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SARAH HANSEN: Today on *Chalk Radio,* how thinking like scientists can make us better teachers and how teachers can be powerful mentors for future scientists.

I'm Sarah Hansen. For this episode, I sat down with Dr. Summer Morrill.

SUMMER MORRILL: I started off as a graduate student at MIT in biology, but I'm currently the Instructor of TA Training in the Biology Department

SARAH HANSEN: I actually spoke with Summer right before she left MIT. Now she's a science instructor at a secondary school in New Hampshire. One of the reasons we were excited to bring Summer on the show was her unique and innovative approach to *thinking* about teaching.

SUMMER MORRILL: I guess what I'm most interested in is thinking about how we can apply all of our research ways of thinking to the classroom. We all, as scientists, get this training of asking questions, and iterating, and looking at the evidence, and trying again based on that evidence. And I think that we can really bring that into the classroom.

I'm a first-generation woman in science and didn't have anyone in my family or close circle who was a scientist. I didn't know what that looked like. And so, for me, having teachers who were role models has been instrumental, starting from high school all the way through college and graduate school.

SARAH HANSEN: So it seems like those life experiences sort of led you to be interested not only in biology itself but the teaching of biology.

SUMMER MORRILL: Yeah, absolutely. I think that they gave me the passion for the subject material but also were excellent models of what a good teacher looks like.

SARAH HANSEN: Can you remember one person in particular?

SUMMER MORRILL: Yeah, my high school biology teacher, Mr. Janaki. He was one of the first biology teachers I ever had, and he just encouraged us to question and not just to sit there and accept what was in the textbooks but actually think about why is this the way that it is and how does it work. And I think that that method of questioning really has left me being curious about science and wanting to impart that curiosity to my students.

SARAH HANSEN: In her role at MIT, Summer and her colleagues were tasked with training about 100 teacher assistants working in the biology department each year. Some of these TAs were undergrads in a teaching role for the very first time. I was curious what kinds of worries or challenges new TAs usually came to her with.

SUMMER MORRILL: I think the biggest one that we see is worries about being wrong. What do I do and someone asked me a question and I don't know the answer, which I think is something that every new teacher struggles with.

And I love being able to tell them that being unsure and not knowing is actually a great thing to show your students because it models that curiosity, it models that question-asking. And you can come back to them and say, here's what I learned and how I learned it.

SARAH HANSEN: For Summer, teaching is a way to enhance her scientific chops, to approach problems with humility and curiosity, but it's also an opportunity to help students see science thinking in practice. This encouragement for TAs to intentionally model their science thinking skills in the classroom is central to Summer's philosophy. I wanted to know what you can of experiences informed her approach to teaching scientists how to teach biology.

SUMMER MORRILL: This is funny to say as someone who is now a teaching professional, but I, in high school and college, was terrified of public speaking, like absolutely terrified. I could not get up on a stage or in front of a room without shaking, and my voice would shake.

And so, for me, by the time I got to graduate school, some of those nerves had gone away. I had done presentations for my courses. But I still felt that in my gut the first time that I got up to teach. Am I going to be able to speak eloquently? Am I going to be able to be understood by this group of students who are trying to learn something from me?

And I think that that nervousness, that imposter syndrome, was a really big barrier. And we had a great pre-semester training run by one of the professors in the department who tried to put us at ease, answer, those questions about what do you do when you don't know the answer to a question. But when I stepped into the room, it felt like all that went out of my head, and I just wasn't sure how it was going to go.

SARAH HANSEN: While Summer's experiences as an instructor informed a lot of her approach to teaching TAs, she also drew upon insights from other students and instructors to make sure the approaches that TAs implemented were inclusive and equitable.

SUMMER MORRILL: What often folks don't realize is how different folks' experience is coming into college, right? People are coming from all different places, all different types of school systems, and that means that they aren't starting on equal footing. And so if we treat all our students equally, that ignores who they are as people.

SARAH HANSEN: So in her TA instruction, Summer teaches a strategy for creating a more inclusive classroom. This strategy is called Multiple Hands, Multiple Voices.

SUMMER MORRILL: We really focus on participation strategies and how we ask our students to show up and participate in the room. And we try to talk about strategies that are more inclusive and allow for people to have space to think and to respond in different ways.

And so Multiple Hands, Multiple Voices is one of these techniques where, normally, if you ask a question and you call on the first person who raises their hand, it's often the same student every time or the same select few, and those are the people that think fast on their feet.

But if you wait until multiple hands are raised and you call on multiple different people to share their perspectives, it gives more time to think and also provides a picture of maybe how different people think differently about a particular problem.

I often ask folks to kind of either count to six in their head really slowly or sing a verse of "Happy Birthday," whatever you got to do to fill that space in your own head because it can be really daunting to just look out and see blank faces. But one of the things we talk about with inclusive participation strategies is transparency and letting folks know that you are giving them conscious time to think.

And so sometimes it means saying, "I'm going to give you 30 seconds to think about this question while I erase the board," and just leaving that space to know that they have time to think can be really powerful and less awkward for the TAs.

SARAH HANSEN: This focus on encouraging students to draw on their different experiences to create space for different ways of thinking and learning is powerful, and it doesn't start and end with classroom instruction. As Summer explains, grading is another important piece of creating equity as an instructor. There's a whole session in her TA training focused solely on this kind of approach.

SUMMER MORRILL: What we really try to do throughout all of the series is provide tools and takeaways that teachers can bring into their classroom. So we try to offer this session right as TAs have their first assignment they need to grade. And it feels real, it feels concrete, and they're left asking this question of, how do I grade effectively? And more importantly, how do I grade equitably for the students in my classroom?

And what that means is thinking about, are you being objective with your grading? And are you allowing any implicit bias to enter into your grading? And that's a hard question to answer because, of course, it's implicit. It's unconscious. And so creating structures for yourself as a teacher, as a teaching assistant, so that you can combat and mitigate those issues of equity ability is really important.

And so we work with TAs to design and implement rubrics for grading. We encourage them to do anonymized grading as much as possible, and we introduce them to programs that allow them to do that as well as give detailed feedback.

SARAH HANSEN: It struck me as I was talking with Summer that her teaching doesn't only emphasize modeling science*thinking* as an instructor. It also emphasizes modeling *empathy* and *care* for students as human beings. One session of the TA course is titled, "Supporting our Students," and for me, this was where the focus on humanity and empathy really came through.

SUMMER MORRILL: Grounding these issues of student support in real-life scenarios is so important for not only TAs that are experiencing some of those challenges but also have not yet experienced them. They can start to think about how they would respond.

So this whole session is thinking about how we can listen to our students well, how we can actively listen to them and respond to them in a way that helps them to grow and empowers them to make their own decisions. And so not only is it thinking about challenges that our students face, maybe the first exam that they've ever just totally bombed or something that might be going on in their personal life that's affecting their learning.

But it can also be these challenging scenarios where students are challenging us to be better teachers, and so I often tell them as-- because I give them the list of scenarios to choose from as we're going through this, and I ask them to choose something that either feels very relevant to them or most challenging to them.

And I think that that's really important that they can push themselves in that way. And so the scenario of the student that calls you in-- this was actually an example that I took directly from my own classroom. So I was teaching a cell bio course as a teaching assistant, and we were talking about genetics. And often in genetics-related topics and genetics courses we throw out Mom and Dad as being the genetic donors, and Mom and Dad, maternal, paternal, very gendered terms.

And I had a student who raised their hand-- this was a non-binary student-- and they let me know that this kind of felt weird to them that we were using all of these gendered terms to talk about a very scientific thing, genetic donors. And they felt that it was exclusive of their experience.

And I really, for me, in that moment, wished that I had thought about this ahead of time because all I could do was thank that student for letting me know and say, you know, I'm going to look up more about how we can be more inclusive in genetic language.

There is research and papers out there that put forth new systems of explaining genetic terminology, but if I had thought about it ahead of time, I would have been able to really expand on that and talk about the intersections between the way we talk about things as scientists and kind of societal issues and societal reflections on what we're learning.

SARAH HANSEN: Given how complex it can be to implement these concepts of inclusivity, equity, and empathy, let alone as a first-time TA, I was curious how summer implemented systems to provide feedback, especially since so much of these TAs' work was being done in real-life, real-time classrooms.

SUMMER MORRILL: This was one of our key priorities that we identified as something that TAs were looking for. They wanted to know if they were just shouting to the void or if what they were doing was actually making a difference and having an impact.

And so one of the graduate students that I worked with during the needs assessment process-- he developed a worksheet for an observer to go through to kind of think about community and engagement and how those were playing out in the classroom.

For anyone who wants to be observed, I have folks sign up. We usually get about 20, 25 teaching observations per semester, and I have them choose a time that they'd like to be observed and sit at the back of their classroom, trying not to intrude, and just listen.

And I type up notes, and those are notes for them to keep. But importantly, those are notes for them to learn, and they are not evaluative in any way. So I try to create a space where TAs feel like it is a learning experience and not something that they're going to be judged for.

Getting observed as a terrifying experience, even if it's someone that they know and are comfortable with. We meet together afterwards to look at those notes. We talk about what's going really well. We talk about the ways they're connecting with their students.

And then we brainstorm and discuss ideas that might make things go more smoothly or might engage those students that tend to be quieter in the back of their class. So it really is just an opportunity for us to touch base and for the TAs to learn.

SARAH HANSEN: It's so interesting. I think, culturally, we almost think of teaching as sort of an innate ability versus something-- as a skill set that can be cultivated and practiced. And I feel like programs like this really emphasize that growth model and that-- I think that's why people are afraid to be observed, because they're like, oh, I'm not good enough, instead of, I haven't developed those skills *yet,* but here's a program that can help me do that.

Just like if you were learning to play the flute, of course you're going to be terrible the first few times until you have some modeling, and some learning, and get better.

SUMMER MORRILL: Absolutely. I think, as their students are learning, they are learning, too, and the next time that they go to teach, it will be a different group of students. It might be a different course. But they'll have taken all of what they learned about teaching and connecting with students into that next experience. And even beyond teaching folks can think about how it applies to their roles as mentors in the lab, as scientific communicators and presenters.

SARAH HANSEN: Now, if you're an instructor of another subject, you might be wondering whether Summer's tools for biology pedagogy would work for you. So I asked Summer whether her OCW materials would be adaptable for other subjects and instructors.

SUMMER MORRILL: Yeah, absolutely. I think what I've tried to do in the materials I've developed is leave space to make it adaptable to your particular discipline. So often, for example, when we look at providing feedback and looking at grading practices, what I do is I pull a problem or a question from one of the courses that the TAs are in.

And so right now in the materials it'll say something like, "Pull something from your TAs' courses," and it could be an essay question that's graded. It could be more of a problem-based question. But, absolutely, I think with some reflection on what the needs are you'll absolutely be able to adapt these materials.

One of the big things-- not only did we reach out to stakeholders in developing this program but tried to match the pacing of our sessions with what our TAs were experiencing during the semester. And so that would be the advice I would give is, try to tailor it to the TAs direct experience as much as possible.

SARAH HANSEN: Before I left my conversation with Summer, I asked her if she was excited to move on to her next position teaching students at the secondary level.

SUMMER MORRILL: I am. I'm super excited to transition to the high school world. As I mentioned, that was where I first learned to love biology, and so I'm super excited to get to be a mentor and a role model for those high school students that don't yet know that science is their thing. And we'll get to do lots of cool biology together.

SARAH HANSEN: If you are feeling motivated to improve instruction in your field and want to teach with Summer Morrill's materials, you'll soon find them all on our MIT OpenCourseWare website. As always, they are open and free.

Thank you so much for listening. Until next time, signing off from Cambridge, Massachusetts, I'm your host, Sarah Hansen, from MIT OpenCourseWare. *MIT Chalk Radio's* producers include myself, Brett Paci, and Dave Lishansky. The show notes for this episode were written by Peter Chipman. Be sure to give us a follow on Instagram, Twitter, and wherever you get your podcasts.