of the workshops, you know, the modeling workshops.

Matt Greenwolfe (00:57:09):

No, that's different,

Mark Royce (00:57:10):

yeah. And you guys have you both taught workshops also?

Matt Greenwolfe (00:57:15):

yes,

Fran Poodry (00:57:15):

I have not actually.

Mark Royce (00:57:17):

Oh, really? ... What's wrong with you?

Fran Poodry (00:57:21):

So, there was a point when we were trying to get some workshops started in Philadelphia and they just never got off the ground. They eventually did get off the ground with Jess Dykes and Ray Howanski, they started getting that stuff going in the Philadelphia area. They've done a fantastic job with it, but yeah, I've just never happened to run a modeling workshop.

Mark Royce (00:57:48):

Yeah well it's okay. I was just teasing about what's wrong. You know you're brilliant! Ray did one of our episodes for the podcast, you know, so that's cool.

Fran Poodry (00:57:57):

Yeah. He's a great guy.

Mark Royce (00:57:59):

Well, uh, it's been a joy talking with you guys. I mean, just a real joy and I think I've certainly learned a lot and, I hope that our listeners will also take to heart what you guys have shared from your position and philosophy on these things, but also get encouraged about the tools that are available and the opportunities for collaboration and to join the community, to add their voice, to learn from disparate voices, you know, as we work together, it's always important to hear different perspective and you guys have really brought a great perspective and I appreciate it very much. Thank you for spending this time with me.

Matt Greenwolfe (00:58:44):

Thanks for inviting me. It was really great to sit and talk.

Fran Poodry (00:58:47):

Yeah. Thank you, Mark. It's been fun.

Mark Royce (00:58:49):

We' ll stay in touch. Bye everybody.

Matt Greenwolfe (00:58:52):

Bye...

Fran Poodry (00:58:52):

Bye Bye