

Mark Royce ([00:00](#)):

Well, hi Jon, how are you?

Jon Anderson ([00:02](#)):

Oh, I'm doing well, Mark, how about yourself?

Mark Royce ([00:04](#)):

I'm well. I'm staying busy out here in California. So, <laugh> Well, I want to jump back in your timeline and ask you about, cuz it's been several years, but how did you first get interested in the modeling approach in the classroom, and what introduced you to it?

Jon Anderson ([00:26](#)):

Sure. Well, it's a little bit of a convoluted history. I got introduced to Arnold Aarons and his book when I was in my master's program. I got an M Ed in physics education and that was in the early nineties. And that began to validate some of the things that I, or give voice to some of the things that I was doing in the classroom at the time. And it really stuck with me. 2002 was my first formal introduction to modeling. That was at a workshop that was run by Tom Okuma and, uh, Kurt Heigelkey. It was at Miami-Dade Community College. And one of the presenters, it was a three-day workshop that they used to run for two-year college and high school instructors.

Jon Anderson ([01:27](#)):

And, um, and so one of the presenters in that workshop was Dwain Desbian, who I know was a recent guest of yours. And Dwain specifically, introduced modeling as an approach, if you will, at that time. But then he really focused on the use of whiteboards and introduced us to using whiteboards as a communication, debriefing from a lab sort of tool. So it was something that I started to adopt. And I've always approached my physics from a very hands-on perspective. And I'm fairly mechanically inclined, so I always look for ways to enhance what we were learning with physical apparatus, whether it be for a demonstration or whether it be most typically a lab or an activity that the students got involved in.

Jon Anderson ([02:28](#)):

So it was starting to come together, right? You know, these things that I've read, from Arnold Aarons that stuck with me, and then this introduction in 2002 to modeling. But when I really got on board was when I did a three-week workshop at Florida International University in Miami. And that was in 2009. And it was sort of this culmination of... I'd been using Vernier software and related equipment since '93, and then wrote a couple of grants for my high school to the tune of about \$25,000, in '94, and then again in '96. So I was able to buy the whole suite of Vernier equipment and really began to integrate that into my own curriculum, even moreso. But when I took this modeling workshop, it's like it all fell into place, right?

Jon Anderson ([03:24](#)):

It was like, here's what I've been trying to do. But it didn't really have a description, or it didn't have sort of the layout that modeling gave it. And so, like I said, things just fell into place. You know, the equipment that I'd been using, the phenomena first approach, the deployment activities that come after they learn something, sort of a de-emphasis on the math and more on the physical phenomena and

applications to the real world. It just completely validated, if you will, a lot of the things that I had been trying to do, and just gave it more of a framework that I thought made sense.

Jon Anderson ([04:15](#)):

So I did that workshop, that was 2009. And in the next academic year I was teaching three sections of a concurrent enrollment physics class through the University of Minnesota. So my students would get credit for the course they took from the University of Minnesota. They were fully registered students. And essentially my high school was like a satellite campus for these classes. And so I was teaching three sections of that and then two sections of introductory physics. And so what I decided to do was I put away any materials that I'd accumulated for my introductory physics course and by this time I'd been teaching close to 20 years, or at least 20 years, I guess. Yeah, I gotta get my dates right. Yeah. 20 years.

Jon Anderson ([05:11](#)):

And so I had an accumulation of 20 years of curriculum and just things that I'd done and I just sort of put it all away, and jumped in with both feet with the modeling curriculum, with my two high school physics classes. And so that was a real baptism by fire for me to really implement it that way. And then, as time went on, I just integrated more and more of it into both my... I used that approach exclusively with my introductory physics. And then I picked up a couple of sections of an honors ninth-grade physics in place of the introductory physics. And they were completely on board with it. I mean, there was no hesitation for them cuz they hadn't been indoctrinated, <laugh>, I don't wanna say indoctrinated, but they hadn't gotten used to being given the formula and then just working a bunch of problems.

Jon Anderson ([06:07](#)):

So they really jumped in. And then, as time went on, like I said, I just integrated it more and more into my own, into my college and the schools courses. And just found all kinds of ways to make that work. And then the other thing that happened was then the following summer, 2010, I got asked to lead a workshop at FIU, at Florida International University. And I did that for the next five years. And then started also leading the workshops at Cal Poly in San Luis Obispo. And, so that's kind of my history with it, still leading workshops, and still learning a lot by doing it. I mean, to me, that's one of the best things about it is not only sort of spreading the gospel, if you will, but also, all the stuff that I learn from the people that participate in the modeling workshops. I consider myself as much of a beneficiary as I am a provider of professional development at that point.

Jon Anderson ([07:22](#)):

Because they bring a lot. So yeah, that's, that's sort of my history with it right up to then. And I, I've led workshops also at University of Central Florida at Orlando, one at the University of Minnesota. And you know, it's all about funding of course. So, money's gotta be there for them to do it.

Mark Royce ([07:48](#)):

Are you teaching this summer, any workshops?

Jon Anderson ([07:52](#)):

Yeah, I'll be at Cal Poly for two weeks this summer. That's the two weeks right after the week of the fourth. I think we start on, call it the 10th. I'm not positive of that date 'cause I'm not looking at a calendar, but I believe it's the 10th of July and we go, but it's that Monday after the fourth, and then we go for two straight weeks after that.

Mark Royce ([08:14](#)):

Right. Cool. Well, if our listeners are interested in joining your workshop, then they can check it out on the AMTA website, I'm sure modeling.instruction.org. Yep.

Jon Anderson ([08:27](#)):

Yep. And there's concurrent chemistry, biology, and physics workshops that happen during those two weeks.

Mark Royce ([08:35](#)):

Yeah, I think my wife is doing the chemistry workshop while you're there. She's mentioned though that you pick one of those to participate in, but you guys do do some cross-training a little bit. There's some interactive stuff between the participants of each of those workshops. Is that correct?

Jon Anderson ([09:00](#)):

There is on a couple of levels. One is we always set aside, or I shouldn't say always, we've been doing this, well then you throw COVID into this mix. So let's just say that we have done, I can't give you an exact number, but let's just say that we have done more than one part of a day where all three groups get together and we look for some common threads through the different subject areas for the modeling. So that's one way that it happens. And then the other way is, is that the participants often will stay in the same housing facility when they're there. And so naturally, they're just gonna have casual conversations that revolve around what they're learning and the modeling approach that they are picking up.

Jon Anderson ([09:58](#)):

And several participants that I can think of, have taken both the chemistry and the physics, not necessarily in one order or another, but people have taken both of them. So that I guess is sort of a third way that it naturally leads to overlap. But yeah, lots of discussion amongst the modelers at lunch and during common break times that we have. It's just very collegial and very easy conversations that people do have. Because they're there by choice.

Mark Royce ([10:41](#)):

Right. That's very cool. So tell me, what is your favorite part about the workshops-- teaching 'em, you know, when you get into those two weeks, what's your favorite part?

Jon Anderson ([10:53](#)):

Yeah. Well, there's so many, Mark. I, first of all, I mean, I just really enjoy hanging out with physics teachers, right? <laugh>, I mean, they're an interesting and an engaged, group of people. At least my experience has been. And so I really enjoy just being around like-minded people that are there to try to pick up as much as they can and enhance their teaching. Um, you know, like I said, personally, I learn a lot from the participants. And so I really like that part of it too. But I love seeing, particularly veteran teachers, look at teaching physics from a different perspective, or from a different, taking a different approach to teaching it than, perhaps they had felt comfortable doing before or maybe weren't aware that it was an option.

Jon Anderson ([11:55](#)):

So, those are all things I like. I've been really lucky to work with lots of Noyce scholars and I think that they are really motivated and energetic group of participants. I like also the interactions that happen between, sometimes we've had pre-service teachers as well as quite veteran teachers, and watching those interactions between pre-service teachers and experienced veteran teachers. And that's a two-way street too, because there's a lot to be learned from both directions there, from both groups of people. There's so many things, but it makes for a really enjoyable and fast-paced couple of weeks every summer.

Mark Royce ([12:53](#)):

Yeah. That's great. We'll be right back to our conversation, but first, we want to encourage you to help bring modeling instruction to your area. The AMTA is currently looking for individuals or organizations to host face-to-face summer workshops. We can help craft a workshop experience to meet the needs of your teachers. Our team can guide you in the process and provide facilitators and digital materials, learn more by emailing Kaylene.klove@modelinginstruction.org. That's klo, K L O V E modeling instruction.org. Hey, I wanna ask you a couple questions about your practices in the classroom. And you can approach either high school or college or both, it doesn't matter. But I know one of the things that you are really focused on and proficient at is lab design and how you set up your classroom, setting up your classrooms. Do you wanna talk about kind of some of your approach to the lab design and set up?

Jon Anderson ([14:16](#)):

Sure. I think every physics teacher, maybe I'll say most physics teachers, have had to design some of their own equipment, right? Maybe, you know, didn't have it, couldn't afford it, whatever the case may be. I've always enjoyed that part of it, right? I've always enjoyed putting together... one of the things that I got so much use out of when I was teaching high school was like 10 inch long pieces of two by four, right? And this isn't a whole lot in the design department, but just, you know, just little chunks of two by four that I put an eye hook in on one end and put a felt pad on two sides, on an edge, and on the face of it.

Jon Anderson ([15:14](#)):

And using that for lots of different things. Building a centripetal force apparatus, building hovercrafts that students could put to use. So my approach has always been the modeling approach where we start with the phenomena and then we follow up with the explanation, whether it be mathematical, whether it be graphical, a written explanation or description. And then looking for lots of examples of where they're gonna see the same thing out in the real world. And, so that's something that I've always really enjoyed. And so anything that I've put together, whether it be with existing lab equipment or something that I've made, has been with that in mind: to either give them a good experience in starting out their study of the topic, or to try to show them applications of it and perhaps additional deployment labs that we do that are part of it as well.

Jon Anderson ([16:29](#)):

And along the way we develop the math, but it really has to start with something that they have to physically manipulate and that they have to be involved in building and putting to use or setting up and putting to use and taking their own data. The other thing that I've always been a firm believer in is the fact that students really like ownership, right? They wanted, I mentioned this I think in the, some of my preliminary stuff that I sent you, but, students like to own the things that they do. And the things that

they learn. And they also like to be in the expert role. And I think that's one of the things that modeling does so well is that they set up their own lab equipment.

Jon Anderson ([17:25](#)):

They collect their own results. They analyze their own results, and then they display their own results if it's graphical, if it has a graphical application. But that's, that's theirs, right? And what's great in a discussion, a classroom discussion is that each group will often have a slightly different approach and sometimes a drastically different approach to getting the data. And what makes that unique is that that's their own. And they get to say, this is how we did it, and this is the data that we collected, and here's how we're displaying it. So that automatically puts them in the expert role too. And it gives them voice that they wouldn't have if I handed them a sheet of directions and said, here you go. Right? You know, make sure you do step seven before you do step eight <laugh>, you know, and then put all your data on this nice neat little table here that I've set up for you. That's just plug and play. That's not them. There's nothing authentic about that, in my opinion.

Mark Royce ([18:37](#)):

And you mentioned the discussion groups. Do you have tricks that you use that you've learned to help facilitate that discussion among groups and in your classroom? What are, what are some of the tricks you use to help make that happen, especially in the context of your science classroom?

Jon Anderson ([19:02](#)):

I think there's a couple things. I think first of all, you either have to do modeling or you don't, right? You can't start the year with one approach to teaching your physics class and then start sprinkling in some modeling. I just don't think that works as well. I think you have to establish in your classroom that this is going to be you basically directing your learning. And I'm gonna be facilitating it and providing the materials for it. And I think they have to start getting used to that. And they're not used to it with "they" being, of course, the students. So there's some struggles that happened with that at the beginning. As it gets going, they also realize that every time that they're gonna be asked to discuss their procedure and share their results and that their input is an important part of the learning of the class, for the class as a whole. I always make an effort to, I'm very clear about setting up the board meeting, the white whiteboard circle rules, right from the beginning. And then I'd stick with them, to the point where I don't have to mention them anymore. But what I always tell my students is that when we get ourselves into some closed geometric figure, not necessarily a circle, I don't think it's ever been a circle, but it is some sort of closed geometric shape, that they should be in a position where they can't see anybody else's back.

Jon Anderson ([20:57](#)):

And also that they can see everybody's whiteboard that's on display. And 'cuz I want everybody to be up the same level. And I'm even, in some places where I have taught, the stools are adjustable. And I just make sure they're all at the same level too, cuz I don't want somebody sort of like, hovering over somebody else. I'm really careful to set up that environment that I think is all about respecting their peers and the input that their peers provide. And then I'm also really clear to point out, initially, how important the input that each group provides, how that contributes to the overall understanding, and that it's sort of this group sense-making that we do.

Jon Anderson ([21:57](#)):

And that is based purely on the input from the other groups, not from, me putting formulas on the board or telling them to read this or work these problems, but the initial knowledge that they gained comes directly from their own experimentation and from the other groups. And a classic example of that is the first lab I always do, which is a pendulum lab. And rather than have each group, --there's three variables for a pendulum. There's the pendulum length, there's the angle of release, and there's the mass on the end of the pendulum and only the length of the pendulum has an impact on the period, the time it takes a pendulum to oscillate once.

Jon Anderson ([22:51](#)):

And so what I will do is I'll have some couple of groups do each of the three potential variables and so they do only mass or they do only angle of release, or they do only length, and then we take a look at it after everybody's done and analyze the results and put it on a graph and we do the whiteboard circle. What'll happen is, it's really clear that on the mass versus time, it's a horizontal line. On the angle of release versus time, it's a horizontal line. And on the length versus time, it's a side-opening parabola. In other words, it's increasing, time is increasing as the length increases, but not linearly. But I tell, I point out, I said, you know, this is something that each of each of your groups have contributed to this understanding of what impacts the period of a pendulum. And that we're gonna do that a lot, right? And then we'll never talk about the formulas for a pendulum at all, right? It's just, we just move on, right? It's all about establishing, the value that each group provides as well as beginning to work on their scientific, on their lab procedures.

Mark Royce ([24:23](#)):

You mentioned something in your notes to me as we were discussing this ahead of time about providing relevant model deployment opportunities.

Jon Anderson ([24:36](#)):

Yeah.

Mark Royce ([24:37](#)):

I didn't fully understand what that meant. You know, I'm not a science instructor, but what are you talking about when you talk about providing relevant model deployment opportunities?

Jon Anderson ([24:51](#)):

So that can take lots of different forms. So I'll give you an example, a couple of examples. One of them is that, when we begin to investigate acceleration, what I like to do is, I like to take, I have a collection of bowling balls that I have acquired over the years. And I find that bowling balls heighten interest, you know, they're big, you could see 'em, the potential for danger goes up considerably when you're using a bowling ball. And so what we'll do is, depending upon the time of the year in Minnesota, I try to get 'em outside if it's possible. And we find a real gentle slope. I know of a couple of places where this happens at my school, real gentle slope, or if the weather's crappy, there's a couple of hallways that have fairly gentle slopes that we use too.

Jon Anderson ([26:01](#)):

But what we do is we go out and we, lay out long tape measures and they let the bowling ball go, and they time the bowling ball and they do it, you know, some, some groups will do how much time to get to certain distances. Some groups will do at a certain time, what's the position. And again, that's gonna be

up to them. And so then they come back in and they've got all their data and they make some sense out of their data in the way that I just mentioned where ultimately it culminates with a board meeting and we definitely see that the position changed at a non-linear rate. And then we start to jump into graphing the velocity versus the time, and they see that that's linear, but then I'll provide 'em with opportunities using the Vernier equipment, for instance, right?

Jon Anderson ([27:04](#)):

So we'll follow up and do a series of labs on a ramp, where they're moving up the ramp toward the detector, which registers as as negative, right? And negative velocity, moving toward the detector. And then they'll be down the ramp away from the detector. Then they'll put the detector down here and it'll be up the ramp away from the detector and down the ramp toward the detector. So those are sort of the main ways that they look at it. So that's one deployment. We will also look at applications of things that accelerate. Whether that's working problems, or one of the assignments I always give my students is to keep a list, come up with at least three things that they felt accelerating or that that accelerated, in their day. Of course, you know, a car is always one of 'em, and some of them may have gone home and ridden a snowmobile or they may have ridden a bike or whatever the case may be. But that's just to try to keep it in their world as much as possible. And I always figure if they can't look at the world without seeing physics, then I've been successful.

Mark Royce ([28:37](#)):

<laugh>. Yeah. That's awesome. That's really cool. So in general, what would... Okay, you're an experienced teacher, you've been doing this for ...

Jon Anderson ([28:55](#)):

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Mark Royce ([28:55](#)):

36 Years, <laugh>

Jon Anderson ([28:57](#)):

been teaching for 36 years. Yeah.

Mark Royce ([28:59](#)):

Yeah. So, you got a room full of newbies, new teachers. What's your best teaching tip that you would share with those teachers, from your experience?

Jon Anderson ([29:14](#)):

There's so many little things that-- I also supervise student teachers, and so I'm thinking about these things, these things that I'm watching my student teachers acquire as time goes on right now. So I've got five physics student teachers right now, and one of the things I really encourage 'em to do is learn their students names as quickly as possible. And to try to do that, if they can do it in three or four days, and even if they maybe don't know all of the names, use enough of the names to convince the students that they know all the names. Until you get 'em all. I think that's so important in terms of making a connection with the students. It shows the students that you are interested in them, that they're not just another face sitting in your classroom, but that you are invested in them as individuals.

Jon Anderson ([30:19](#)):

And I also tell 'em, I don't expect you to know any physics when you walk in here, right? Zero. Right. Because, you know, yeah, physics has been part of your world, you know, every day. I mean, you fell down enough times when you were learning how to walk and that's because of physics. But I don't expect you to know and understand any physics. You're here to learn that, right? And don't be afraid to take risks, to ask questions. So I think maybe on a more, on a personal level, to try to begin to establish a rapport with the students immediately, everything follows, flows more easily after that. And also set up your classroom and be consistent in the way that you approach things. Because you, as a teacher, you're expected to be the same person tomorrow that you were yesterday, that you are today. And you don't get to go hide in your cube if you're having a rough day. And, so, but be consistent in the way that you approach things too, because that goes a long way to establishing a positive environment, I think, in your classroom.

Mark Royce ([31:33](#)):

That's awesome. So, Jon, tell me how modeling has, you know, impacted your life?

Jon Anderson ([31:40](#)):

Well, I mentioned this earlier that it really gave structure and voice to what I had been attempting to do and the approach I felt like I'd been using leading up to my formal training in it. I can honestly say that when I look back on it, that workshop was transformative in the way that I teach physics. It had a huge impact on my approach and frankly, on my career. And because it makes it so much fun, <laugh>, you know, I mean, as an ADHD guy, I cannot just sit in front of a room while my students work on problems. And so having even more opportunities to interact with them when they're in lab groups and have them doing, actually doing the experiments, is huge. And it came at a perfect time in my career too. And I've heard something similar from other participants about what an impact it's had on their career. And I don't take that as me having an impact on their career, but rather them being introduced to the modeling curriculum, the modeling approach is what had an impact on their career. And I'm just happy to have been a part of that.

Mark Royce ([33:11](#)):

Yeah. Wow. That's awesome. Well, you're very encouraging and I hope our listeners, if you haven't been to a workshop that you'll consider getting involved with a modeling workshop in whatever discipline that you're focused on, whether it be physics or chemistry or biology, or, there's a couple, others too, I know that are being promoted now in the AMTA website, which is modeling instruction.org. I believe is, AMTA's url. Jon, thank you so much for taking the time outta your busy schedule to talk with me today. It's been great. I've really enjoyed talking with you and I think you've been very insightful. You have anything you want to say before we go?

Jon Anderson ([34:09](#)):

I just want to echo the same to you. I really appreciate you asking me to do this. It's really enjoyable to talk about things that I'm passionate about. And things that I feel like I know well, and this is certainly one of 'em. So, it's been nice to talk with you. Thank you for the opportunity and I look forward to maybe seeing you in San Luis Obispo this summer.

Mark Royce ([34:37](#)):

It's possible I might be there. So you have a great rest of the day and I hope the snow is melting and you guys can get around.

Jon Anderson ([34:50](#)):

The sun is now North of East and West, so that's, that's a good thing, <laugh>.

Mark Royce ([34:57](#)):

That's great. You take care.

Jon Anderson ([34:59](#)):

You too. Thanks, Mark.