



Research that Reaches Out Podcast

Episode 14: Contextualizing the Problem with Dr. André Butler

Hannah Nabi: Hello, and welcome to the Research that Reaches Out podcast from Mercer University. I'm your host, Hannah Vann Nabi. Research that Reaches Out is an initiative at Mercer University in Macon, GA that was launched in 2015 as part of Mercer's Quality Enhancement Plan, or QEP. We work with faculty and students to help them integrate service and research to address real-world problems affecting our communities at the local, regional, national, and global levels.

Today I'm really excited to get to talk with Dr. André Butler, Associate Professor of Environmental Engineering and Chair of Environmental and Civil Engineering in Mercer's School of Engineering. Dr. Butler completed his BS in Mechanical Engineering at University of Illinois at Urbana-Champaign and his Master's of Engineering in Mechanical Engineering and Environmental Management at Carnegie Mellon, and his PhD in Environmental Engineering at Georgia Tech. He's been teaching at Mercer and working with undergraduate researchers for the past 20 years.

Dr. Butler's research relates to air quality, and our office connected with him in 2017 when he was selected for the summer student research program, which provides support for faculty and up to two undergraduate research assistants to conduct full-time service research on the Macon campus in the summer. At that time, Dr. Butler and his team were developing a device called a Dustduino, which is a sensor that measures particulate matter in the air. And then they took the Dustduino to the Dominican Republic on a faculty-led service-learning study abroad program called Mercer On Mission.

Dr. Butler uses the Dustduino in his research in the Dominican Republic and also in Macon, and he actively engages undergraduates in the research in both locations. I'm really looking forward to learning about how this works. So welcome, Dr. André Butler.

André Butler: Thanks for having me. I'm very, very happy to be here.

Hannah Nabi: So tell us a little bit about your research with indoor air quality and what Dustduinos are.

André Butler: So in your intro, you mentioned some of my stuff from the past, and so the graduate work was looking at ambients, which is outdoor air quality, in Atlanta and pediatric respiratory health effects. So once I got here to Mercer, you know, obviously very interested in teaching air quality. And also public health, so I teach a public health class for our environmental engineering students. And, you know, so over the years, in recent years, the World Health Organization has come out with some data indicating the importance of indoor air quality and how that has had a very deleterious impact on the health of folk in developing countries. So I got really interested in that. And

obviously, you know, that's the kind of problem that, if you're trying to address it, trying to investigate it, then measurement is fundamental. You know, getting quality data. But the instruments are expensive.

Okay. So I started reading a little bit in the literature about low cost instrumentation and decided that we could get involved in those kinds of projects here, you know, with undergrads at Mercer in the School of Engineering. So, you know, did some, had some conversations with some colleagues, developed some ideas for collaboration with Dr. Choi in Electrical and Computer Engineering, Dr. McCarthy, one of my colleagues here in Environmental and, you know, the rest is history. I guess we just started talking about how we could put it all together and make it work, and definitely the Research that Reaches Out initial funding sort of got us on the right track.

Hannah Nabi: That's good to hear that it was a good investment. So one of the things that I find particularly fascinating about how you've designed your research is that you have your undergraduates doing work both in the states and abroad, so students can collect data and analyze results in two very different locations. How does this affect students' learning?

André Butler Well, you know, I think it helps to put the scope in perspective. I mean, so, we have this little box, right, that measures air quality – a particular component of air quality called particulate matter. The details of that aren't that important. But when they begin, the students, when we've tested it, you know, and they take it outdoors and collect measurements or they take it to their dorm rooms or their apartments or whatever and collect measurements, we get data. We get values that we may or may not perceive as being high or low compared to what we know and what we think about air quality here, you know, associated with, for example, the Environmental Protection Agency and the National Ambient Air Quality Standards that have been promulgated for ozone and PM 2.5 etc. Right. So we collect some data and compare it to that. And we're like, either, okay, you know, I feel good, I'm safe or, oh my god, you know, when I cook bacon in my house, the PM 2.5 concentrations get high.

So, and then we take those, you know, we've had the opportunity to take those to developing countries, to the Dominican Republic specifically, and then they really see what high is. You go into one of these outdoor kitchens or enclosed separate kitchens from the main dwelling and, you know, four walls and a roof, and there's a woman in there cooking a pot of beans over an open fire, you know, using wood as the fuel. And you kind of open the door and walk in the kitchen, and your eyes start to water. And, you know, concentrations of PM that we see there are hundreds of times higher than what we see in our own homes or, you know, in outdoor environments here. So you know, I think, I think having the opportunity to go to different places and see what I'll call real developing world data is eye opening and helps them to sort of contextualize the problem.

Hannah Nabi: So how does that, seeing, so, you know, sometimes our reactions are pretty basic. You know, this is the problem. The problem is cooking with wood indoors, right, so just stop cooking with wood indoors. Right, so, how does the experience sort of you, you mentioned that it adds context to the understanding of the problems. How does that help them think about solutions differently?

André Butler Yeah, I mean, so, so what you said is exactly sort of the knee jerk thing, right. Stop cooking with wood. And then you go there and you realize that, you know, it's just not that easy. I mean, they've, they've been cooking that way for a long time. They are used to it. They don't have the same sort of immediate acute response to the poor air that we do. I mean, you know they don't react to it because they're used to it, They like the way it makes the food taste. It's how, you know, their mom prepared meals. It's how their grandmother prepared meals. It's been handed down from generation to generation. So you know, as we've discovered in looking at a number of different problems, you know, changing, modifying someone's behavior is a difficult thing to do. You know, we often, we, you know, folk from the states or other developed countries see things as very black and white. Very cut and dry, you know, very right or wrong. But, you know, it's much, much more nuanced than that.

You know, I, another thing, Hannah, think most folk, we have a concept of poor, you know, cousins, aunts, relatives, friends, whatever, who are poor, you know, who maybe grew up in the country here in Georgia or some other state or whatever. So we have sort of an Americanized concept of that. And then you go somewhere else. And you're like, oh, you know what I thought was poor. Yeah. That ain't poor, right. So that's kind of what we saw in the Dominican Republic. You know they cook with wood because that, in some cases, that's the economic option that they have, you know. They can't afford a kerosene stove. They can't afford, you know, other kinds of fuel. So, you know, wood's in abundance. It's cheap slash free, so that's what's used. So, yeah. Really, really trying to help students process what they see, process the data that we collect, and then sort of think through solutions that will obviously help the long term health of these folk. But, you know, also be attainable and accessible to them is, is you know 95% of the problem.

Hannah Nabi: So when you collect data in the Dominican - so you mentioned on campus, they're collecting data, like in their, in their homes and their apartments and then when you go and your guests and in a host community, where do you collect data? Are you walking around in neighborhoods? Are you going inside people's houses? What does that look like?

André Butler So, um, you know, before we do anything, right, so once we get in country, our process is to sort of sit down with our in-country host who, ours is just phenomenal. She's part of the local Catholic Diocese there, their sort of outreach arm to every corner of this community in Western Dominican

Republic called El Cercado. So we sit and talk with her about communities that we'd like to go visit. We looked geographically, you know, north, south, east and west, sort of around the town center. We look at, you know, communities where there will be people who might be interested in talking to us, you know. Certainly not everyone is open necessarily to have a chat with, you know, a small group of American folk kind of running around their neighborhood so we try to identify neighborhoods geographically, neighborhoods where there are people who will talk to us, neighborhoods where there is a wide sort of variety of cookstoves and techniques and wood versus maybe charcoal sometimes versus maybe dung used as a fuel other times. So we carefully sort of, you know, designing an experiment is sort of a loaded term. You can talk about statistics, statistical design of an experiment. So we don't necessarily do it at that level, but we do try to think critically about where we go and just to make sure that we are successful as far as meeting folks who are willing to chat with us and will ultimately provide the data that we need.

Hannah Nabi: So how do you prepare your students for engaging with local residents and for being respectful and ethical in their approach and in their data collection? That's sort of, there's an added layer of nuance with that when you're working internationally and all the loaded issues of, you know, like the Western savior idea and all of that.

André Butler Sure. So the best time to address that is as early as possible. So you know in our very initial interviews with the students, when we're recruiting them to go with us, we're very frank about what they'll see and what they'll experience. And, you know, try to present as much truth as we possibly can and then gauge, you know, as best we can, their ability to kind of roll with that. Some folks, quite frankly, can't, and that becomes abundantly clear in the first few minutes that you are sitting there and talking with them. So, you know, the students that sort of graduate past that part and are selected for the program, then we have a week or two weeks of prep prior to the trip where we do more of that. You know, we do more, sort of a deep dive into some of the experiences and some of the some of the things that they see or that they might see. And yeah, just the respectfulness and, you know, understanding that we're not going down there to to be the savior. You know, that at least 50% of this experience will be learning. And, you know, shutting up and letting people talk to us and and chiming in when asked, you know, if we have something constructive to say, , and only then. Being friends, more than being scientists and researchers, you know. Being interested in the people at least as much, maybe even more so than we're interested in the problem that we're down there to to solve. So that's a critical component of it, Hannah, is making sure that the students are prepared. That we aren't, you know, down there being the ugly Americans is something that we take very seriously and you know, so far so good. We've been quite successful with that.

Hannah Nabi: You mentioned that for students who are able to participate in the Mercer On Mission to the Dominican Republic, they're able to get a new perspective on life in the United States and sort of the relativity of poverty and circumstance. How does working in close quarters with people and doing the data collection in the Dominican Republic in that sort of like increased humanization or human component affect the way they read and understand and analyze and apply the data?

André Butler: You know, I want to, the first part of that question I'd like to address is even more broad. It's more, to me, you know, how does it affect them as human beings. I know that I've been shocked, over the years, the number of students that I discover have never traveled outside of Georgia. Some have never traveled much outside of Middle Georgia, you know, so their view of the world is, is that. You know, it's this state, you know, in this part of the country or this county in this part of the state, right. So, you know, travel anywhere, in my view, you know, whether it's a developing country or not, but travel anywhere is a broadening experience and has the tendency to open up a young person's eyes to to new viewpoints, to new perspectives, to everything to the world. So when you go to a place where the language is different, where the culture is different, where almost everything is different, I think that helps young people especially you know as their brains are still elastic and, you know, able to sort of assimilate and process new information and take it all in and use it. I think it's just a tremendous benefit to to them as they grow into adulthood. Right. I think it makes them a much more well rounded, responsible, informed citizen. So now you kind of drill that down and apply it to the specific problems that we're trying to solve. And you know, so we're engineers and we're nerds and we do things. We have equations and we calculate stuff and we get an answer, right. And, you know, we put a big fat box around an answer and call it good. Well, you know, yeah, we have to be correct in how we calculate stuff but, you know there's context to everything. There's context to everything, you know, every, every number, every flow rate, every volume, everything that we calculate, you know, has a context associated with it. So, you know, seeing these new cultures and meeting new people and having these different kinds of experiences helps tremendously to sort of think about those numbers that we're calculating and determining whether or not ultimately, it makes sense, right. So we can figure out and use an equation to figure out how something, how much something might cost. Then if the folks that we're trying to help with this thing flat out can't afford it, then what have we done, you know, have we done much of anything, you know, at that point, so kind of a long winded way to say, having them see these new people and places and things is a tremendous benefit to the work that we do. And more importantly, tremendous benefit to them as they mature and grow.

Hannah Nabi: I want to ask you a little bit more about your initial work in the summer 2017. So when I was preparing for this interview I was going back and looking at some of our historical files and I noticed that you specifically recruited

undergraduates who had knowledge outside of your disciplinary expertise, looking at students who had more experience with programming. That's not something I hear too often from faculty who are recruiting undergraduate researchers, and that really has piqued my curiosity. Talk about how you think about, how you recruit students to join your team and sort of the selection process and what kinds of things you look for in how you approach that.

André Butler

So, so that's actually a little bit funny. There's not going to be, Hannah, a this is the way bullet point by bullet point. This is the Butler way, right. So I got super lucky. As I said, you know, when I started thinking through these issues, initially, and having conversations with my faculty colleagues, you know, I was talking to Dr. Choi, my colleague in electrical and computer engineering about this and you know so. So the background is these little devices that we build require some programming. We have to program the instrumentation to control things, you know, long story short. That's beyond my expertise. So in chatting with Dr. Choi, he had met this young student who was a super duper good programmer and just thought that he might be sort of perfect for this kind of activity. And he was, I mean, absolutely perfect for this activity. And oh, by the way, you know, as I was chatting with him, he had, you know, plans to go to Mercer On Mission at some point in the future. So once I explained to him what I would like this project to lead to as far as sort of international work, he was all in favor of joining us on this trip. The one student I did recruit was an environmental engineering student to work on the initial project, and I thought that that she would sort of help the other understand sort of the environmental aspects and what we were doing and be a little bit more able to think statistically about, you know, data that we're collecting and how we can analyze it. They were a match made in heaven as far as being able to sort of feed off of the other's strengths. Where one was strong, the other was weak and vice versa so that worked out perfectly.

And so those two students have recruited everyone else who's worked with me on this project. So the initial guy, Tim, who did all of the programming, recruited subsequent people, subsequent nerds from, you know, electrical and computer engineering to do the programming. The initial woman I had, Becca, recruited subsequent environmentalists to kind of head up that part of it. So it's been very serendipitous for me that the students have done the work for me as far as recruiting.

Hannah Nabi:

I actually, I did an interview with Dr. Choi yesterday, and he had similar things to say in terms of really empowering students to sort of take the lead and experiment. And it seems like that's something that y'all do really well in the School of Engineering. And so sometimes we get a few listeners who are not from Mercer. So for folks like that who may be thinking about delving into the area of working with undergraduate researchers, because it has a lot of challenges. It can be very rewarding, but it's a lot of work because they're so young and I'm curious, what advice would you offer to faculty who may be just starting out, or trying to sort of get their feet wet in working with

undergraduate researchers, what do you think that they should know or think about?

André Butler

Yeah, I think one of the first things is to understand the differences kind of that you alluded to. The difference between working with undergraduate students and graduate students, right. So, you know, for example, you are professor at a big state university working with graduate students. Basically, you tell them this is the project scope. Go! Right, and they, for the most part will go do it. And the students become the experts and they sort of keep you in the loop and make you look good, but the students are doing all the work. They're investigating stuff, you know, they're coming to you, of course, occasionally with problems that you may or may not be able to help them with, frankly.

But with undergraduate students that's not the case. I mean, they're not really sophisticated enough to do all the work without some leadership and some guidance. So you have to understand that, initially you know, You are going to be, you know, as you're working with undergraduate students, you're going to be in the day to day, in the nitty gritty, you know, kind of learning right along with them. So all of you will sort of be the experts. Right. And then sort of added to that, we have sort of a, you know, we have a range of aptitudes. So, you know, our students range from pretty bright to geniuses. They range from having a, you know a pretty good work ethic to a phenomenal work ethic. Right. So obviously the gold standard is, you get the genius person with the phenomenal work ethic, then that'll make things very easy and very smooth for you as the advisor to undergraduate an research project. things will go quite well the vast majority of the time. In the other extreme, you know, you get the reasonably bright student who's, you know, reasonably motivated and has a reasonable work ethic, and that's going to be more of a challenge, quite frankly. Those students can still, you know, you'll still be able to work with them, typically, and get some good work done and a good product at the end. But, you know, you're going to be quite involved with that. It requires a good bit of your time and a good bit of your energy. and you know any papers and such that come out of that, you know, you're gonna write.

So, and then, you know, you have students anywhere in between on that spectrum, right. So, you know, I just think you have to realize what you're starting with, you know, often you're starting with kids with young people who just don't quite have the maturity yet to to do everything by themselves, or in some cases to do anything by themselves. So if you are interested in being hands on, you know, if you're interested in learning right along with them, then undergraduate research is great.

If you're not interested in those things, then you need to sort of rethink it because that's what it entails the vast majority of the time.

Hannah Nabi:

Well thank you. And we're coming to a close and our conversation, but I always like to ask our, our guests to leave us with a final word on why your work is Research that Reaches Out.

André Butler

Yeah, I mean, I think environmental engineering, sort of, you know, as a discipline sort of lends itself almost automatically to thinking about these big sort of global issues, you know, drinking water quality. Air quality. You know, health. I could say democracy, but we'll leave that conversation to another day. And you know the discoveries that we make in those big areas are important in and of themselves. I mean, definitely, you know if we can figure out how to economically work on those issues. Right. That's a good thing. But you know, I think above and beyond that, if we can sort of apply these solutions and help people with them,. There is, there's this notion of do we do sort of low tech work that's not rocket science, but might have a tremendous impact on the lives of people. Or, do we do cutting edge research that is expanding our horizon in this area, or that area that may be 20 or 50 years out from being applicable to someone's life. There are merits in both, for sure, but I think there's, I get a lot of fulfillment. I'll put it that way. I get more fulfillment out of working on the low tech sort of non rocket science issues that are potentially applicable right now to help people. So, you know, those are the projects that I like to work on. Those are the projects that I've had some success with, and those are the kinds of things in my view at least, that lend themselves to working with undergraduate students, you know, at a place like Mercer where that's the focus.

Hannah Nabi:

Well, thank you so much, Dr. André Butler, for talking to us today. And thank you to our listeners for tuning in to this episode of the Research That Reaches Out podcast at Mercer University. You can check us out on our website at QEP.mercer.edu and subscribe to our show at [SoundCloud.com](https://www.soundcloud.com).