Maggie Lindsay's long, white cane swishes back and forth through the leaves, as she makes her way up the mountain slope with her fellow students. Tiny twigs snap beneath her sneakers. Trees rustle in a light breeze. Summer sunlight filters through the branches, warming her skin, as the sweet scents of soil and pine mix in the mountain air.
There's a lot for Lindsay's senses to take in on this warm June day — even though she can't see her surroundings.

Seated at a concrete picnic table amid a group of teenagers, 16-year-old Lindsay is handed a living butterfly. She gingerly touches its wings as the insect tiptoes across her knuckles.

"It's definitely still alive — it's crawling on my fingers," she says.

Next come beetles, spiders, dragonflies, ladybugs, wasps, bees — a mix of real insects and plastic models — passed from one student to the next so they can feel them with their hands.

Some, like Lindsay, can't see the insects at all, while others can make them out to some degree.

All of the students have gathered on Mount Lemmon to experience science through the University of Arizona's Project POEM, a National Science Foundation-funded project designed to introduce visually impaired middle and high school students to career possibilities in science, technology, engineering and math.

**Project POEM Goes to SkySchool**

Lindsay, who will be a junior at Veritas Preparatory Academy in Phoenix in the fall, is one of 10 visually impaired students, from across Arizona, taking part in the program, which kicked off this month with a weeklong stay at the UA's Mount Lemmon SkyCenter, north of Tucson.

There, the students participated in an adapted version of Sky School, a K-12 science education program based at the center.

They spent their first full day on the mountain handling insects, analyzing soil and testing water quality, under the guidance of UA student instructors. They also met with visually impaired working scientists.

The Sky School experience was the first phase of the 14-month Project POEM, which stands for Project-Based Learning Opportunities and Exploration of Mentorship for Students with Visual Impairments in STEM. The project is funded by an NSF grant of more than $1 million.

Lindsay — who is interested physics, biology, chemistry, and science and learning in general — was referred to the program by two of her teachers who work with students with visual impairments in Phoenix. The ever-inquisitive teen had plenty of compelling questions for her Sky School instructors, as she set out to soak up as much information as she could.

"I like learning things about the way the world works," Lindsay said. "And seeing how each little piece is connected to every other little piece to create this beautiful planet that we live on."

Lindsay wants to have a career in science one day. It's the goal of Project POEM principal investigator Sunggye Hong that she, and other young people with visual impairments, feel
empowered to pursue that dream.

**Underrepresentation in STEM**

People with visual impairments often lack encouragement in STEM and remain highly underrepresented in STEM careers, said Hong, an associate professor in the Department of Disability and Psychoeducational Studies [4] in the UA College of Education [5].

As a child growing up with visual impairment, Hong once thought of becoming a scientist himself, but wasn't encouraged to pursue it.

Now he wants to show students interested in STEM that visual impairment shouldn't be considered a barrier.

"The goal of this project was to break that ice and possibly come up with ways to motivate our own students — have them be equipped with the knowledge and ability and power to seek opportunities or become a scientist with visual impairment," Hong said.

In some cases, vision limitations might even give students a unique advantage in STEM, Hong said.

For example, Lindsay recalls learning about chemical reactions in a high school chemistry class. Since she couldn't see changes in color in lab experiments, she noticed things such as temperature and smell, which her sighted classmates did not.

"I think because the world we live in is so visual, sighted people tend to overlook those things, not on purpose, just because they use their eyes so much," she said. "Since I can't use my eyes, I had to find all the other ways I could do it, and I ended up learning, in some ways, more."

**Playing to the UA's Strengths**

Project POEM covers a variety of sciences, but it especially leverages two strengths of the UA: astronomy, which is typically thought of as a highly visual field, and the College of Education's training program for teachers of visually impaired students [6], which Hong oversees.

"We thought the synergistic power of combining these two areas of study would be great," Hong said.

Students were introduced to astronomy at the Sky Center, through telescope viewings augmented with sounds that fluctuate with light intensity.

They will continue learning about astronomy and planetary science in the next phase of the program, as they engage, throughout the coming school year, in a unique STEM curriculum developed by the Project POEM team. As part of the curriculum, students will receive 3-D models of real spacecraft and documented craters discovered in Arizona and on the surface of
the moon and Mars.

Many of the models, which are designed to let students experience craters through touch, are based on data and images collected by the UA's Mars HiRISE [7] camera. They're being cast in the lab of Project POEM co-principal investigator Steve Kortenkamp [8], an associate professor of practice in the UA's Department of Planetary Sciences and the Lunar and Planetary Laboratory [9].

The Project POEM students each will be paired with two mentors, with whom they will interact virtually — a UA student in a STEM major and a visually impaired professional who currently works in STEM. The industry mentors are located throughout the country and work in a range of disciplines, including oceanography, math, software engineering, biomedical engineering and organic chemistry.

The Project POEM team members hope their curriculum may eventually be adopted on a national scale.

Meanwhile, for students such as Lindsay, the project is helping to realize a dream for the future.

"I know that it's possible to do science being blind, because I know people who do that, but I don't really know how I would do that, so I want to learn," Lindsay said. "I also think that I, hopefully, will learn how to think about the world in a scientific way — as in, see problems and then think of ways to fix them. Or just be extra curious."

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