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CURT NEWTON: Today on Chalk Radio, we're exploring global food production, water, and climate change, and the challenge of teaching when polarized opinions come to class.

DENNIS MCLAUGHLIN: I'd say generally, the students learn that most of these issues are more subtle and complex than they thought when they came in the class. So one of the things that happens at the end of the class is, people's opinions are usually not as polarized as they were in the beginning.

CURT NEWTON: I'm Curt Newton, your guest host for this episode of Chalk Radio. At MIT, officially, I'm director of MIT OpenCourseWare. But for so many years at MIT and in my personal life, I'm also doing a lot of work on climate change. So when Sarah Hansen, your usual host, lined up this episode dealing with these issues that are so deeply personal for me around climate change, food systems, and water, and gave me the chance to join in, I jumped at it.

With prolonged droughts made worse by climate change affecting food production and ecosystems all around the world, this conversation couldn't be more timely. Our guest, Dennis McLaughlin, is a professor in MIT'S Civil and Environmental Engineering department, and he's the instructor for Course 1.74 Land, Water, Food, and Climate.

Professor McLaughlin's interest in hydrology and what it can tell us about our food systems has been years in the making. It all started back in 1991 on a research trip that took him halfway around the world.

DENNIS MCLAUGHLIN: I went to Australia. And there were a lot of discussions at the time about what was sustainable food production and whether or not Australia could grow more food with limited water and the connection between the availability of water and the population and food supply. It struck me as a really interesting application area for hydrology.

CURT NEWTON: Dennis explained that some of the big wheat-growing areas were becoming reliant on irrigation to supplement natural rainfall with water pumped from underground in order to keep the crop big and healthy. But over time, all that irrigation causes salts to build up in the soil.

DENNIS MCLAUGHLIN: You could go out in the fields and see near the irrigation ditches just white layers of salt accumulating. It's the same kind of problem that ruined Mesopotamian civilization millennia ago. And it wasn't like it was a big surprise. But there was not really a good mechanism to encourage farmers to hold back on their irrigation. There was a lot of interest in changing regulations and incentives for farmers to have less adverse environmental impact, especially with salinity, and to make sure that there was enough water to keep the agriculture economy healthy and going.

I mean, it's not a reasonable solution to say we won't have any more farming, and therefore we won't have salt accumulation, and so on. So it's that balance between sustainable use and economically productive use that's tricky.

CURT NEWTON: This experience in Australia led to the creation of a course on water usage and agriculture and food systems. It was here where Professor McLaughlin recognized that teaching these topics can bring about an extra challenge.

DENNIS MCLAUGHLIN: One of the interesting things about the course, and a challenging thing as a teacher, is a lot of the topics we talk about-- sort of like talking about climate change, or GMOs, or food waste, or vegetarianism-- students come in with opinions already. And they can say things in a seminar that are based upon just their common knowledge and not based on the readings.

So for example, in GMOs, the focus of most of the students is, oh, would GMOs hurt me? Human health-- are they going to cause me to have cancer or whatever? And that's really not the scientific perspective so much in GMOs, because there's almost zero evidence that any GMOs are harmful to human health. And they learn that by reading the papers.

The problem is, what do they do to the ecosystem, and what do they do to other plants that are not genetically manipulated, and what are the unintended consequences of GMOs, because GMOs are generally designed to help the farmer be more productive. One of the things that happens at the end of the class is people's opinions are usually not as polarized as they were in the beginning.

CURT NEWTON: In my own work on climate change, I've certainly had this experience of trying to have conversations with people coming out of polarized opinions and preconceived notions. I was really curious to hear how Dennis moved beyond that in this class and helped the students have more productive conversations to view these sometimes controversial issues from multiple angles.

DENNIS MCLAUGHLIN: It's really just an introductory course. And it's to kind of stimulate interest that they had when they came in and show them that it is possible to pursue difficult topics by going to the literature. Many of them aren't used to reading scientific papers, the undergraduates especially. They're used to being lectured to and things being in textbooks.

CURT NEWTON: And here's where Dennis McLaughlin gets creative. For each article he assigns, a student is asked to present that article to the class. But Dennis also gives a specific prompt to make sure that these presentations actually help the students understand the material.

DENNIS MCLAUGHLIN: Another challenge in the course is to make sure that their presentations don't bore the other students. So I said, you just have a minute or two, and you should pose some questions for the class or some issues and make them as controversial as possible. So that's what we try to do.

CURT NEWTON: As controversial as possible? Wouldn't encouraging controversy just prevent us from moving beyond polarized opinions? Dennis went on to explain why controversy really is productive and important to deal with, especially in science and engineering classrooms.

DENNIS MCLAUGHLIN: Another thing they're not used to, the students, even some of the graduate students, is scientific controversy. There's perhaps not that much controversy, ironically, interestingly, about GMOs. But there's a lot of controversy about things like organic farming and whether or not we should be willing to sacrifice yield a bit to have more sustainable agriculture.

And one of the things we find out in the class is, many people who are organic farming advocates are out of the mainstream of the scientific literature. But when you review the papers on the other side that say, for example, it's silly to try to continue smallholder farming in Africa. Africa's agricultural future should be large, industrial farms, perhaps run by foreigners who buy or lease the land. Some people write assessments like that.

And you say, well, yeah, but they're being funded by the large agricultural industry. Well, does that mean they're wrong? Are they biased? Well, I don't know. But they become advocates, too. So the students read the papers, and we try to discuss both sides of an argument based on the merits. And I'm not saying students don't get exposure to that kind of thing elsewhere. But if they're taking physics, and we're talking about Newton's law, it's not presented as a controversy.

CURT NEWTON: Motivating students to engage with the scientific literature to unpack controversies is only part of the work involved in teaching this engineering course. There's something else, too, something really important.

DENNIS MCLAUGHLIN: It's a challenge to decide how much effort and discussion to spend on learning about scientific issues, scientific controversies, more or less agreed-on facts, and how much to spend on things like values, because you really can't talk about smallholder farming unless you talk about poverty. You can ask questions as to why is the smallholder farmer so poor? Why does the smallholder kids not want to stay on the farm? They want to go to the city. What do they do in the city? Are there jobs there?

Well, do they have any education? Well, no, because the smallholder farmer doesn't have enough money to send the child to school. What about the role of women in farming and the role of cultural differences in how women are viewed? And can they, for example, participate in ownership? You could just spend the whole semester talking about this stuff.

CURT NEWTON: Dennis's course attracts students from a wide variety of disciplines and backgrounds. And it's this diversity of experiences among the students that enriches the class for everyone, including Dennis.

DENNIS MCLAUGHLIN: I had a student in the last class who was an art student at Mass College of Art. And she knew almost nothing about engineering or science, but she came from Venezuela and settled in Puerto Rico, and her aunt is a farmer. And so she talked about how hard it was for Puerto Rican farmers to be competing with Central American farmers, who were very poor, who were exporting produce to Puerto Rico.

So Puerto Rico, this place where you can grow food all the time, this very productive climate, is not producing much food for its own residents because of pricing. And she actually brought that to the class and talked about it. And I wouldn't have even thought about it. So there's this interaction between the students who have had farming experience or just a student from Puerto Rico who's talking to one from Philadelphia, and they're both from cities, but they have a much different perspective. So not only did the other students learn from these students, but I learned from them.

CURT NEWTON: As you may have picked up by now, climate change is an important topic in this course. We asked Dennis how climate change will affect food and agriculture.

DENNIS MCLAUGHLIN: Well, that sounds like a question we could pose in the class. And we do discuss it through reading papers. So this is a big topic and a controversial one. One thing that there seems to be pretty good agreement on is if climate change increases temperatures during the growing season sufficiently, that will hurt agriculture. But it depends on the crop, depends on the place. It's a lot different talking about small increases in average temperature versus large increases that could actually reduce yield or even kill crops. So temperature extremes probably won't help.

CURT NEWTON: This course really pushes its participants to look beyond their own assumptions. Questions, contradictions, uncertainties-- those are inevitable when we take on topics as complex as food, water, and climate change. Professor McLaughlin embraces that questioning as a core part of the class, even as he tries to provide some answers.

DENNIS MCLAUGHLIN: Especially undergrads, they're used to going into class and thinking they're learning, quote, facts, and that's the end of the story. But I view the teacher as kind of adjusting, resetting the discussion to keep things kind of on track and consistent with the papers. But giving the students the freedom to say silly things or to go beyond the scope of the paper is part of why they like the course.

When they learned that there are differences of opinion, even among experts and that there are values, value judgments, and that there's social equity, and all kinds of things-- they don't even connect that, really, with formal education. But it's not so easy because, for one thing, it takes the students off balance a bit. So it's definitely an art, and you learn it over multiple times. You can't just start the very first year and be perfect on it. So you have to learn the teaching style as well as the content. You have to teach yourself how to be observant to what works and what doesn't.

CURT NEWTON: Maybe we could all take a page or two from Professor McLaughlin and his students and get a little more comfortable being knocked off balance. Dennis' perspective made me wonder how other educators handle similar situations. How do you integrate conversations about values and culture into your science and engineering courses in a way that feels balanced? You can share your insights via the link in the show notes. And we'll pass them along to MIT faculty and listeners, who could incorporate your ideas into their teaching.

If you're interested in learning more about Professor McLaughlin's work or teaching with his open educational resources, you can check out his course, 1.74 Land, Water, Food, and Climate, on our MIT OpenCourseWare website. It's one of over 150 courses in OCW's extensive environment courses collection. And for even more, check out the MIT Climate website at climate.MIT.edu, where you'll find a wealth of material spanning these topics and more.

Thank you so much for listening. Until next time, signing off from Cambridge, Massachusetts, I'm Curt Newton from MIT OpenCourseWare.

Chalk Radio's producers include Sarah Hansen, Brett Paci, and Dave Lishansky. Scriptwriting assistance from Nidhi Shastri. Show notes for this episode were written by Peter Chipman. We're funded by MIT Open Learning and supporters like you.

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