Science Societies

Interactive ag education

College students study agronomy and soil science through experiential, hands-on learning

By Alison Jennings

March 26, 2026

A soil science lab uses childhood toys to teach undergraduates about runoff. Photo courtesy of Grace Ogden.

- Experiential learning, “learning by doing,” is a potential way to introduce undergraduate students to topics in agronomy and soil science.

- Dr. Grace Ogden excites her new students about soils using LEGO bricks. She presented this activity at CANVAS 2025.

- Dr. Randa Jabbour encourages her students to think deeper about topics in agroecology by connecting lectures to museum artworks. She published her experience in *Natural Sciences Education*.

“To be honest with you, I never planned to get into teaching,” says Grace Ogden, Assistant Professor of Agronomy at East Texas A&M. “I really appreciated the science. I appreciated being in agriculture. The teaching just kind of came with other parts of the job. But it's actually ended up being my favorite part of what I do.”

Many professors get some kind of teaching experience while in graduate school. But Ogden was able to get a unique experience developing curriculum under her Ph.D. adviser, Dr. Beatrix Haggard, at Oklahoma State University.

“Beatrix was my undergrad adviser, and I really liked her teaching. When I went to look for a Ph.D. program, she said, ‘Hey, I would love to have you as a Ph.D. student. I just got this grant. I need a Ph.D. student to take on this curriculum piece. Are you interested?’

And I was like, 'I get to work with you on it. So yeah, sure, absolutely.'"

Ogden's lesson plans are hands-on and centered on active learning, often pairing lectures with field trips to farms and research stations. This hands-on aspect of her classes has followed her from graduate school to her current position at East Texas A&M, where she teaches a variety of classes including intro to plant science, soil science, forage and pasture crops, and weed science.

Both Ogden and East Texas A&M value experiential learning, an approach to teaching that makes students active participants in the learning process.

"We're really focused on experiential learning for our students and equipping them with skills that are directly transferable to the workforce," says Ogden, adding that she often adds extra educational material into her lesson plans based off of what kinds of jobs her students want after graduation. "One of the things I learned during my Ph.D. experience was to approach a lot of teaching backwards. What do you want your students to learn at the end of the day? Start there and engineer backwards."

If a student wants to earn a pesticide applicator license? Ogden incorporates those skills into her weed science class. And if a student wants to work at a dairy? Ogden incorporates lessons on silage into her forage and crop science class. Conversations with her students drive her class curriculum—Ogden is grateful that her student engagement is pretty high.

The goal of experiential learning is to learn by doing. But what if you can't bring your students outside to a farm or a community garden?

In a general education, undergraduate soil science lab, Ogden and her colleague, Michaela Bledsoe (interim instructor of the soil science lab), used an activity inspired by Ogden's Ph.D. work to get students excited about all things dirt.

The students mixed sand and soil together to create foundations for small houses made of LEGO bricks. They optionally placed plants around their newly constructed landscapes, and simulated rainfall. These simulations represented either a normal rainy day or devastating flooding and soil erosion, depending on each group's vegetation and soil composition.

The goal of this lesson was to observe the importance of soils and soil engineering in society. The project also illustrated the impact of natural disasters and how water is such a powerful force in eastern Texas.

Unearthed: soil science for everyone

This lesson engaged students and set a tone for the remaining semester. "I've picked up on our students being more engaged in discussions surrounding [soil science after this lab]," Ogden says. "I would have students come to class and they would be like, 'I saw on the news that a skyscraper or an apartment building in such and such town collapsed. And it's because there was a sinkhole underneath it. And you know, gosh, I wish they'd looked into their soil more. We just talked about this last week.' A lot of those conversations felt sparked by this activity."

This class—a traditionally intimidating soil science lab—was lightened by Ogden and Bledsoe's LEGO brick lesson.

"This activity was what they did on their very first day of soil science lab. … These students come in and we hand them their most nostalgic childhood toys. And we say, 'Let's learn at the college level with these things,'" says Ogden. "We gave them literal dirt—and I know that's blasphemy in the soil science community, but you know—we gave

them LEGO bricks, dirt. Here's some tools. Be creative."

Ogden stresses that there was no right or wrong way to do the activity—above all else, it was an opportunity for curiosity. "All of those components made this soil science lab that notoriously has a reputation of being really hard, really approachable," says Ogden. She was happy to see that students started coming to lab with a positive attitude after this activity, too.

Even students who aren't studying agriculture get invested: "This is an activity that captures attention and then leads to discussions and kind of brings in *everybody* because *everybody* cares if our streets function properly," says Ogden. "*Everybody* cares if bridges are stable because the soil around them has been adequately assessed. Some of those community ideas become very clear with this project."

Photo courtesy of Grace Ogden.

Why sand?

East Texas A&M is located in an area with heavy soils called Vertisols. These soils are made of clay that shrinks when dry and dramatically swells when wet. “We spend a lot of time in class talking about the big cracks we get in our soil and how those soils are shrink-swell,” says Ogden. “We'll get a big rain. All of a sudden, everything is so muddy you can't even drive across it. It's dreadful. And because they expand so quickly, sometimes the water is not infiltrated very effectively.” Ogden’s lab activity illustrates this concept with sand: Since sand doesn’t absorb water well, it acts like the heavy soils the students are familiar with.

Both sand and heavy clays have runoff problems. In this group’s lab activity, water runs quickly through the gutter, carrying sand particles as it flows unobstructed. With more time, the toy houses will start to slide away, too. Video courtesy of Grace Ogden.

Even if the students aren’t interested in soil science, they’ve heard of these unique soils before. Most students attending East Texas A&M have lived in eastern Texas for most of their lives, and these soils are culturally (and even legally) relevant. “The cracks we get [in dry Vertisols] are several feet deep,” says Ogden. “I've been able to stick a yardstick down in these cracks—it will not reach the bottom. … [And] some of our lease agreements around here will have language in it that says you need to irrigate from like, May to November. And that's not because they want you to have a nice-looking lawn. That's because if you don't irrigate during that time and we get drought conditions—which we often do—it will crack the ground significantly, which will impact the foundation. We try to make sure our curriculum applies to everyone

and we're focusing on how soil interacts with society, not just in agriculture, but for everybody."

Plants are the key to stabilizing soil. Ogden says that vegetation helps prevent runoff because the plants slow down the velocity of the water, making the water less likely to carry as many soil particles as it runs over the soil. Plant roots also increase soil infiltration, which further decreases runoff. Photo courtesy of Grace Ogden.

Integrating art and science

“Visuals can be really powerful: Whether we are creating them, using them for our own memories and note taking, or interacting with a piece of art,” says Randa Jabbour, Professor of Agroecology at the University of Wyoming. Jabbour teaches many courses in plant science and has recently started incorporating art museum pieces into her curriculum. She coauthored a paper in *Natural Science Education* about her experiences and takeaways from these initial lessons.

Jabbour believes that these days, collaboration between art and the sciences is “something people strive for.” Existing efforts (such as cross-disciplinary initiatives like Science, Technology, Engineering, Arts, and Mathematics; STEAM) aim to increase creative thinking, create better lesson plans, and illustrate how science and engineering impact everyday life. And this integration is for good reason: There have been studies showing how experiential learning through art can help increase a student’s understanding of natural history and taxonomy, among other disciplines.

Museums are ideal places to combine science with the arts, but despite this, there have not been many attempts by science teachers to utilize art museum collections as a resource, says Jabbour. “This kind of specific way of working with an art museum and the objects they have—I just felt like it *could* be so generalizable, as long you have that partner in the museum,” she says, adding that this generalizability was the main reason for her desire to publish this material: “We weren’t just going to keep doing this in our own little nook.”

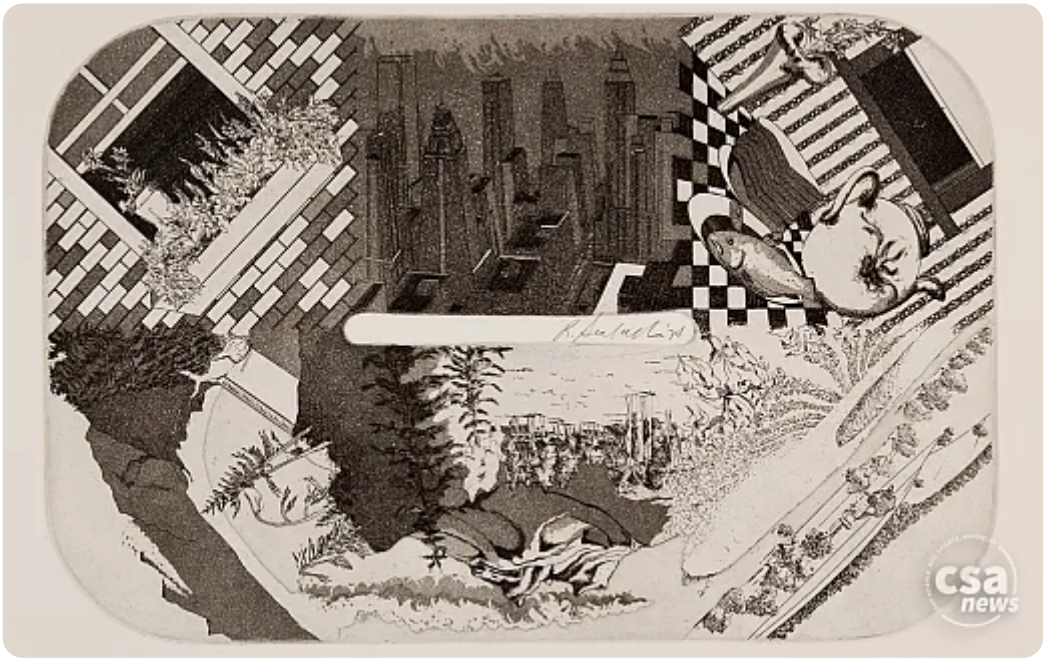
While many people think a museum’s main purpose is informal education or outreach, Jabbour hopes to extend this reach and utilize these collections for formal education. “It was eye-opening to me many years ago to meet someone from the university's art

museum and realized that they wanted to work with us too," she says. "The art museum here, they're here for everyone."

Jabbour's goal was to use an object-based learning (OBL) approach to teaching, which utilizes some kind of primary resource (like a painting or a drawing) to drive discussion. She collaborated with coauthor Raechel Cook (then a University of Wyoming Art Museum educator) because of the museum's many artworks depicting food systems. The two instructors tasked undergraduate students in an introductory agriculture science class with analyzing and writing extended labels for art pieces that aligned with themes in Jabbour's lectures.

"This is a course where we go over the history of agriculture, and we talk about different points in civilization and agriculture, food production—things like seed storage. I feel like seed storage can feel dry to some people as a topic," says Randa Jabbour, from the University of Wyoming. "The seed pots were a nice way for the students to reconnect with all the lessons they learned about seeds but with such a nice, tangible, and kind of human-connected example." ***Seed Pot*** *by Rachel Concho. Late 20th Century. Pigment on ceramic. Gift of James R. Nolan. Copyright of the University of Wyoming Art Museum.*

Extended labels serve various purposes, such as providing more information about an artist, adding historical context, or discussing compelling artistic qualities of a piece. The coauthors wanted Jabbour's students to use extended labels to add agronomic context surrounding the art pieces; in turn, the students got a chance to practice science communication for a general audience and dive deeper into themes of plant, soil, and animal science. "It's really an opportunity from an agricultural literacy standpoint," says Jabbour. "To me, it was an interesting way to bring this kind of agriculture conversation into a space where that's not usually the primary focus amongst artists."



"In our agroecology course, a lot of it is about systems," says Randa Jabbour. "What does it mean to think about ecosystems, food systems, and all of these components? How do they fit together and how do they interact?" ***Cycle*** *by Robert Seabeck. 1974. Etching, aquatint on paper. 11-3/4 x 18 inches. Gift of Robert Seabeck. Copyright of the University of Wyoming Art Museum.*

Whether the students were knowledgeable about cattle health, farm equipment, or plants, they all had a chance to bring their perspective to the museum collection. The artworks—some of which are depicted here—covered a diversity of both agricultural topics and artistic media.

Frog Sandwich

by David Gilhooly. 1977. Glaze on ceramic. 4-1/8 x

3-5/8 x 3-3/4 inches. The Dorothy and Herbert Vogel Collection: Fifty Works for Fifty States, a joint initiative of the Trustees of the Dorothy and Herbert Vogel Collection and the National Gallery of Art, with generous support of the National Endowment for

*"**Frog Sandwich**, by artist David Gilhooly, is a representation of the future of food and how one can find joy, sustainability, and the true meaning of balance in agriculture. The concept of a frog as an edible protein may be unfamiliar to some cultures but considered the norm for other cultures. We are led to think about how we can redefine what a 'normal' meal may look like in the wake of climate change."*

—Exhibit label by Kya Morris, Drea Hineman, and Maggie Keogh, University of Wyoming.

the Arts and the Institute of Museum and Library Services. Copyright of the University of Wyoming Art Museum.

Deep looking—careful observation connects art and science

Small Seed Pottery *by Diane Lewis. Not dated. Pigment on ceramic. Gift of James R. Nolan. Copyright of the University of Wyoming Art Museum.*

"Even though our disciplines seem very different, what we have in common is this idea of the importance of careful observation or what my art colleagues called *deep looking*," says Jabbour.

Sitting alone with a piece of art—even just for three minutes—can feel like an incredible exercise in diligence and attention. It's a skill that these students will also need if they want to pursue any career that requires careful observation. For example, plant scientists need to be able to sit with a specimen for a long time, diagnosing its insect damage, disease, or nutrient deficiencies.

"One of my diagnostic colleagues who also has art training, William Stump, he was the one who said to me, 'there's what's in the painting and then there's what's off the page,'" says Jabbour. "What's going on in the field? Is there too much water, not enough? That was a big part of our goals, to just give students a different way to practice this careful observation. And I think some of them found that really valuable and some of them found it really hard."

Jabbour remarks that what works for some students is perhaps more challenging for others. She says that some of her students hadn't even been to an art museum before they took this class, so they had some uncertainty working with art—especially if they were looking at very abstract art pieces. Jabbour has a plan to improve the lab moving forward with more guided discussions and one-on-one meetings between students and the instructors.

Many of the students were drawn to Winter Feeding, says Randa Jabbour. Some liked it because of their animal science background, some related to the landscape, and some of them thought about the role that people play in agriculture. ***Winter Feeding*** *by Irwin Hoffman. 1939. Etching on paper. 9 x 11-3/4 inches. Friends of the UW Art Museum Purchase. Copyright of the University of Wyoming Art Museum.*

Training the next generation of scientists

Determined, Jabbour will continue to integrate her science classes with art to show her students "an authentic representation of how science works" and connect them to new ways of thinking.

Round Seed Pot *by Joseph and Barbara Cerno. Not dated. Pigment on ceramic. Gift of James R. Nolan. Copyright of the University of Wyoming Art Museum.*

"Science is not in a vacuum on its own. It's this process that is connected to a lot of different kinds of people who have different disciplinary expertise. And it's embedded in community," she says. "My main take home is just that this is another way that we can connect students to the broader community and give them a sense of what it actually is like to work as a scientist and engage with people across our disciplines and with people in our communities that may or may not see the world the way we do."

Whether in a lab or a museum, the two professors conclude that the best way to train our undergraduate students for their next chapter is to get them out of their seats and into a new environment.

“The more experiential learning we do, the more we get our students engaged in this hands-on component—whether it's in the field, or in the lab, or whatever—the less time they're sitting stagnant and just listening and the more that they are physically handling something, physically doing something, in my opinion, is really good,” adds Ogden.

Dig deeper

Jabbour, R., & Cook, R. K. (2025). Integration of art with science: College agriculture students practice science communication by writing art museum labels. *Natural Sciences Education*, *54*, e70008. https://doi.org/10.1002/nse2.70008

And view the presentation, “Constructing Knowledge: Using Legos and Farm-Based Learning in Soil Science Education,” by Grace Flusche Ogden at CANVAS 2025: https://scisoc.confex.com/scisoc/2025am/meetingapp.cgi/Paper/168346

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