Growing Veggies and Curiosity

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Children in schools across Tucson are observing insects pollinating plants, formulating scientific questions and measuring the effects of growing veggies underneath solar panels under the guidance of Jessie Rack, who oversees the Supporting Environmental Education and Communities [1] program, part of the UA Community and School Garden Program.

Established in 2009, the Community and School Garden Program assists lower-resource schools in the Tucson Unified School District in establishing school gardens and helps teachers incorporate those resources in their lessons. The program Rack coordinates aims to increase interest in science, technology, engineering, arts, mathematics and social science among K-12 students.

Rack joined the School of Geography and Development [2] in 2018. Now in her second year, she teaches environmental education classes in seven classrooms at five schools across Tucson, with an emphasis on hands-on approaches, critical thinking skills and the scientific method.

"The whole idea I try to get across is that everybody can be a scientist," Rack says. "My goal is to empower these kids so they can see a place for themselves in science, even if they don't end up in academic research. I want them to realize that it could be a possibility no matter who they are or where they came from."

Throughout the school year, students explore research questions that they design themselves, make observations and contribute the data they collect to local and national projects, such as Nature's Notebook [3], a national monitoring program offered through the National Phenology Network where citizen scientists monitor plants and animals in their areas and note how they change over the course of the year. Each spring, the students present their findings during formal poster presentations and an art exhibit.

Depending on the season and the grade level, children might dissect seeds, learn what parts make up a plant, design monitoring experiments or learn about phenology ? how the natural environment changes with the seasons. Other topics Rack teaches include animals inhabiting the region, adaptations to desert living, ecology, and how to understand and use the scientific method.

"From the beginning, everything we do is inquiry-based," Rack says. "We explore how scientists learn what they know by observing things, by asking questions and by testing them. The kids learn how to come up with a hypothesis and how to design an experiment to test it."
Rack says workshops such as "Adapt-a-Seed" are especially popular with her students. Working in groups, they have to modify real seeds—such as lima beans, which are large and easy to work with—using engineering skills to overcome specific evolutionary challenges.

"For example, I tell one group their seed has to float on water," Rack says. "Another group has to make a seed that's capable of sticking to a person and hitching a ride for at least 20 feet without falling off. Things like that."

Rack says there is no such thing as a typical day for her. When she is not working in a school, she can be found in the "pod" on the top floor of the Environment and Natural Resources 2 building, writing lesson plans, preparing for classroom visits and researching new activities to try out.

"Anytime we get to go outside, the kids think it is something special and they have a lot of fun," she says. "Bringing the classroom to the outside world puts a different spin on things."

As much as possible, Rack lets her students design their own research projects and pursue them even if they may seem ill-fated at first. This past winter, a group of sixth graders chose to monitor the growth of mesquite trees during a time of year when not much change is likely to occur. Predictably, the young scientists started getting bored because nothing seemed to change.

But then one day, the kids noticed small lizards underneath the trees they were monitoring. They modified their research focus, expanding it to include not just mesquite trees, but the animals around the trees. Monitoring lizards as winter turned to spring allowed them to observe both an increase in the number of animals and an increase in their speed, as warmer lizards move a lot faster.

"I let them grow into their questions and their own curiosity," Rack says. "Whether or not their hypotheses end up being supported or not isn't too important. What's important is that they keep asking questions."

In this video, Rack explains earthworms' important contributions to garden ecosystems.

Many of the activities get the students thinking across disciplines and seeking out innovative approaches. At Manzo Elementary School, Rincon High School and University High School, students work with replicas of an agrivoltaics research project housed at Biosphere 2. Here, crops are cultured under solar panels so students can study how the two systems affect each other to mutual benefit. The students' experiments looked at how the panels change the moisture in the soil, and how that in turn affects the height of the plants or their blooming.

"The agrivoltaics systems provide kids with real-world examples of how science is useful and can be applied," Rack says. "In the spring semester, my students are responsible for working in groups to figure out their own questions and design their own experiments to test these questions? for example, 'Does a garden growing underneath a solar panel make it cooler and therefore more efficient?' Turns out, it does."

Rack, who is an avid naturalist, science communicator and educator, says she attributes much of her question-driven approach to teaching to her own scientific upbringing. Her eyes still light up when she talks about the research for her doctoral thesis in ecology and evolutionary biology at the University of Connecticut, where she observed how different
populations of salamanders detect the presence of predators through chemical communication.

"Aquatic ecology is just bonkers," she says, "absolutely wild and fascinating."

Although she likes conducting research, Rack says she most enjoys talking about it to people and telling stories. Somewhere along the way as she was interning at NPR's science desk, mentoring undergraduate students in scientific writing, leading field trips at summer camps and working as an environment educator for a nonprofit land conservation trust, she realized that she preferred taking kids on wildflower hikes and catching frogs over the pressure of the publish-or-perish culture of an academic research career.

"Often, these schools don't have many opportunities to get kids involved in science," Rack says. "Through our program, we can show them that they, too, can be scientists, and whatever they are interested in, there is a space for them."

While science is a big part of the program, Rack says, there is a big-picture aspect as well.

"By taking the reins of science, children learn how to take food and water security into their own hands," she says. "I hope that science gives them the tools to think critically and provide solutions to our most critical real-world problems. We are going to need all hands on deck."

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[2] https://geography.arizona.edu/