

Podcast script: Air Pollution Monitoring Turns Students into Citizen Scientists

[Theme music]

Ashley Ahearn (Narrator): You're listening to Environmental Health Chat – a show from the National Institute of Environmental Health Sciences that explores the connections between our health and our world.

I'm Ashley Ahearn.

[Music fades out]

There aren't too many people lucky enough to say this:

Jessa Ellenburg: Oh my gosh, I cannot wait to go to work every morning.

AA: Jessa Ellenburg is the director of educational outreach at 2B Technologies in Boulder, Colorado. The company developed a personal air monitoring device called a PAM. And they partner with schools and other community groups to use the PAMs to gather data about local air quality.

For Jessa, working with young people is the highlight of her job:

JE: The excitement that students get from using these instruments is just amazing to see.

AA: 2B Technologies was started by an atmospheric chemist named John Birks. He'd worked for years studying air pollutants like ozone in the upper atmosphere. He developed small instruments that could be attached to balloons and kites, mainly for clients like the U.S. Environmental Protection Agency and other organizations focused on air quality.

JE: And in 2009, he was really saying to himself, well, I am a professor, and it's in my blood, and so I want to do some educational projects. So that's when he found me.

AA: Jessa is actually a bridge engineer by training – and she says she loved that work too. But she found that what she really loved about her time in the world of engineering was working with underrepresented groups and doing outreach. John Birks gave her an opportunity to expand on that.

JE: And he offered me a job – basically my dream job – to engage students in air pollution measurements, instrumentation, and it checked all the boxes for me: the relationship with students and youth, the engineering aspects, and also hoping to protect the environment for future generations, that was also really important to me. So that's how a bridge engineer became an outreach person.

AA: With the mobile PAM devices, 2B Technologies started AQTreks with a mission to engage citizen scientists – mainly students – in understanding the air quality in their surrounding environments.

JE: So AQTreks allowed students to take mobile measurements of air pollution, design a study, think about where they thought air pollution might be high, and go there and check it out.

AA (on tape): That is so cool. So, you're basically empowering kids to be air pollution detectives.

JE: That is exactly what we're doing.

AA: With grant money from the NIEHS they sent PAMs to almost 100 schools across the country. Students could then go out and sample the levels of CO₂, carbon monoxide, and particulate pollution around their schools and neighborhoods.

JE: And then we pair the personal air monitor with an AQTreks smartphone app. So the students, when they're doing their investigation, their information is being recorded, their pollution levels along with a map of where they've gone. So they can associate their high and low levels based on their location. And then after they've collected their data, they can upload it online, and then go into their classroom and really deeply analyze their data and look at what they found.

AA: And their findings were sometimes concerning...

JE: For example, one school had an auto mechanic lab that they discovered was not properly ventilated – with high carbon monoxide levels and high particulate matter levels. So they were able to tell the facilities management people that there was not proper ventilation in that school.

AA: But Jessa says the data, across the board, shows that schools often have high levels of carbon dioxide, which is an indicator of poor ventilation.

JE: And that has only become an increasing problem with COVID and ventilation in regard to COVID transmission. So I think in and of itself, the schools represent an interesting case of funding issues leading to kind of an environmental justice problem in their lack of ventilation.

AA: Collecting data was empowering for students. Some were inspired to present their findings to administrators to make the case for better ventilation. In one school, students found that a faulty boiler in the boys locker room was leading to elevated levels of carbon monoxide. They told school officials about it, and the boiler was replaced.

But Jessa says her student scientists often faced roadblocks and excuses in response to their calls for action.

JE: And it's quite depressing at times, because they don't have a lot of recourse. And it's been somewhat heartbreaking to see people discovering issues that don't get fixed. So I think that's a fundamental issue that needs to be addressed in schools across the United States is regular air monitoring, especially indoors, to determine if the building is operating properly for the safety and health of the occupants.

AA: Jessa does take heart the fact that over the decade plus that the PAMs have been in use, some students have gone on to become atmospheric chemists and environmental policymakers themselves.

Citizen science has long been met with skepticism from the established scientific community. Is the data reliable if untrained people are collecting it? Or do the results have merit if they're not peer reviewed?

Jessa says 2B Technologies prioritizes sound science and data collection. The PAMs are a highly advanced and expensive device. But the company loans them free of charge to schools and other community groups. Then, between deployments, the company checks and recalibrates the devices.

Jessa says it's important to ensure the data is robust so it stands up to scrutiny from parties that may be held accountable, depending on the findings.

From a business standpoint, this kind of work – developing expensive technologies and loaning them out for free – won't necessarily make you profitable.

JE: All of the funding from NIEHS has been really quite pivotal in what we've done with schools and communities. It has allowed us to focus on things that perhaps a company wouldn't normally be able to focus on because of trying to focus on the bottom line. In our realm as an instrument manufacturer, seeing the effects that it has had on the people that we've served with the funding has been incredible.

AA: 2B Technologies was recently awarded a new grant from NIEHS to expand their programming beyond schools. Now, they're developing citizen science monitoring programs in five communities across the country, including one international location. They'll be sending their PAMs to the Navajo Nation, an environmental justice community in the city of Atlanta, and others, to gather air pollution data.

For Jessa, it's about getting people connected to their environment – and their health – through data. And presenting that data using maps and other accessible ways to make it easier for students to understand their world – and take action.

[Exit music comes up]

JE: Just make the measurements so that people start to understand what's happening. The place we can help the most is making instrumentation that can produce high quality

data so that community members can advocate for change. And that's the place you have to start.

AA: I'm Ashley Ahearn. Thanks for listening to Environmental Health Chat.