Christopher Richmann: Welcome to Professors Talk Pedagogy, a podcast from the Academy for Teaching and Learning at Baylor University. I'm your host, Christopher Richman. Professors Talk Pedagogy presents discussions with great professors about pedagogy, curriculum, and learning in order to propel the virtuous cycle of teaching. As we frankly and critically investigate our teaching, we open new lines of inquiry, we engage in conversation with colleagues, and we attune to students experiences, all of which not only improves our teaching, but enriches and motivates ongoing investigation. And so the cycle continues.

Today our guest is Dr. Hollylynne S. Lee, Distinguished Professor of Mathematics and Statistics Education at North Carolina State University. In spring 2023. Dr. Lee is in residence at Baylor University as the recipient of the Robert Foster Cherry Award for Great Teaching. Dr. Lee earned her BS in Secondary Mathematics Education from the Pennsylvania State University in 1991, her Masters of Arts in Education and Secondary Education Mathematics in 1995 from the College of William and Mary, and her PhD in Mathematics Education from University of Virginia in 2000. Prior to her work at the university level, she served as a K12 teacher. Among her many teaching awards and honors, Dr. Lee was named in 2020 as a fellow of the American Statistical Association in recognition for excellence and advocacy in data science and statistics education and the professional development of teachers. She was honored with the UNC Board of Governors Award for Excellence in Teaching in 2019-20 and named a fellow of the International Society for Design and Development in Education in 2019. Dr. Lee has secured millions of dollars in external and internal grant funding. She has committed much time and energy to creating open educational resources, offering free online courses for educators from around the world, and sharing research-based multimedia materials via creative commons licensing. Her scholarship and writings include over 100 journal articles, book chapters, and conference proceedings, four co-authored books and a co-edited book on scholarly practices and inquiry in the preparation of mathematics teachers. We are delighted to have Dr. Lee on the show to discuss teaching future teachers, creating resources for teacher development, and much more.

Well, Hollylynne Lee, thank you for joining the show today. Congratulations are in order, first, I think here, on your being named the 2022 Cherry Award winner, which if I have my facts straight, is both a national teaching award but also the most significant monetary prize in the realm of teaching awards as well. What do you think that this award demonstrates or recognizes in your own teaching?

Hollylynne Lee: Yeah, first I just want to say I've been so incredibly honored and humbled to be recognized for this award and to even be nominated when my university wanted to even nominate me for it back in 2020.

CR: It's a process.

HL: It's a process. I really think that I just came back from my experience at Baylor, from being able to be there in residence and had a lot of time to reflect on what did this award recognize through my teaching. I really feel like over the years I certainly have impacted many students, both undergraduate and graduate. I've been at this for 23 years now. Directly in my college classrooms. I think I bring a lot of compassion and creativity, as well as an innovative spirit to my teaching. I'm not afraid to fail, so I'm not afraid to try new things. I really consider myself an educational designer. And that means, from my perspective, that I take seriously designing the tasks that my students will engage in. The tools that they'll use, whether they're electronic digital tools or whether they're physical tools. The questions that I'm going to ask and thinking creatively and carefully about how I'm going to orchestrate those interactions in those learning moments in my classroom. So that's all from even when I was a K12

teacher. I really thought very deeply about my pedagogy. In the past 15 years, I've really been able to ramp up these teaching practices to develop instructional materials and to co-design different software tools with others. Developing things like video cases of classroom practices, and all of those I've been able to package in ways that I can give to faculty at other universities to use in their courses. I think that that's a lot of what I'm being recognized for. That it's not just my impact at NC State with the students that I teach every year. It's the fact that one: the students that I teach are teachers themselves. They go out and reach more students. But that I've been able to share my pedagogical strategies along with my collaborators. None of this has been done in isolation. To be able to share that with faculty at other universities, package those materials and be able to then have my ideas and my collaborators' ideas influence those learning moments for students at other institutions.

CR: I've heard of the post-tenure and/or post promotion slump, where a faculty member maybe just feels like a little bit of a letdown after, after that great recognition like what's the next thing? Here at Baylor, we have a status known as master teacher, which I joke and say it's the award after which Baylor says you can't win anymore awards. We're done giving you awards basically for your teaching, like this is getting out of hand. Let's just give you this last huge one and call it a day. After winning an award like this, as prestigious as this, how do you maintain the fire in the belly, innovative spirit?

HL: I think it has actually lit it even stronger. It's returned to me, returned me to my roots of the college classroom itself. Because so much of my recent work has been in packaging materials to be able to do faculty training and educating faculty to use these at other places. This has reminded me I'm a classroom teacher, and there's still so much more that I can learn and do in the college classroom that I want to continue to do that. I also, within my own discipline, I focus on statistics and data science education. Those disciplines are really taking off. I see it as an opportunity to really have an impact both in the K12 education space, but as well as the collegiate space of educating the students of tomorrow and bringing that creative spirit to that task.

CR: As you mentioned, you were on campus here at Baylor for the spring of 2023, just wrapped up that semester. Tell us about the courses that you taught, and what were the things that you were trying with Baylor students?

HL: Yeah, I got two new course preps for my time at Baylor. One of them was critical issues in mathematics education. And that was for juniors that are preparing to be middle and secondary mathematics teachers. In that class, I was really able to think about, well, what are some of the critical issues that are happening right now? That's a class that can't stay stale because issues always change. We spent some time at the beginning of the semester where I was hearing from the students. You've had some field experience right now. What do you see happening out in classrooms? What concerns you even from your not-so-distant high school experience? What are some of the concerning things? We've built a lot of the curriculum around that. Like, okay, what are you concerned about? They were very concerned about how do you use technology appropriately. The pandemic really amplified that in math classrooms in particular. And how do you really focus on keeping students engaged when there might be lack of motivation? And the whole talk about "learning loss" for students, I don't really like that phrase at all. We dismantled that phrase in my class, and it was like, no, they actually learned a during the pandemic. It may not have been the minutia skills that the educational system wanted students to learn, but they learned a lot. And anyway, that was one of the classes that gave me an opportunity to dive into a lot of material around particularly access and equity in math education, and how do we approach things from a strengths-based perspective rather than a deficit view of learning. And to really help my students with that. And of course, because I'm very focused on the teaching of statistics and data

science, that was a critical issue that I wanted to bring in as well, so that they were aware of some of the changes in suggested changes for creating different pathways for students in high school, where bringing in more math modeling, bringing in more statistics, more data science, more application-based learning that is going to meet the needs of all students, rather than just this march towards precalculus and calculus for all students, or most students or whatever. But that was the critical issues class.

The second class was data and chance. It was for elementary and middle school preservice teachers. These were mainly sophomores with a few juniors in there. This class was very much focused on getting these preservice teachers comfortable with ideas around statistics, around data, around probability, so that they can create those learning moments, those data collection activities, those analysis activities in their classrooms with students. Even though this is a focus area of mine, I had never taught a class specifically aimed at elementary and middle school teachers for the entire semester, so I purposely didn't choose a textbook, and I created the class on the fly. I really took the opportunity to listen every day to what they were, what they were talking about, what they were struggling with, the things that the interactions that I had orchestrated, how well were they going and what was I going to have to do that next class period to build from that moment rather than feeling like I was stuck to a particular textbook. So, that was an invigorating and challenging experience, but I wouldn't have traded it for the world.

CR: I love that idea of being really flexible with the course and your course design. Like you've got ideas of what you want to accomplish, but like how and in what order and how long you spend on this or that can be negotiated. Did you feel like it was…did that create any issues for students who desired more structure, which we know many students really do?

HL: So I don't think in the moment it was, it was, because I was also very good at, you know, it was a class that was met Monday, Wednesday. And set up I set up a structure where by the afternoon of Wednesday I would post materials that would that had to be completed online between Wednesday and Sunday. So, they knew that structure that they were always get some things from me to be completing on their own. And that between Monday and Wednesday, I was really thinking carefully about what I thought was going to be the best learning things for them to do on their own between Wednesday and Monday. And sometimes that changed and after class, I'd be: okay, give me an hour to go back to my office and make a few tweaks before you start on anything.

CR: I love that. Give me an hour. Time me. Here we go! Well, people who know me well know that this is something that I harp on a lot, even though I also succumb to it. It's a little bit ludicrous that we plan out these 14, 15 weeks so far ahead of time before even having met our students many times. We've got this idea of exactly how this learning thing will progress. It's conceited, when you think about it, to approach it that way.

HL: Right. It's one of the things, particularly preservice elementary teachers will often self-report that they're not a math person, not a numbers person. I became, I want to be an elementary teacher because I want to be involved in literacy. They tend not, exclusively, it's not a generalization, but many of them feel much more comfortable in *not* math or science. And they will tell you that. And my number one learning goal was to make them love data and chance, and for them to walk away. I didn't care (I did care), but it mattered a lot less to me how deep into the curriculum we got. It was more about making sure that the meaningful experiences that they did have, we're going to make them excited about it. Excited about what they could do with their own students in their future classrooms. And willing to pick up a book on their own. If they needed to actually brush up or learn something more deeply.

CR: Yeah. That becomes the internal combustion for what they're actually going to do in their professional lives.

HL: Exactly. It was really one of the best learning moments of the semester for that particular class. When I would write the weekly announcements, I would call them things like Data Doers, Royal Regressors, Perfect Probalists. I would make up funny, names for them. And one day after class in April, I was putting the desks back together and on the sideboard somebody had written, "I love being a Data Doer." I took a picture of that and made it into stickers for the students and gave that to them at the end of the semester. And the first question on their final exam was, I am a data doer? true or false.

CR: Talk about easy points.

HL: Yes, confidence building. Yeah, it's not approaching it as easy points. It's like, look, I know some of you are so anxious about even taking a test. Let's let that first question be one that reminds you, you're in this space and you can do this.

CR: Yeah. Well, you're already starting to touch on it. And you mentioned their concerns about student motivation as they get into their own classrooms and using technology in their own classrooms as well. What are some of the other challenges for now, teaching and preparing teachers in the K12 sphere?

HL: Yeah, one of the challenges is recruiting teachers to come into that space, to begin with. I think as a system, we have to get much better at making it clear that teachers are professionals and that they are designers of learning opportunities for their students, and we need to treat them as such. And getting them excited to be able to come into a career in education, and to be able to stay. That's a challenge right there. But I think as far as some of the preparation, I was talking a little bit about elementary teachers. On the other end, with our secondary teachers, they often were highly successful in their own math learning. But not necessarily for the same kind of reasons that we're trying to promote now. They may have been very successful because they were a rule follower, they liked getting those worksheets of 50 things that looked exactly the same because they could actually just regurgitate out and do it, and they were successful at that. So, it's a challenge when we start giving them, as in math education, faculty start putting them in positions where they actually have to model some mathematics. They have to dig deeper into some concepts shakes their belief of, wait a minute, I used to be pretty confident in what I thought was mathematics. And really helping them reshape a vision of what mathematics is, that is probably a little different than the way they experienced it themselves. Working with secondary teachers, it's a completely different challenge, because they come in with a lot of confidence. And it's not like you want to break their confidence. You want them to be confident, but you have to re-shift and reshape their vision of what math and math teaching and good pedagogy really is. Because it's probably different than what they experienced.

CR: That sort of brings to mind, I don't know, it escapes me who coined this taxonomy, but the difference that you're describing there is like the performance learner versus the deep learner. The performance learner is the learner that oftentimes we really enjoy having in college classrooms because they just want to do all the work, and they never push back.

HL: They're a pleaser. They want to please the professor. They want to do everything, every assignment that was given to them.

CR: Yeah. But at the end of the day, they frustrate us because they're not interested in asking questions and finding out the internal workings of things.

HL: Right. So those are some of the challenges. I think that as interesting as it is, the preservice teachers now, and even some of the service teachers, are digital natives. They've grown up in a digital world, which is completely different than the world that the prior generation grew up in, as far as social media, the way you can stay connected to people, with all of those pros and cons. And the way that technology can accomplish things. Being able to help preservice teachers really think about, if I'm going to use technology appropriately, it, it's not using technology just to do a computation. Technology is super easy for that, but how do I use technology to actually reorganize students' learning so that we're getting at those deeper conceptual-wise and taking advantage of the fact that, like for example in data that we can drag a variable onto a graph. That we can create a graph that has three or four different variables on it and is using size and shape and color along with the axes to communicate something. We can click on a single dot and be able to interrogate that dot and find out what is that case about, what state is that? What are some of the details about that? We have to learn how to use the technology to go deeper than just using it as a computational tool.

CR: It's not unlike many of the conversations we're having about AI right now. Especially with the writing and things like that. Yeah. It can crunch the letters now too, not just the numbers.

HL: The questions that we ask have to be different. The problem is no longer, can you graph this function or can you, can you create this scatter plot? Okay? So what? The computer can do that that. It's what interpretations and what interrogations can you do once that thing actually exists. Right?

CR: So what about the flip side? What do you like most about teaching that particular population of college students, those who are going to be future teachers?

HL: Well, I love it because they're in it, because they care about the education of the future. So you don't have to do much convincing that what they're preparing to do is a really…that they need to take it seriously to learn everything that they can. They recognize that it is a, that there are some things that we just classroom management, yes, there are some strategies that we can teach you. But in the end, it's these strategies along with your own, your personality, your comfort zone, your style, the relationships that you're going to choose to build with your students that's going to make your classroom manageable. I think that they were very open to seeing, okay, there is this craft to teaching, and they're willing to take on the challenge.

CR: You described yourself as an educational designer, which I love that phrase, and I think that probably dovetails with a lot of the work that you do of creating resources that instructors, I'm assuming, across the globe, can use for these freely accessible resources. Describe some of the major projects that you've been involved in, things that you're most proud of in that sphere.

HL: Yeah, actually this work started with a grant that started in 2005. My colleague, Karen Hollebrands and I, we're dreaming up how to actually better prepare middle school and high school teachers to teach with technology. We both had been researchers in that space and been working with students with different technology tools. And we recognized we have got to get ahead of the curve and put out teachers that are much more comfortable with technology. We wrote a grant to the National Science Foundation and started putting those materials together. And we had to pick a content domain to start in. And she mainly had done research in teaching and learning geometry. I had done work in teaching

data and probability. And we decided to go with data and probability as our first content area that we were going to be focused on. We worked on those, we developed video cases because we know that teachers learn a lot by actually watching and listening how students interact with things. And at the time, there were very few video cases that, that showed classrooms where technology was being used. And there was basically none where there was any statistics or data, or probability. So we took that on to create some video cases. That's an example of those first materials that we created, as well as lessons where we would have really rich tasks that the teachers would get engaged in as learners themselves using the technology. And then we would start unpacking the student thinking and the potential pedagogy behind that task. There would be this opportunity for them to experience it as a learner themselves. Now let's focus on, okay, well if we were going to work with the same task with your future students, how do we actually go about that? And what are the things that you might have to anticipate as a teacher using this task in the classroom and using this particular technology tool? That work continued, it's actually still going on today. We have continued modules to that. Back in the day, we had spiral bound textbooks with CDs in the back sleeve. And eventually around 2013, we transitioned to abandoning all books and CDs and creating things electronically and making them available for free.

CR: You know, you have a successful project if it has survived a major media change.

HL: Yes, and that was a very painful media change.

CR: I can only imagine.

HL: And that took a lot of work. But once we made that transition, then the things that we continued to build after that, we had a model of how to do this. Then following from that, I had an opportunity to teach a MOOC for educators, a massive open online course for educators. And this was outside of actually my scope of being a college professor. This was connected to a grant that had been given from the Hewlett Foundation to the Friday Institute for Educational Innovation, which is at NC State, and I'm a senior faculty fellow there. They came to me and said, we have a little of bit money left in this grant. What about taking some of your ideas around teaching statistics and create a MOOC for teachers? And I had never taught an online class before. This was 2014, and I'm like, oh my goodness, I finally took on the challenge. I had to think about it for a little while, but that radically changed how I really thought about the kinds of ways that I could package instructional materials for learners. Those learners were practicing teachers rather than college students preparing to be teachers. That really just took me into a whole new direction of being able to think about how to package online materials that could provide, that could be modularized and could be chunked into smaller little bits that would have the highest level of impact. Since then, I have just been focused on that. I have two main projects from the National Science Foundation, where I'm focused on developing materials for preservice teachers around statistics and data science. And then another one that we just launched in March, a free public online platform where it actually, it can be personalized for educators, where they can come in and we ask them a couple of questions to learn a little bit about their background and their experiences. And then we suggest learning modules for them, like your Amazon shopping experience. So that we say, okay, based on what we know about you, we think you could learn something by going to this module or going to this module. And a lot of that research came from the MOOCs, where we studied, what did teachers do, what did they talk about in the discussion forums? And what were those high impact materials? Then we took a lot of those high impact materials and repackaged them into our online platform. It's called InStepWithData.org. And that just launched in March publicly, and we are super excited to be sharing that with the world.

CR: So whether it's research or practice, what are the horizons or the frontiers in—you can take your pick—in either mathematics or statistics education.

HL: For me personally or research frontiers in general?

CR: Well, maybe let's start with you personally and it might get broader.

HL: Okay. For me personally, I think that now that we have this public launch, I'll just go from this particular website, this personalized professional platform. Now that we have that there, I need to really study when teachers do come into this platform and engage in learning on their own time, what are they choosing? And being able to follow them back to the classroom to really understand what the impacts are back in their classroom and with their students. That's something that you build, build, build, and build. And now you have to really take a very careful, systematic approach to studying the impact of it. And so that's on the horizon for me for that particular project. For research frontiers in general, in mathematics and statistics education, I think if we're introducing new pathways for students at the high school level where we're modernizing the curriculum. We need to understand who follows those different pathways and then what the successes are and what the challenges are. It's not all going to be successes. What have we gotten right and what have we gotten wrong, so that we can go back and fix it? I do worry that if we're not careful, part of creating new pathways for students in high school is to solve the access and equity issues that we have put up barriers to students where we don't give them access to high quality and rigorous content and topics. And we're trying to solve that. But in doing so, I'm nervous that we might create more inequities than we actually solve. Because we have a lot of convincing to do for parents and guidance counselors and administrators that different pathways are, can lead to success in different careers rather than a traditional-looking math pathway.

CR: Well, we know that there's growing interest, especially among humanities scholars, to discover these statistical tools and data science tools to create or to leverage a different methodology for what they do when they're studying texts or artifacts, or visuals, or whatever it may be. So recognizing that you're not a higher ed educational specialist, but I think you've got enough experience here to help us. What could instructors at the college level be doing to incorporate some of those data science tools into our teaching?

HL: I think that there is a huge opportunity for that, because I think that data allows a window that we can learn with and through data to understand different phenomena. As you were mentioning, the humanities, understanding historical texts, understanding the writing patterns of different authors from a data perspective can be incredibly powerful. You can learn some of those rather than just being told what they are. Or you can only read so many texts. But if you can have the machine, so they analyze some of these texts, and then it's your job to actually try to unpack what the patterns are. Then you're asking now a different question. In the social sciences, being able to look at census data, for example, and talk about economics, talk about civics issues, talk about historical trends that have happened. And being able to compare census snapshot data across time and see how our US demographics have changed, how our income levels have changed, how our educational outcomes have changed. We can do all of that from a data perspective. And when you release students into this data world, then they are creating those learning opportunities. Because then they're asking questions of the data, and so we're creating problem solvers at the same time. I think that any instructor who can just take a mindset that the content that they teach, the phenomena that they want their students to understand, could be understood better through a data experience. And getting datasets that allow them to start playing. There's lots of different data warehouses out there. In science, we're used to our students creating their

own datasets because they are performing different experiments, they're collecting their own data. But there's also a wealth of scientific data that we can actually pull down from NASA. We can pull from, there's just so many different data warehouses out there around different climate change, scientific information, weather patterns that our students can actually think about and start questioning world around them through data.

CR: Then there's the visualization element of it too. Can you map it? Can you timeline it? Can you create clouds of certain…

HL: There's lots of tools that you can use that are low computational bar. One of the tools that I use is called Coda. But there's also tools like Tableau and other data visualization tools that don't require a lot of coding. I think sometimes people think data science and they're like, oh, but I don't know how to code an R and Python. You don't have to. In fact, you probably shouldn't when you first are looking at data. You need to use a tool that allows you to visualize the data very quickly and get in there and make it a playful experience. If it's a painful coding experience, then you're not going to enjoy it and you're going to be focused on particular lines of code that you're missing, you're focusing on the trees and not the forest.

CR: And I think in some ways we owe it to our students to give them some experience with these tools, but also to show them, because this is the direction many of our disciplines are moving to. We want to create an honest representation of what it means to make knowledge in our respective fields, and this is one way to do it.

HL: That's exactly right. Thinking about the fact that we have bio statistics, that we have data journalism. There are so many disciplines now that are the combination of a variety of different fields, and they truly are interdisciplinary. I mean, data journalism, I think is just a wonderful story of how that came about and the fact that we have data storytellers employed in the media. That's their job.

CR: Yeah, inconceivable ten years ago.

HL: Right.

CR: Fascinating. All right, well Hollylynne Lee, thank you so much for joining the show today. Congratulations again on being named the Cheery Award winner for this past year. And best of luck to you back in North Carolina.

HL: All right. Thank you so much, Chris.

CR: Our thanks again to Dr. Holly Lyn Lee for joining the show today. You can find links to Holly Lynn's work and some of the data science tools we discussed in our show notes. If you'll visit baylor.edu/atl/podcast. You'll find this show in season three. If you are enjoying this show, please subscribe and give us a five-star rating at Apple podcast. Well, that's our show. Thanks for listening and join us next time for Professors Talk Pedagogy.