Mark Royce (02:18):

Here's my interview with Rebecca and Colleen. Hi Rebecca.

Rebecca Vieyra (02:24):

Hi there. How are you doing today?

Mark Royce (02:26):

I'm doing quite well, thanks. So how are you and your husband holding up in Washington, D.C. during the pandemic?

Rebecca Vieyra (02:32):

We're okay. We've got a daughter too, so it's lots of fun. We've been watching lots of movies and taking lots of walks around the same blocks, the past six weeks now. I think I had one adventure when I went to the nearby bodega to get us a gallon of milk and toilet paper. We do have a community garden. So we visit that once a week because shockingly, we've just been too busy during the week. Too busy. It's hard to have boundaries and limits when you're at your home computer all day.

Mark Royce (03:12):

Yeah. I've spoken with a lot of people that are surprised at how busy they have actually become doing things that maybe they didn't have time or opportunity to do when they were in full time work and their jobs and all that. So it's very interesting. So we've been talking about the history of AMTA and we've been talking about kind of some of the things that have developed over the years to bring us to where we are today. And I know that you and Colleen work closely together and are involved in some of the cool new things that are evolving. Before we go into that, tell me a little bit about how you got connected with AMTA.

Rebecca Vieyra (03:54):

Sure. I studied to be a high school physics teacher as an undergraduate. I attended Illinois State University, with my father actually as the teacher educator-- physics teacher educator. We had a really robust program and, Colleen, I don't know if he knew you personally, he certainly knew about you. But he actually brought modeling into some of our methods courses, but I didn't know it as modeling. So I did a lot of my student teaching, I guess in what I'd call the modeling style with a lower case M and then I ended up, taking a summer workshop right before my student teaching. And, you know, got formally exposed to modeling and felt like my eyes were opened about actually understanding physics after four years undergraduate.

Mark Royce (04:39):

And what year was that?

Rebecca Vieyra (04:40):

That would have been 2007. I taught high school physics for seven years, did modeling right off the bat. But I also, like a lot of modelers, brought in lots of different things and thought about how modeling could be applied in a variety of different contexts and eventually kind of got involved in technology with my husband being a mobile app developer, and things took off from there. In terms of wanting to make sure that my kids could get experience with physics, not just in my classroom, but with tools that they had themselves. Which, you know, again, including mobile devices, tablets, smartphones, things like that.

Mark Royce (05:20):

So in the classroom, you were there seven years till 2014, correct?

Rebecca Vieyra (05:27):

Yes.

Mark Royce (05:28):

And then what, where'd you go? What happened?

Rebecca Vieyra (05:31):

What happened? So after I taught for seven years, I just kept looking for more opportunities to branch out and I got accepted as what we call an Albert Einstein Distinguished Educator Fellow, which is a federally funded, actually nationally federally legislated program for K through 12 STEM teachers to go work as a guide, counselor, advisor, on STEM education issues at federal agencies and on Capitol Hill in a variety of different political offices. And I ended up getting placed at NASA headquarters in the aeronautics research mission directorate, which is the part of NASA that works on airplanes and helicopters that people don't often think about or even know about. And after that, I spent almost three years at the American Association of Physics Teachers as a their K through 12 program manager. And now I work mostly internationally with teacher education initiatives through a diplomatic organization.

Mark Royce (06:28):

But you've continued to stay connected with AMTA?

Rebecca Vieyra (06:31):

Yeah, very much so. When I was at AAPT, I remember my first formal conversation with Colleen, which ended up being around an NSF proposal, National Science Foundation proposal, because when I was an Einstein fellow, even though we were all at different agencies, we had these, what we called first Fridays, which were professional development sessions based upon the interests of the fellows. And one of them happened to be bootstrap for algebra, which was originally out of Brown University. And kind of like modeling opened my eyes about physics. I felt like that single four hour session on programming -- bootstrap is a, an approach to programming with the intent to teach algebra -- opened up my eyes about programming and made me feel competent and made me feel like it was accessible. And I said to myself, well, if they can do this with the intent of supporting algebraic understanding, can't we use it also to support physics? And so I had this tiny little idea and I brought it to Colleen and Colleen's, like we can write an NSF proposal about that. So, you get pretty intimate with people, right? When you write NSF proposals. And that's where it started. That was in 2016 possibly 2015. This might've been when we started that.

Colleen Megowan-Romanowicz (07:53):

It was the winter meeting. January, 2016.

Rebecca Vieyra (07:57):

Okay. Well there we go.

Mark Royce (07:58):

And so where has that proposal gone?

Rebecca Vieyra (08:01):

Yeah, so we got funded, for 1.25 million. Actually prior to that we'd actually gotten a hundred, about a hundred thousand dollars through 100 K and 10, through our partner STEM teachers New York City, STEM Teachers NYC, which is a group of modelers in the New York city area. So we started with that and then went right into the NSF grant, which we would have finished this year except we are going to be extending into the following year. So, um, that has become a pretty robust program where we have worked with over 63 teachers. All of them have gotten two to three weeks of professional development. Some of them have been with the program for multiple years and have developed leaders, developed a set of curricular resources and which is all on line AAPT.org slash K12 and then you can click on computational modeling and physics. And I'm sure AMTA also has, they also have a program page. It's also linked to bootstrap for algebra. So there's many ways to get involved with it and to find out about it because there are many different partners.

Mark Royce (09:08):

Wow. So specifically how do you think our AMTA listeners would want to connect with that?

Rebecca Vieyra (09:16):

Well, we actually have a variety of different ways. I mean, of course with Coronavirus things are a little bit of a standstill. But, again, the student facing resources, which are really pretty robust and dovetail very nicely with physics first material, that's all freely accessible and online. In terms of actual trainings, professional development, we already have our cohort filled for next summer for the face to face, three week workshop. And that's summer 2021. And we currently actually have an online course that is finishing up, but I anticipate there will be more opportunities for those things in the future. So I would say again, you know, visit the webpage aapt.org/K12 and you can get our contact info and reach out for updates as they come.

Mark Royce (10:07):

If you'll share with me any links and contact points, we can put it on the website for the podcast and people can go there to find how to connect in with that. Excellent. So, Colleen, you and Rebecca and others are collaborating on some things and ways to bring new resources to the modeling community. Can you tell me about that?

Colleen Megowan-Romanowicz (10:31):

Sure. So if we, if we reach back a little bit and, and think about, um, how members want things. And so AMTA makes it happen. And there had been a sort of groundswell of interest starting in the two thousands, so late 2000 decade, of physics teachers who wanted us to incorporate programming into high school physics. They felt that they wanted their students to learn to program and they weren't getting programming courses in their regular curriculum, but that it could easily be incorporated. And a number of these teachers went ahead and did it themselves using V Python. So there was a groundswell of interest in the community to incorporate computing into our physics modeling workshops. That was the backdrop for the conversation that Rebecca and I had initially in 2016. I had been listening to members for years saying, wouldn't it be great if we could have a computational modeling workshop and here was the perfect opportunity to have a computational modeling workshop. We had not originally thought of that as something that you could do with physics first, which is physics for ninth graders. And yet, this particular approach to teaching kids to code was very compatible with a ninth grader. They were teaching it as a way of teaching kids algebra. And that's really what kids are learning as they are taking ninth grade physics. So it seemed like a perfect fit. So why not? I already knew this is what members wanted. The 100K in 10 funding -- 100k in 10 is an organization of professional development providers, teacher education providers and foundations, people who give money to STEM education. And so they have periodic grant competitions, for relatively small grants, in the a hundred thousand dollars range, anywhere 5,000 to a hundred thousand. And so we won one of those grants because we had someone in New York City who could help launch the program. So this gave us a little extra appeal when we applied for funding to the National Science Foundation because we were able to tell them that we had already won a small grant to pilot this idea that we were proposing for the larger grant. And I'm sure that gave us a little leg up in the competition. Nonetheless, we, we won the grant and, we've made it go of it. We have learned a lot of things about what it takes to be able to do this and to sustain this, this reform, over the long term. It turns out logistics is probably a bigger barrier to doing computing in physics than cognitive abilities. And also there's some really squishy ideas out there in the research community about what it takes to learn computing and physics. There's a lot of discussion around computational thinking and there are standards both in math and in science having to do with computational thinking and there isn't a good definition of what that is. So we have worked on that definition as well and we have developed some assessments that we can use in ninth grade physics classrooms that help us and that will ultimately help teachers see how this is translating into students' ability to think computationally about physical phenomenon. So we've been working on that now for four years and as with all modeling workshops, it's still a work in progress. We invented modeling physics workshops 30 years ago and they are still at work in progress. So it continues to evolve as the affordances we have in our classrooms evolve. I can't tell you what the next generation of computational modeling physics will be. It's on the drawing board. I will tell you that.

Mark Royce (15:07):

Rebecca, are you involved in this thinking as well? The development of all this?

Rebecca Vieyra (15:11):

Oh, yes. Yeah. This is basically our grant project in a nutshell, right? I mentioned programming, but programming is simply a tool to help students become good computational thinkers, to be good, become, in the context of physics, computational modelers. That's what this is all about.

Mark Royce (15:32):

So in kind of a concise, compact way, what are the results of this grant that you guys are bringing to the forefront?

Rebecca Vieyra (15:39):

So, one thing that our teachers regularly talk about is the importance of representations within modeling instruction and we've got algebraic representations, graphical representations, we've got verbal representations vector and sometimes even physical three-dimensional representations. And this particular project now brings the computer program as one additional computational representation. And what I concretely mean by that is if we're trying to represent motion, for example, we might look at a position-time graph a velocity-time graph, we might even draw some arrows and dots to create a vector plot. But now we also have a way where we can, using the language of computers, or using computer code, express that type of thinking in a different way. And you know, in physics and especially with algebra, we often focus on time based equations, right? Everything is dependent upon time. But with the computer it doesn't have the same sense of time. It's much more moment to moment to moment like a motion map or a vector diagram. And so we're trying to help students be able to correlate, to make connections between and among all these different representational forms with the hope that it helps them to more deeply understand how we think about changes in systems, be it motion or be it force or... That's mostly what we focused on. But we've also thought about how could this get expressed in other things like fields for example, wave motion. And we haven't quite gotten there. Some of our teachers have dabbled in it, but as a project we haven't quite gone there yet.

Mark Royce (17:21):

So you guys are managing that grant. Colleen, did I hear that there's another grant that you guys are kind of collaborating on?

Colleen Megowan-Romanowicz (17:30):

There is. We have a grant to develop an app for your smartphone and in fact the app has now been developed, that lets you visualize a magnetic field, using augmented reality. So it takes an image you are seeing with a camera on your phone and it uses the magnetometer in the phone to superimpose little dots or arrows that represent the magnitude and direction of the magnetic field around, I don't know, anything in your house or anything in your world, including the world itself.

Mark Royce (18:12):

Wow. Now what would the application for a teacher, I'm not a teacher, you know, this, I'm not a modeler. I'm just an interested party with a wife who's very into it. Well, how was the application for the, for our instructors, our teachers?

Colleen Megowan-Romanowicz (18:29):

Rebecca, you want to take it?

Rebecca Vieyra (18:30):

Sure. I'm happy to. So let me put it this way. So typically when teachers teach about magnets, the one kind of concrete experience that most teachers will do is students is to place like a bar magnet on the table, put a piece of paper on top of it, and then to have students place iron filings and then what you see as a pattern, it's a pattern where you can kind of see lines that go from the North pole to the South pole. You can't tell the direction though, but you kind of see this pattern. It's like a butterfly pattern almost, around the magnet. Sometimes we'll get really creative teachers that I've seen that'll actually place magnets in jello. So you take clear jello and you mix in iron filings and you suspend a magnet and you can actually get the iron filings to kind of get suspended in the jello. And you can see this three-dimensionally. That's a pretty awesome example actually I got from PTRA, the physics teaching resource agents of the American Association of Physics Teachers a while back. But most people just leave it at that and then they'll move on to electromagnetic interactions basically. So, I feel like there's a lot of space for, I guess no pun intended for, for deeply understanding fields because for many students, they don't really have a good understanding of fields. Now modeling does a great job of when we study things like gravity, to think about like energy fields, to think about force fields that traditionally physics and physics teachers may not touch on. But magnetic fields I think are really cool because, number one, they're fascinating for kids, you know, get magnetized marbles or whatever. Kids will have hours playing with those kinds of things, but kids don't often have a deep understanding for three dimensionally how these things look. And again, just the concept of fields is very new for many people. It's bizarre. It's so bizarre in fact that there's this wonderful book called the evolution of physics. It was written by Albert Einstein for the general public in which he talks about this idea of fields. And it's because of the idea of fields that we have some of these more modern understandings of physics, but people were still struggling. The general public was still struggling with these ideas in the 1940s, 1950s, because it was just so novel. And I think what I love magnetism and magnetic fields is it really brings to life this whole paradigm shift in physics. And with the app in particular, it kind of goes back again to representations, right? AR is not a physical thing, but it does take place in physical space. And so unlike having a computational model, where you can like rotate something that looks three dimensional on a flat computer screen, this particular app that we're talking about allows you to move through space with your phone and to see magnetic fields from different perspectives, and to collect the data as you go. And it's raw data. It's real data. So it's not just some computer telling you what it should be. It's actually allowing you to visualize in real time and real space what that three-dimensional field looks like, which may be much more complicated than a field around a simple bar magnet. So I guess it's hard for me to answer your question because that's the question that we're asking for our grant is what can we practically get out of this? I see lots of opportunity and aspiration, but you know, let's see. Let's see what the teachers tell us they can do with it.

Mark Royce (21:54):

I love crowdsourcing where you put it out there and then you collect the data on how people are developing creative uses and you know, pulling that in. So this is kind of exciting to see how it evolves. So right now I want to ask, how do people get the app?

Rebecca Vieyra (22:10):

We also have a website. I'll be your website person today. https://www.magna-ar.net If you go to that website, there are direct links to take you to the app for Android phones and also for iPhones.

Mark Royce (22:31):

We'll post that on the website as well. Under your episode, this episode,

Colleen Megowan-Romanowicz (22:36):

I'm just going to jump in for a moment and say that, as Rebecca said, fields are hard and this is something that teachers, especially high school teachers have approached with caution, if at all. It's one of the most avoided topics in high school physics and understanding of fields. And many teachers will say, well, I don't really talk about fields because the kids just don't get it.

Mark Royce (23:03):

It's magic.

Colleen Megowan-Romanowicz (23:05):

It's action at a distance, right? It's magic. And that may be code for we don't really get it right. Sometimes. I will admit that when I first taught physics, I didn't really get fields. I could kind of get gravitational fields because, well, it's just down, right? And it's just an attractive force and I've got a representation for that. But I didn't have a good representation for magnetic fields that was three dimensional. And I think that's the big aha for people when they use the app, that if they want to know what the magnetic field is here, they can turn on their app and they can place a dot on the phone here and they can see exactly what that magnetic field is. And if they want to know how it changes as you move through space, they can do that. And if they want to take their phone and move somewhere else and look at the magnetic field, they just put over there, they can do it, they can see what it looks like from the other side or from underneath or from above because they can move their phone around and still look at that field. And it's just hovering there in space. Telling you at the points where you touched that phone and made a dot or an arrow, that's what the magnetic field looks like. It's pointing this way and it's this strong. And the visualization for a three dimensional thing like a field is a very big deal for really getting it. If you're, whether you're a kid or a teacher,

Mark Royce (24:48):

that's really exciting. I think it's going to be neat to watch how this all unfolds over the next bit of time. These are some very cool things that AMTA is involved in bringing resources to our teachers. Can you tell me, are there some things that you're dreaming about that you'd be willing to share? I guess this would be future look if we, if we could.

Colleen Megowan-Romanowicz (25:13):

Yeah. There's been a lot of rumbling. As always, this has to do with what teachers want. So there has been a lot of rumbling for... We need modeling instruction for elementary teachers and when we do something for elementary teachers, we're not just going to be teaching them ways of teaching, but, we will also undoubtedly be strengthening their content knowledge. We need modeling instruction for mathematics, and we need guidance for using modeling instruction with English as a second language students. So these are several of the areas where we continually hear from teachers with questions about how to reach students better. I think this is just speculation, but, sitting in the midst of the pandemic. I think that we're going to start hearing from teachers who want ways of using modeling instruction via distance learning because it really is a different learning environment and they are stuck in it right now and no one has high expectations right now. Everybody knows it's rough because there was no preparation for plunging into this new environment. But now that we're here we need to know how to do it well. So what does that look like? That's going to be another area I'm sure of exploration.

Rebecca Vieyra (26:48):

Can I add one too, Colleen? And this is something that I feel has actually come out of our computational modeling grant, which is the big data question. I think that there are a lot of folks or there's a number of folks who've been doing programming with spreadsheets, but what's attractive about this is the idea that physics people use big data including raw data. So things like seismic data, earthquakes, being able to really bring in some of this earth and space science data, in a way where -- I don't want to say traditional modeling but, but kind of the original modeling very much is focused on classical mechanics, very linear kind of, you know, one-, two- dimensional kind of stuff. We know that we at some point need to move our kids towards messier data, and towards some contextualized data. With the foundation and the original stuff of course. But, we know that we can take our kids further.

Colleen Megowan-Romanowicz (27:49):

Sure. Yes. We absolutely have to move into data science, or move data science into science and mathematics. We have the tools. There is no excuse. Yeah.

Rebecca Vieyra (28:05):

yeah. Kids just need more time taking physics. Honestly, what needs to happen more science in general. More STEM for sure.

Mark Royce (28:12):

Rebecca, when we first invited you to come talk with us. Did you have anything you thought we might need to talk about that would be important to you?

Rebecca Vieyra (28:21):

I guess there's a couple of things that I think I'm really excited about with the projects that we're working on. The one with the computational modeling, I think as you mentioned earlier, it's really important for any research project to give the something-- whatever it is you're working on-- to give it to the teacher and see what they want to do with it, see what they come up with. And with that computational modeling project, we actually started not doing trainings, so much as saying, here's a new idea, take what you can from it and make it into something beautiful. And out of that, we've got a number of workshop leaders who are extremely competent and who are really driving this process. So, you know, teachers as partners in research, I think is really critical and that has always been a focus of modeling instruction. It's never been teacher-proof curriculum, you know, it's never been... we say workshops, we don't tend to call them trainings. We want teachers to be full partners. And so that vision and the vision of teachers as leaders and teachers as creators is probably one of my life missions is to make sure that we respect everything that teachers bring to the table. And we just help to facilitate. They're becoming the best they can be.

Mark Royce (29:43):

Are you involved as a workshop leader or doing any distance learning or any of that kind of stuff?

Rebecca Vieyra (29:50):

No, I am not. I attend the workshops, but my role is very much more on the programmatic development. At this point it's mostly about the managing all the logistical pieces, but then also the research, interviewing people, and helping to develop some of the instruments for assessment. So, no, I wish I could have been a workshop leader at one point, but I don't have summers anymore to have that time to dedicate to the things that I'd like to dedicate to.

Mark Royce (30:28):

Well, reading your bio, I kinda thought maybe there was three people with the same name. You're very active and involved with, you've got your fingers in a lot of pies, but it sounds like you're contributing at a really high level and we're really appreciative of that.

Rebecca Vieyra (30:44):

Thank you. I mean, it's all about the ecosystem, right? When you plant a seed well and you water it well and it gets lots of sunshine, it grows into to something that's pretty awesome. And I've been extremely lucky from my time at Illinois State University, from the exposure that I had from my parents into these kind of intellectual communities and then these people who fostered me along the way and invited me into their communities. I mean, that's great. I only hope that other folks get the kinds of invitations that I've gotten. And I hope I can offer that to others as well.

Mark Royce (31:22):

Yeah, I know that people who hear this episode will be interested and some will have questions for you specifically and will want to connect so you'll share with me any ways that you're reachable and we'll share that on the website as well. So Colleen, is there anything that you'd like to share any more about the development of AMTA?

Colleen Megowan-Romanowicz (31:49):

Well, so just maybe riffing off what Rebecca said, AMTA is like a big field and it's full of teachers and you put things into that field and they're like little magnets. You change the direction that they're pointing. It feels our interactions, right? So the iron filing interacts with the magnet, the iron filing changes the magnet and the magnet changes the the iron filing. Well, modeling instruction is a little bit like that. So you've got your field with modeling instruction in it and with people in it, like Rebecca, and they are orienting or reorienting teachers and they're teaching by their interactions. So we have workshops in that field and we have teachers in that field and we have people in that field who are shaping each other as we go. Ultimately we're constantly changing because we're in the field, we are actually interacting with the teachers, which is maybe a little bit different than classic things in that field, which are like textbooks. They don't interact, they're just there. They're inert, but we're all interacting all the time. And who knows in this second level chaotic system where we will go next.

Mark Royce (33:15):

it's exciting to me. I, I've heard so many modelers say that one of the great things they gained in the modeling community was just that: community. That they had been missing. And to be able to connect with likeminded teachers and have the resources open up through the common shared ideas has been really important to them. Not just the knowledge and the stuff they can apply, but the way that knowledge is shared in the community has been wonderful. So it's been exciting. Well it's been great talking with you two about these exciting new things and I want to say thank you so much for taking the time to share what you guys have been doing and bring us into the -- I think just getting the app thing is a huge thing today, so thank you for that. And Rebecca, I hope you stay well on the East coast. Tell your husband thanks for the time that he gave you up.

Rebecca Vieyra (34:14):

No worries.

Mark Royce (34:16):

And Colleen, it's always a joy and I have a feeling we may come back around on some of this stuff. We'll check in to see how the app is doing and I think that would be a really fun podcast to have in the future.

Colleen Megowan-Romanowicz (34:29):

'Bout a half hour piece.

Mark Royce (34:31):

We'll definitely try to make that happen.

Colleen Megowan-Romanowicz (34:33):

Great. Sounds great. Thanks a lot Mark.

Mark Royce (34:35):

And Rebecca, it shure would be nice to have you back again sometime.

Rebecca Vieyra (34:39):

I think that sounds great.

Mark Royce (34:40):

Thanks for being here. Take care.