Engaging the Future of Safety Science

How UL Research Institutes' Xplorlabs Educator Fellows are transforming their classrooms

UL Research Institutes | Research Experiences & Education

2025

Xplorlabs Educator Fellowship

The Office of Research Experiences & Education believes that scientific inquiry in the context of real-world phenomena builds the foundation for a safer, more sustainable future where people are equipped with the knowledge and skills to think critically about the world around them.

The Xplorlabs Educator Fellowship provides professional learning experiences with peers and leaders in education as well as UL Research Institutes' safety science experts. The yearlong program includes an active cohort of secondary classroom and informal educators across the country.

UL Research Institutes | ASU Mary Lou Fulton College for Teaching and Learning Innovation, Arizona State University


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XPLORLABS

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Fire Science Safety Education For All

By Janet Ankrum

Middle School Teacher and 2024-25 Xplorlabs Educator Fellow

Phoenix, Arizona

"KIDS THESE DAYS!" Have you ever found yourself mumbling this about the upcoming generation? With more than 30 years of experience educating "the next generation," I have discovered many interesting things.

Most importantly, that there is power and goodness in the following:

- Thinking time
- Active listening
- Notice and wonder: sense-making
- Open perspectives
- Advancing student knowledge
- Positive affirmations
- Realizing that teaching is an act of love
- Building awareness and inviting students to take action

Youth taking action

Action-oriented pedagogy places students in positions of leadership dedicated to enhancing the safety of lives and protection of property in their local community through sustainability and partnerships.

The Xplorlabs Educator Fellowship offered a great opportunity to test my theory of placing students in positions of leadership and community advocacy — coming up with a project that would benefit our community. It started with the three of us agreeing to three days of training in Tempe, Arizona, along with two high school youth scholars from Tucson and dozens of other adult educators from around the nation.

Together, we engaged with the youth at the training by exploring scientific phenomena surrounding lithium-ion batteries, researched the cost and benefit of using them, and reported back with curiosities, confusions, connections, and celebrations. We tried to make sense of and wrestle with concerns we identified with the places and people that we care about most.

The question I asked myself: As a social science researcher, how can I elevate students to advocate for fire science safety in our community?

Data, design, and implement

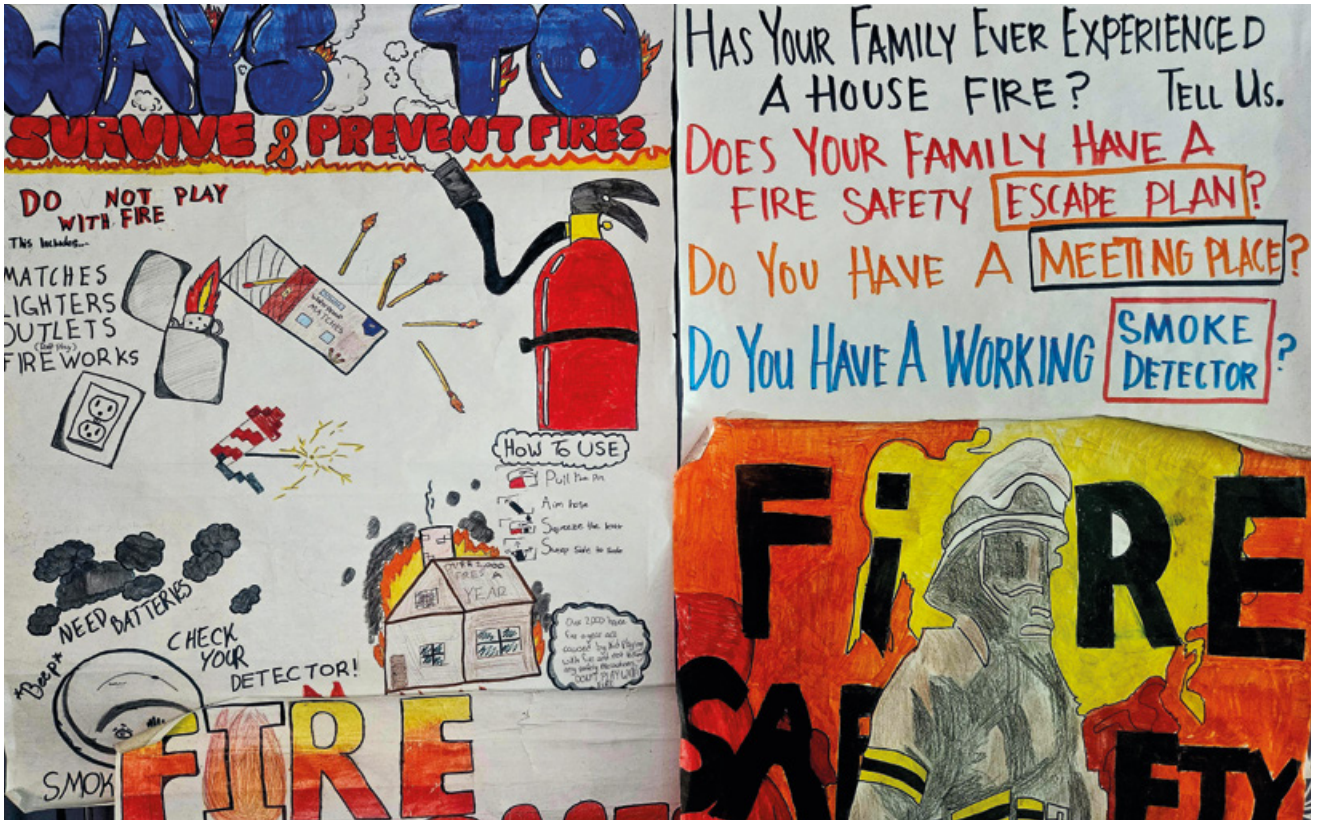
As we collaborated on the safety implications of lithium-ion batteries and the use of everyday gadgets, we carefully critiqued ideas and were not committed to our first generated thoughts. We cultivated a "questioning attitude" and we diligently scanned for potential safety-oriented projects.

Experiencing hands-on investigations and sophisticated learning together with Youth Fellows Andrea and Itzel at the Fellows Summit held at ASU with the Xplorlabs team. Through action-oriented pedagogy, youth are positioned as dedicated, curious, and contributing researchers.

Hands-on curriculum tethered to the four Xplorlabs pathways was being taught in my STEM class. New questions, investigations, and fire science safety work continued to emerge. We continued to ask ourselves how we could design and contribute to a new community-based initiative.

We noticed there seemed to be an extensively higher rate of students at our school who have experienced their homes burning to the ground which prompted us to conduct additional research on this topic. The fire station near our school experienced more than 6,000 fire calls in 2022, spending $400,000 on calls each year. We thought, that's it! This was the single moment when we all knew we were being called to action. We felt ownership and passion to make an impact on saving people, protecting property, integrating sustainability, and showing our impact beyond the walls of our classroom.

Our effervescent enthusiasm about the fire safety project inspired Xplorlabs Youth Fellow Jaleah to get involved. She felt called to amplify and support our transformative efforts to fire safety science activism for our shared neighborhood on her campus. Jaleah was quick to take on the task of contacting our local fire department.



Youth fellows brainstormed a variety of strategies to help prevent fires in our community by promoting the campuswide collection of nonworking batteries from smoke detectors. Once used, batteries are collected, counted, and properly recycled. When possible, students would repurpose the batteries with the solar panels above our Cultivate Catalina Garden Beds. It was important to everyone to tie what we were already doing with our new learning in respect to Xplorlabs' Extraction to E-Waste, and to recycle these batteries and other digital devices properly.

Make plans, stay flexible

Youth are 100% of our future and intergenerationally, we can have fun and learn from each other! As educators, we can begin learning to be comfortable with uncertainty. We need to trust our students. We may need to bridge the gap and help launch them. They are a wildly talented bunch — ready and capable to make a positive impact on sustainability now and in the future. Students need to be included and involved to become the students in action that we are looking for. ■

They are capable.
They are contributors.
This work makes them proud.

XPLORLABS.ORG

NAME
Q:

NAME :
I WANT TO
LEARN ___

FIRE ESCAPE PLAN @ HOME
JACKSON
ALEX

FIRE EXTINGUISHER DEMO

FRI. MARCH 28
OBSTACLE COURSE
↳ FRANKLIN H.S.
PERM SLIPS(?)

CHOICE BOARD
- Collect Stickers
- Prize P100
ALL 6 STATIONS

RECYCLE STATION
OLD BATTERIES
OLD DEVICES

SMOKE DETECTOR EXCHANGE
BATTERY RECHARGE STATION
-USING SOLAR

DIGITAL SAFETY
CYBER SECURITY

FIRE TRUCK
PHX FIRE DEPT

FIRE ! POISON PREVENTION
FLAMBLE CHEM PRODUCTS
AMY
JAMILAH
YARELI

By Andrea Avila

2024-25 Xplorlabs Youth Fellow

Phoenix, Arizona

Hope for Our Future: Empowered Youth Are the Catalyst for Positive Change

IN THE SUMMER OF 2024, prior to starting eighth grade, I just knew I was going to have another boring summer until I was given the incredible opportunity to participate in the Xplorlabs Educator Fellowship with Arizona State University as a youth fellow. This opportunity changed the course of not just my summer, but the future ahead of me.

As a result of my experience as an Xplorlabs Youth Fellow, I have become more aware of issues in my community around fire safety and sustainability. I have recognized the power in me to take action, inspire, and make a positive change not just in school, but in my community. I was thrilled to be a part of this fellowship, and I was excited to learn more about fire safety and potentially, make a positive impact on others.

During this fellowship, I learned that our community has seen around 600 house fires, with 300 of them categorized as crisis-level events between August and October 2024. A crisis refers to a tough situation characterized by stress, challenges in problem-solving, and an urgent need for assistance.

To better understand this issue, I decided to interview my classmates to see if any had experienced a fire. To my surprise, approximately 30% of them shared personal stories of kitchen fires or incidents involving children playing with fire.

After discovering that many of my classmates had been impacted by house fires, I realized the importance of taking action to prevent them. When I realized something needed to be addressed, I understood it would involve a lot of tasks. Understanding what needed to be done, we recognized the importance of advising children not to play with fire and to close their doors before sleeping, while also reminding parents to check their smoke alarms every month.

I took the initiative to invite guest speaker Bryan Dickey from Phoenix Fire Department to our social studies class where he showcased a fire truck and discussed the excitement, joy, and dangers associated with saving lives. He also highlighted that this work comes with a price — long hours, a risk of cancer, and mental health challenges. At the conclusion of our meet and greet, he expressed a strong admiration for our class. ■

All in all,
you're never too young
to change the world.

My Origin Story: Or How I Learned to Stop Worrying and Love (Learning About) Fire Sprinklers

By Dena Bassett

Math Teacher, STEMinist, and 2024-25 Xplorlabs Educator Fellow

Philadelphia, Pennsylvania

OKAY, PICTURE THIS: me, fresh-faced and bushy-tailed (well, maybe not fresh-faced after grading a bunch of statistics quizzes, but you get the gist), ready to set the world of math education ablaze!

I had this burning desire (pun intended, obviously) to bring my engineering background into my urban high school classroom. I envisioned my students — a diverse group of brilliant minds — finally seeing math as the key to unlocking the mysteries of the universe, or at least, a high-paying, meaningful career. I wanted to be the "anti-gatekeeper" for my students, opening doors to all things STEM.

New to AOP

But let me tell you, reality hit me harder than my featherweight champion grandfather did in his last title fight win. Action-oriented pedagogy? More like action-packed chaos! You see, the student-driven learning activities that are the hallmark of this pedagogy can sometimes take on a mind of their own in the classroom — definitely not a great fit for my world of rigid lesson planning and pacing. And because assessing the learning (yes, it always comes down to grading) goes beyond the paper and pencil tests I had become accustomed to, I needed to be skilled at facilitating progress and managing time effectively — without stifling student exploration. There was so much I didn't know.

To top it off, finding the best way to be creative in my class using relevant, engaging STEM curriculum felt like searching for a kittycorn riding a skateboard (thanks to my granddaughter I am practically a kittycorn connoisseur). And the time constraints? Don't even get me started. For the last 10 years I found myself drowning in standards, benchmarks, and pacing guides, leaving practically zero room for, you know, actual learning. I was constantly battling "locked gates" with no "keys" in sight, desperately seeking to ignite my students' passion for STEM, but facing an uphill struggle worthy of Sisyphus himself.

Pulling it together

Then, like a phoenix rising from the ashes of my previous lackluster attempts at STEM integration in my math classes, came the Xplorlabs Educator Fellowship. Suddenly, I was surrounded by like-minded educators, armed with high-quality resources, and encouraged to embrace my own creative spirit and the power of action-oriented pedagogy. And that's when the magic happened!

Okay, so full disclosure, my STEM awakening wasn't a sudden "aha!" moment, it was more like a slow burn. It took a while to sink in, but engaging with some of the most impactful activities, speakers, readings, and modeling by Xplorlabs' education experts from UL Research Institutes' Office of Research Experiences & Education, Arizona State University faculty, and a host of conference presenters sparked little "aha" moments that grew into a full-on realization. My math teacher brain finally connected with my old engineering self to create my Xplorlabs learning experience — finally bringing more STEM into my math classroom.

The students and I dove headfirst into the Science of Fire Safety, exploring the chemistry and physics of fire and analyzing our city of Philadelphia's proposal to mandate sprinkler installations. My students became city officials and property owners, armed with data and quantitative displays, debating the merits of fire sprinklers like seasoned pros. It was amazing!

Sure, I may have had a panic attack worrying about triggering the fire alarm (and ironically enough, the sprinklers) during a particularly enthusiastic demonstration of the fire triangle (rest assured, no actual arson was involved!) but at least the students would've learned about the importance of fire safety devices firsthand.

And as for the future, well, I envision partnering with science teachers for hands-on investigations and inviting real-world stakeholders to provide a richer perspective for my students. Who knows, maybe one day, one of my students will be the one designing the next generation of fire safety technology. Now, wouldn't that be a truly lit ending to my story?

Ready to spark change? Join the Xplorlabs STEM revolution

So, you've read about my slightly chaotic, yet ultimately rewarding journey into the world of action-oriented SEM education using Xplorlabs. Maybe you're a teacher facing similar challenges or maybe you've yet to get started. Wherever you are in your journey — I implore you to take action! Don't let time constraints, budget limitations, or lack of resources extinguish the flames of curiosity.

Learn more about the high-quality resources from Xplorlabs that are steeped in safety science and backed by a sea of researcher-driven and practical knowledge from UL Research Institutes. My class used a combination of interactives, videos, and documents from both the Science of Fire Forensics and Science of Fire Safety pathways, as well as local news articles, government reports, and other data.

Whether leveraging what's new in cutting-edge educational research on AOP or real-world ways scientists and engineers are working to make our world safer, make connections that will bring learning alive for your students. Prioritize hands-on learning to make education impactful. Equip students to become safety champions, and inspire them to give back by building safer communities.

Let's work together to create a world where every student, regardless of circumstance, can explore, discover, and innovate.

If we want to ensure a better, safer future, we must transform classrooms into hubs of creativity, critical thinking, and real-world problem-solving.

The future of STEM depends on it, and the future of our students depends on STEM. Will you answer the call? Let's light this fire together! ■

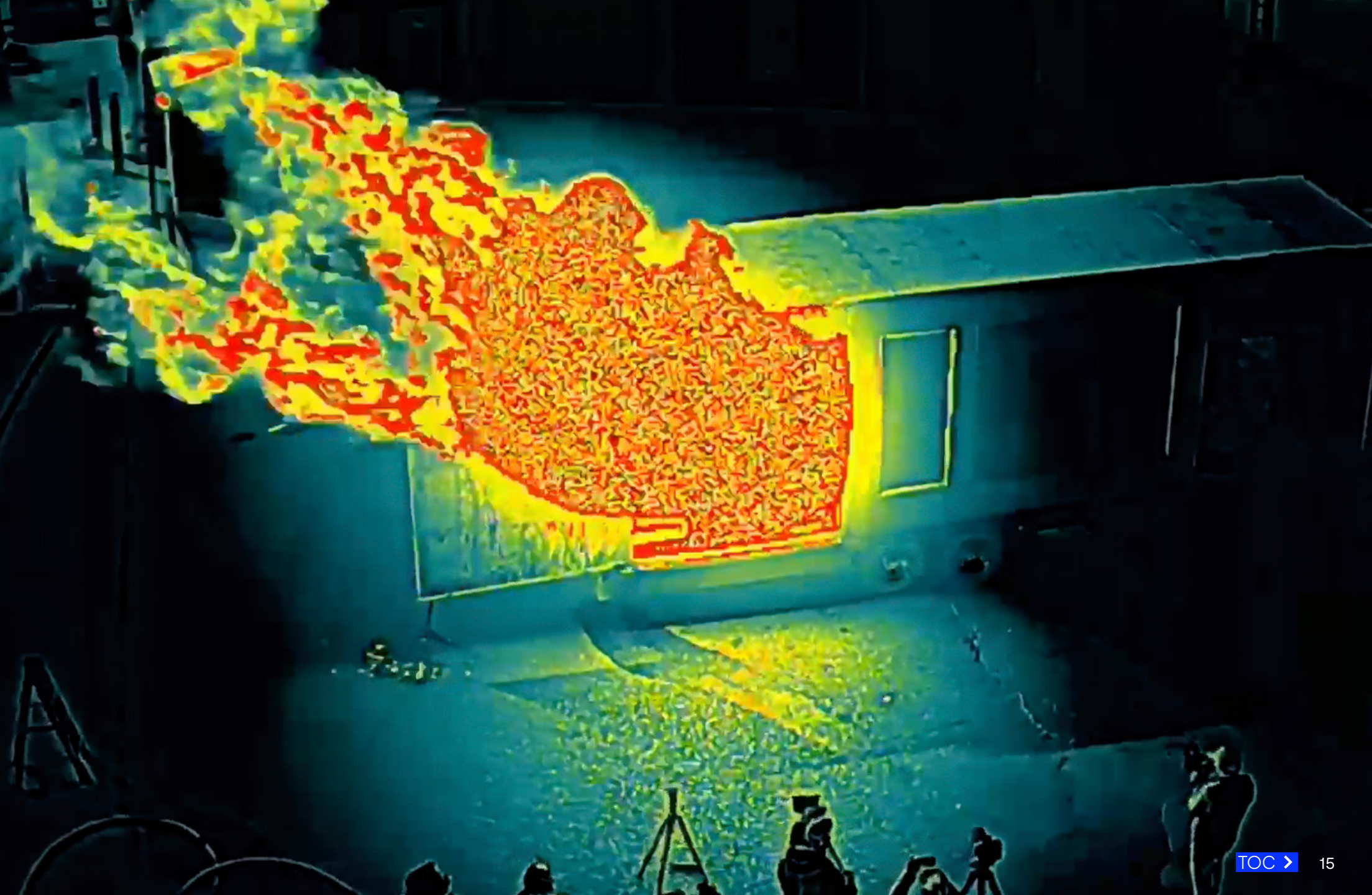
The Philadelphia Inquirer

A battle is brewing over a bill that would require sprinklers be added to older condos

Fire safety experts agree that sprinklered buildings are safer, but opponents to a new mandate say that requiring them in old buildings will be too expensive and disruptive to the lives of occupants.

A Philadelphia Fire Department demonstration on the effectiveness of sprinklers to suppress house fires.

by Jake Blumgart
Published Oct. 5, 2023, 5:00 a.m. ET



Healing Through Fire, Fellowship, and Culture: A Journey with ULRI Xplorlabs

By Krystal Brown

High School Science Teacher, Firefighter/EMT, and 2024-25 Xplorlabs Educator Fellow

Gunnison, Colorado

I DIDN'T KNOW that applying to the UL Research Institutes' Xplorlabs Educator Fellowship would launch me into one of the most powerful years of my life — one marked by loss, rediscovery, and healing. I also didn't realize how much it would bring me back to the Navajo teachings that helped shape my spirit as a child, grounding me in hozhó — harmony, balance, and connection.

When I first applied to the fellowship, my father had just entered hospice. Less than two months later, he passed. Amid the fog of grief, I found myself traveling across the country — from Phoenix's solar fab labs to ULRI's Annual Research Symposium in Atlanta — exploring exposomes, safety science, and community resilience with an extraordinary cohort of teachers. Somehow, science became a sacred path back to myself, to my community, and to my culture.

From ancestry to action

I come from a long line of western pioneers, teachers, and community builders. My family's roots in southwest Colorado stretch back generations — quarrying stone for gathering places, starting some of the first schools, and working the land. I was raised communally, surrounded by the wisdom of not just my biological family but also by neighbors and friends. One of those second mothers had been a boarding school kid, taken from the Navajo Nation. Her stories and strength planted something in me — a spiritual compass that pointed to Navajo teachings when life got hard. While the Navajo don't have a direct translation for the Confucius idea coined by Sir Francis Bacon that "knowledge is power," spiritual and cultural knowledge are believed to be key components of achieving harmony in the Navajo culture. In Navajo, the word "hozhó" encapsulates a way of being — oneness with the universe, harmony with community, self, and land.

Though I am not Navajo by blood, these teachings became an anchor, guiding me through the uncertainties of loss and the search for purpose. "Yá'át'ééh" means "it is good" and because of my journey through this fellowship, I believe that again.

Finding meaning through fire science

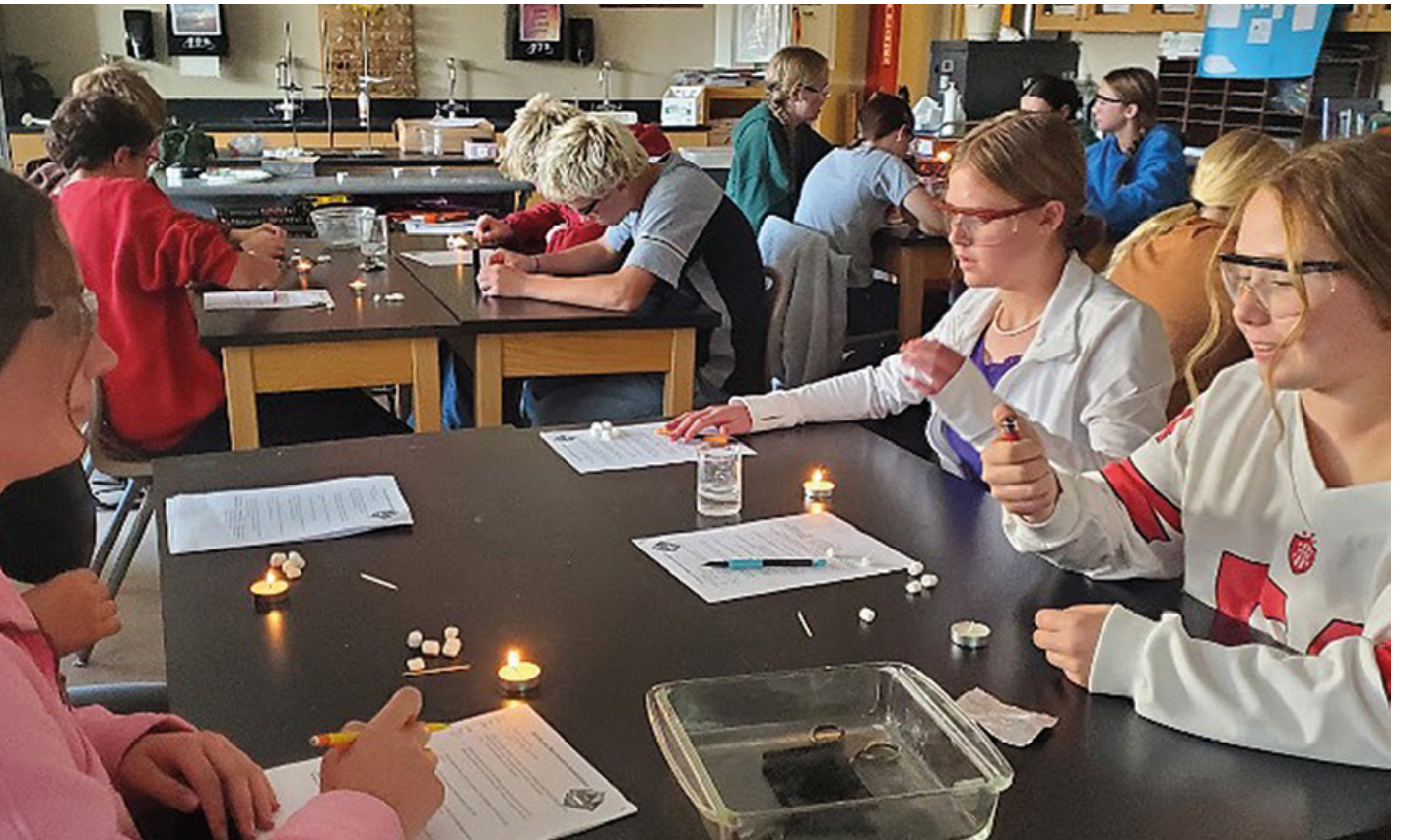
I stumbled across Xplorlabs' booth at the National Science Teaching Association conference. Initially drawn in by the tactile displays and familiar videos we use in firefighting, I was intrigued — and then, hooked. I had just finished presenting the Wildfire Response Game with University of Colorado Boulder's HEART Force and was carrying both the thrill of contribution and the exhaustion of imposter syndrome. I was tired and overwhelmed. But when I learned about the fellowship, it felt like a gift: an invitation to merge my passions for science, community service, and education.

Krystal Brown (center) with Kenny Fent (left) and FSRI Senior Director Steve Kerber (right) at ULRI's Annual Research Symposium.

I was also pursuing science and community, something all of the parents had instilled in us from a young age — especially my dad. We worked on countless electrical and drafting projects, and collected and identified every bug, reptile, and amphibian species we could get our hands on with him. I was reminded of a deep love that pulses below my feet. I am grounded.

Soon, I was in Phoenix and Atlanta with teachers from all over the country as a member of the Xplorlabs Educator Fellowship. Imposters or not, we were teachers and we were soap-makers, junk artists, sustainability nerds, tech tinkerers, and fearless learners. Together, we dove into safety science and pedagogy, exploring exposomes — the sum of all environmental exposures that affect our health over time. This concept resonated deeply, especially as a volunteer firefighter in a rural town. We live this science. We breathe it, literally.

And we all asked the same question: How do we teach this without overwhelming our students? How do we step from overwhelm to action? The answers, I would learn, lie in connection — between people, disciplines, and culture. I've experienced this feeling before in my other profession as a firefighter. Teachers and first responders are a lot alike — no one will know we are overwhelmed, but they will see the life-changing outcomes of our work and eventually, our community and culture will soften any overwhelm we might have otherwise experienced.



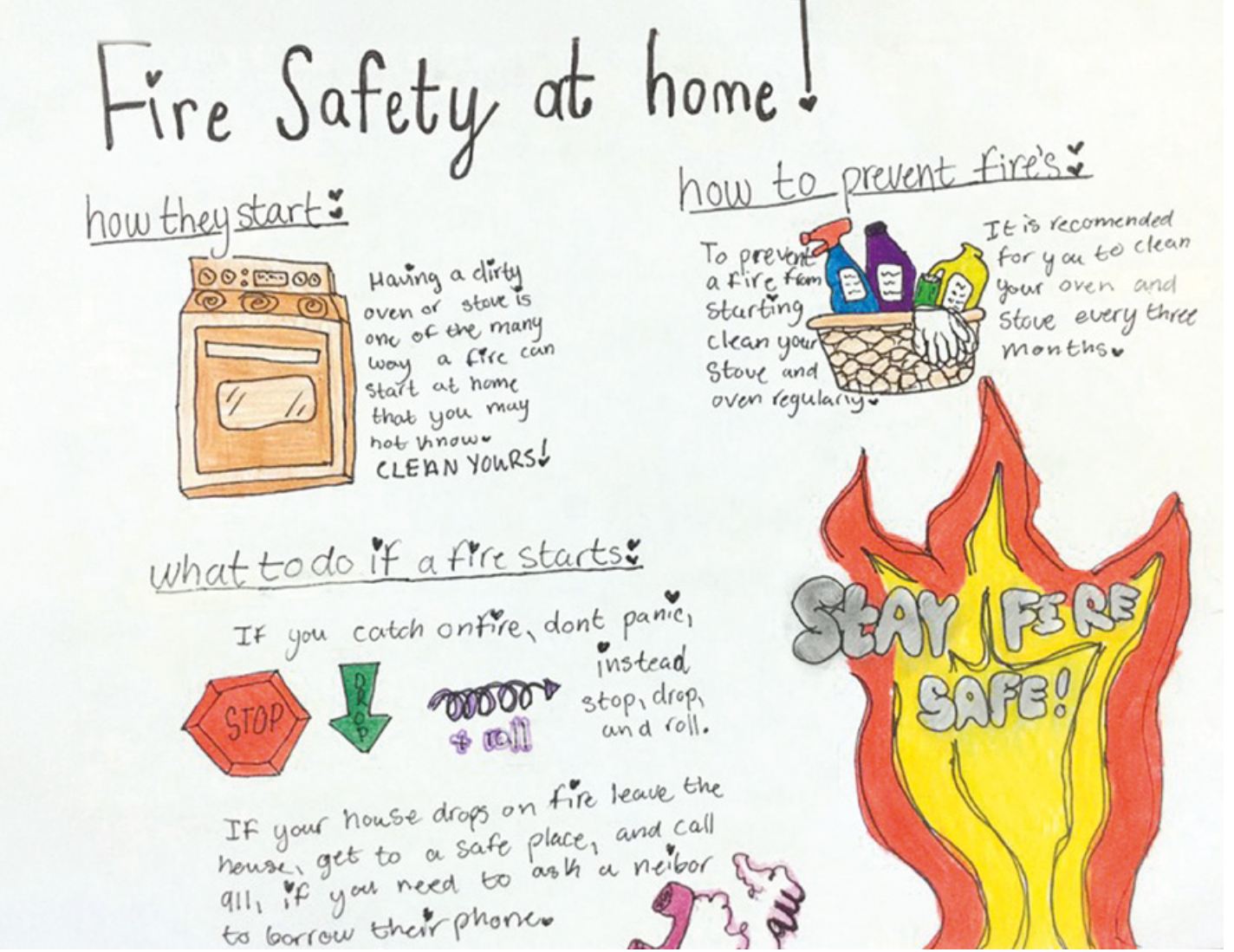
Grief, grounding, and growth

My father's death shattered something in me, but it also gave me clarity. My grief didn't make me weaker — it made me a seeker. I found myself looking for ways to return to the Earth, to simplicity, to a kind of knowing that transcends words. I buried him by hand in a natural grave at the Colorado Burial Preserve. I felt every lesson he'd ever taught me about science, curiosity, and care settle into the soil with him.

That return to Earth paralleled the work I was doing with Xplorlabs. The science of fire forensics, of understanding chemical exposure, of building community resilience — it wasn't abstract. It was personal. It was a legacy. I was no longer just a teacher or firefighter. I was a bridge between generations, between cultures, between the past and the possibilities ahead.

Transforming classrooms and culture

Something they never prepare you for in teacher preparatory positions is that you will always feel like an imposter because you can never be the expert on everything — you are literally teaching the next generation and their skills and interests are as vague to understand and categorize as the world's deep oceans. It doesn't seem like it should be that hard, and yet, we know more about outer space. Back in Colorado, I brought the fellowship lessons to my students. Using Xplorlabs' Fire



Forensics resources, they investigated burn patterns, discussed convection and flow paths, and built fire safety models. But more importantly, they connected the science to their lives, to the well-being of our community.

This wasn't just academic. This was culture-building. They were becoming stewards of knowledge, protectors of each other. Watching them, I thought again of hozhó — this is what harmony looks like. This is science in service of healing.

Honoring the journey

As I held a picture of my dad from one of his wild adventures during my childhood, I felt at peace. His legacy lives in every lesson I teach, every student I empower, and every act of cultural connection I pursue. And the fellowship helped me realize that embracing scientific literacy and cultural healing isn't a contradiction — it's a necessity. I returned from Atlanta to hear students discussing how "the evidence shows convection because the air is transferring heat," making connections between flow paths and building layout. With no direct instruction from me, students were discussing the physics and chemistry of a fire scene and instructing each other about the importance of "closing windows since an open window helps a fire grow by providing oxygen." They were ready to start educating the community about fire safety because Xplorlabs' pathways empowered them while I was away.

The Navajo believe that to know one's culture is to know peace. Through Xplorlabs, I've learned that culture is not only preserved through stories and rituals, but also through action — through data, through fire science, through teaching kids how to build a safer, more informed world.

So thank you — Ahéhee.' For the knowledge. For the healing. For the community.

And if you're reading this — reach out to your local first responders. Dive into the resources at Xplorlabs. Share your stories. Teach with your whole heart. That's where the real learning begins. ■

By Monique Carter

Math Teacher and 2024-25
Xplorlabs Educator Fellow

Philadelphia, Pennsylvania

Math Meets Fire Safety: Merging Math Instruction and Fire Safety!

CAN A PLACE BE SO HOT?

I have heard little about the dry heat of Arizona, and being born and raised in New York, I believed I was MORE than prepared to handle ANYTHING. Little did I know Arizona's heat at 4 p.m. planned to beat down on my glistening shea butter skin, making it almost impossible to move or simply breathe.

I stepped off the Valley Metro Rail because Uber is for losers (I thought), and I proceeded to find my hotel like any New Yorker from my era — I walked! The gods of the crossroads must have watched the footage of me trying to find my hotel with all my luggage in tow as a silent slapstick comedy from the early 1900s.

After 40 minutes in the Arizona sun, I finally found my hotel, which was a mere 10 minutes from where the Metro dropped me off. From the moment I walked into my air-conditioned room, I knew this was going to be a unique and unforgettable experience.

Welcome to Xplorlabs and the planning experience

I share this to note the importance of the personal narrative. As Chimamanda Ngozi Adichie warns us against a single narrative, my first Xplorlabs session allowed me to not only meet dynamic science and math teachers from various parts of the country but to also hear their stories about school, the population of students they teach, the districts in which they work, and later, the dangers of fire and how it impacts their personal community.

Who knew that in some towns in Arizona, fire sprinklers are mandated? Without the Xplorlabs Educator Fellowship, I would know very little about fire safety efforts in Philadelphia. I also would not have received brief guidance from a parent who is employed as a firefighter … or known that the small caps in my classroom were fire sprinklers.

The stories and ideas of others were so motivating and impactful that I began to wonder how fire and fire safety can inadvertently affect different communities of people. After retiring from our sessions, I spent more than a few nights simply researching. Learning about the victims of fire and their propensity to be people of the global majority, particularly Native Americans.

I read countless articles and studies and even began listening to "There Are No Accidents" by Jessie Singer. Through my brief studies, fire safety morphed from a topic where I was simply creating a unit plan to one that personally affected me, my family, and anyone in my community. I then began to wonder: What do fire and fire safety look like in Philadelphia? After asking that question, it was clear what I was charged to do!

Planning session: The ideas that did not stick

One of the most valuable pieces of information I received about planning a unit utilizing the Xplorlabs fire safety material was to not go with my first or even second idea for a project related to fire safety. I was in the unusual position of being a math teacher in a room full of science teachers.

My goal was to teach a unit using Xplorlabs' tools, but unlike most science teachers in the room, my focus was on the math connected to the science of fire and fire safety. My ideas ranged from calculating percentages of materials and metals used in constructing a phone, survey creation, and graphing and floor plan design. Given that I planned on rolling out my unit at the beginning of the year, I knew I wanted my students to understand what their year of math would look like in my classroom. Through my Xplorlabs unit, I combined social justice, narrative, measurement, scaling, area, and perimeter.

I couldn't wait to see how students would respond to our first unit of the year:

Math Meets Fire Safety.

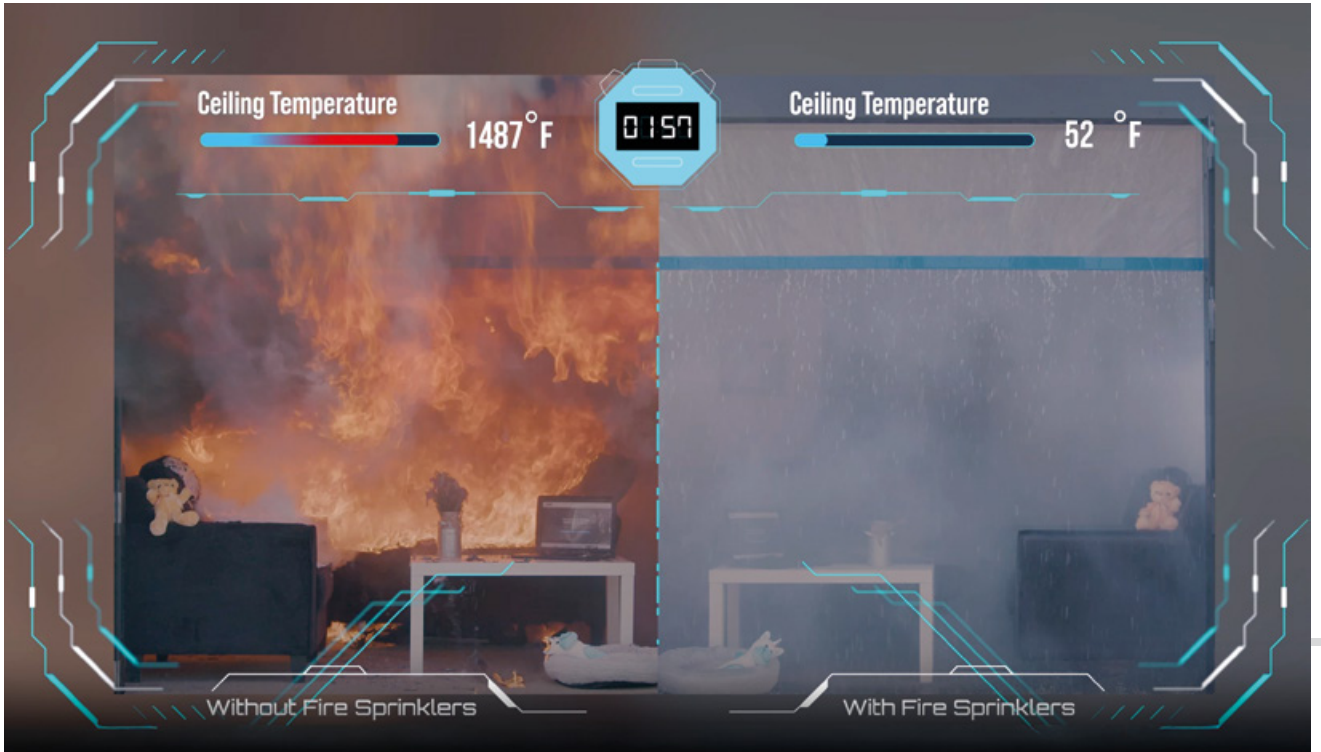
Fire in the Northeast: Fire narratives in the Bronx and Philadelphia

My goal for students in math is to help them naturally connect their personal narrative to their learning, whether it is math, science, or the humanities. I felt like I had to show students what I meant by sharing a narrative about the fire at Twin Parks North West, an affordable-housing building and high rise in the Bronx. The devastation of that story captivated students. When they were tasked with finding a story in Philadelphia that demonstrates the importance of fire safety measures, we landed on the Fairmount Row Home fire of 2023. Both fires were devastating, and both fires demonstrated the importance of making plans for fire safety when designing a home. After reviewing the narratives, students were charged with creating a one-level, fire-safe apartment complete with fire safety equipment.

The Xplorlabs fire safety material was invaluable in helping students make their own collective conclusions about fire safety and home design. It helped students and myself understand how fire sprinklers work, the different types of fire sprinklers, and the economic and practical challenges with mandating fire sprinkler installations in homes.

I don't think any of them will forget that stuffed teddy bear in the side-by-side burn demonstration of a room with and without fire sprinklers. For any student who was not paying attention to the entire unit, they definitely understood various elements of fire safety and shared it with their families. The rich and intellectual conversations that came from the work students and I did was amazing to witness!

I thought after our unit, we were done with our service to Xplorlabs, but we will be utilizing Xplorlabs units on thermal runaway and the battery supply chain in the coming year.



There are so many ways to connect the Xplorlabs material to your subject — I am proof!

Go visit Xplorlabs and check it out for yourself. See how you can integrate one of the Xplorlabs pathways to promote profound connections and conversations in your classroom, and then tell me how it worked! ■

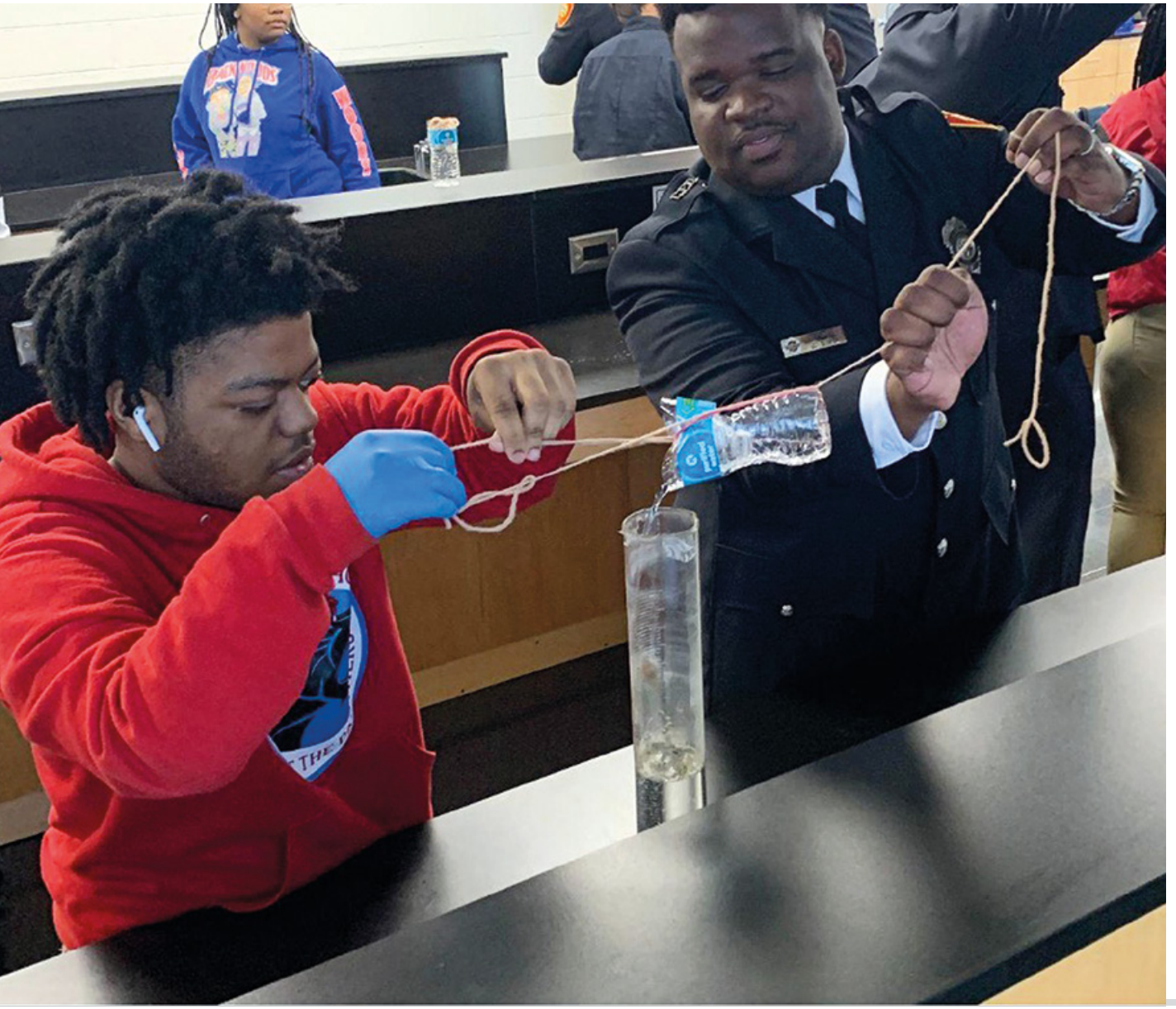
Xplorlabs side-by-side burn allows students to observe different outcomes in a room with and without sprinklers.

From Criminal Justice to Sustainability: My Transformative Journey with Xplorlabs

By Alisha Chavez

Career Exploration and Computer Science Teacher and 2024-25 Xplorlabs Educator Fellow

Chattanooga, Tennessee



My journey into safety science and sustainability: an unexpected path

When my mentor introduced me to the Xplorlabs Educator Fellowship, I initially dismissed it, assuming it wasn't for me. I thought, "What would a high school criminal justice teacher transitioning to middle school career exploration and computer science have to gain from training on safety science and sustainability?" When my mentor brought it up again, I asked him that very question. He assured me they were looking for career exploration teachers, so I applied, honestly thinking there was no way I would be accepted.

Overcoming imposter syndrome

To my surprise, I received an acceptance email, and then imposter syndrome set in. However, I was not entirely new to Xplorlabs. I had previously utilized Xplorlabs' Science of Fire Forensics pathway with my forensics students during a unit on arson. The Chattanooga Fire Department came in to conduct experiments with the students, and they absolutely loved it! Despite my doubts, I embarked on this new journey, culminating in a very eventful flight to Arizona, where I would meet an incredible group of people and truly learn what safety science and sustainability entailed.

Chattanooga firefighter and former Brainerd High School student take part in Xplorlabs' fire forensics.

Inspiring connections and new directions

On the first day, I listened to everyone share their stories and projects about what they were doing with their students, and I felt truly inspired. One fellow participant shared a project involving gardening — a passion of mine — and explained how they were teaching sustainability through it. Unbeknownst to him, that teacher became my inspiration, and as a result, I created my school's hydroponics and gardening club, which became a significant part of my class.

Starting with hydroponics: where to begin

Returning home with big ideas, I wasn't sure where to start. A few weeks later, I attended another training where I brought up Xplorlabs, and my district department head offered me some free hydroponic towers for my classroom. I jumped at the opportunity to teach the kids about growing their own food, thus introducing the idea of sustainability. As we began growing, I learned about different gardening methods, such as no-till practices that improve soil health, and we started a community garden at our school.

A life-changing experience

This experience not only changed my class, but also my life. My journey into safety science and sustainability didn't stop at gardening. Armed with all of my new growing experience, I was inspired to start a flower farm grown on the land of my great grandparents, and named after my grandmother who loved flowers. I dove in learning even more about growing sustainably and Betty Jean´s Flower Farm was born. Additionally, at school, we began using hydroponic systems for year-round gardening. I also used Xplorlabs to teach students about fire safety and how to properly dispose of lithium-ion batteries through computer science. A group of my students is currently working on a Shark Tank project to create easier disposal methods.

Join the journey

My journey with the Xplorlabs Educator Fellowship has been transformative, leading me down a path I never imagined. I invite you to explore this incredible program and see how it might inspire innovation and sustainability in your own teaching practice. Whether you're a seasoned educator or new to these concepts, the resources and community you'll find here can spark impactful change.

Embrace the unexpected, and let your students lead the way to a sustainable future. With each step of this journey, I have come to realize the profound impact educators can have when they blend passion with purpose. The Xplorlabs Educator Fellowship opened doors I never knew existed, allowing me to integrate safety science and sustainability into my curriculum in ways that are both engaging and meaningful for my students. ■

It's not just about teaching facts and figures; it's about empowering young minds to think critically, solve real-world problems, and become stewards of the planet.

My Xplorlabs Educator Fellowship Journey

By Melany Coates

High School Teacher and 2024-25 Xplorlabs Educator Fellow

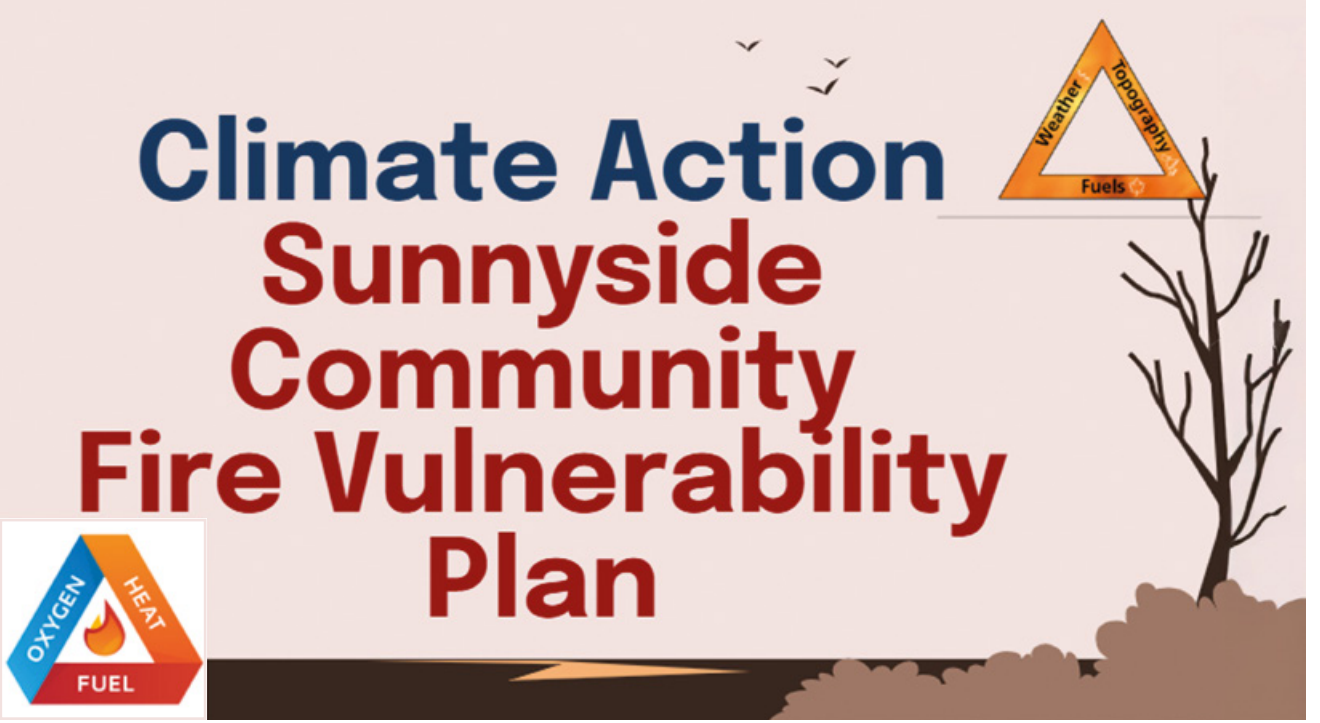
Tucson, Arizona

THE MULTIFACETED and collaborative community that ASU and Xplorlabs put together for the Xplorlabs Educator Fellowship created an environment that is truly inspirational, from both a teaching and a leadership perspective. Our minds came together to learn and create our vision of safety science and how we can bring meaningful experiences back to our students in order to invoke curiosity, agency, and science identity.

I entered this fellowship as a novel learner of all things safety science and built connections across multiple states with an incredible group of diverse teachers and learners.

Deepening my practice by engaging with students: incorporating Xplorlabs' resources into my existing curriculum

While safety science was novel to me at the beginning of this school year, it was even more so for my students. Using safety science resources



from Xplorlabs was an easy fit into my current curriculum. The students and I were already studying fire in ecosystems (with energy and matter as the crosscutting concept), so adding safety science around fire behavior fit beautifully. Students were able to see the need for safety around the wildland urban interface and explore careers around fire safety, utilizing their content knowledge gained from their learning.

My district uses the OpenSciEd curriculum. I was facilitating the ecology unit with zombie fires that focuses on the carbon cycle feedback loop. They came to understand that increased carbon dioxide in the atmosphere is connected to global warming. Students followed matter and energy through fundamental processes like photosynthesis and decomposition. During the annual Fellowship Summit, I experienced an Xplorlabs hands-on investigation to understand "what is fire?" Using a candle and other accessible materials, my students were able to explore what was actually on fire using that same investigation in our classroom.

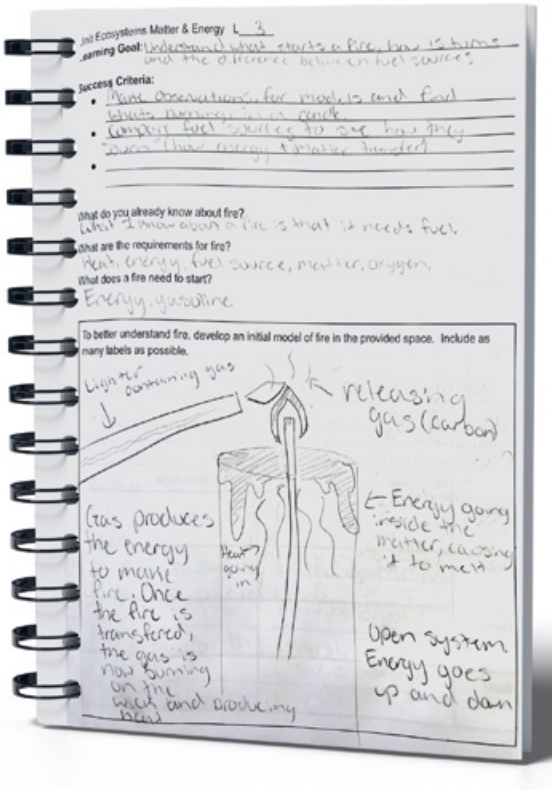
They modeled their ideas about fire and observed that neither the wick or the wax is what burns, but rather the gas. The activity allowed my students to explore, experience, and visualize interactions of matter and energy, then use this knowledge to understand the phenomena they were studying regarding fires, the carbon cycle, and how to manage the wildland urban interface.

The fellowship also helped me build my autonomy by venturing outside of my curriculum adding relevant experiences for the students. We ventured into the mountains to see one of the last-standing fire lookouts, observe for ourselves the devastation that a wildfire can do, and look at management techniques such as burn piles.

Being a fellow and establishing connections helped build my confidence in taking the students outdoors and experiencing the real world beyond the walls of my classroom.

Students addressing real sustainability issues

As part of the teacher learning experience with Xplorlabs and Arizona State University, we began dabbling with concepts and action-oriented pedagogies around our students being change agents through action. Through collaboration with the teacher fellows, and attending workshops around wildland urban interface at the 2024 Annual ULRI Symposium in Atlanta, Georgia, it became clear that I needed to identify and leverage community members that would bring real-world, career-building learning experiences to the students.



We brought in firefighters on our campus to identify fire-vulnerable areas, and learn about environmental factors that influence fire behavior. Students took agency and action! Using historical, cultural, and current fire management techniques, their knowledge of fire behavior, and the feedback loop of the carbon cycle, they presented a plan to our administration on how to mitigate the fire-vulnerable area that they identified on campus. By combining action-oriented pedagogies with the phenomena we were studying, students participated in an experience that was deeply meaningful and authentic.

Building agency, identity, and purpose for youth

Watching the youth fellows work with and influence teachers is at the heart of everything I do as a teacher, action researcher, and leader for my students, their community, and the district. I had the privilege and opportunity to bring two of my students onboard the fellowship as youth fellows. Their knowledge, scientific identity, and stewardship of their community has blossomed within this fellowship. Their call to action around the science of safety and community advocacy is incredibly inspiring! Through Xplorlabs' virtual experiences, they learned about lithium-ion battery safety and wanted to educate the families in their community — planning and hosting a battery collection event.

Xplore real-world resources

Consider how you can incorporate Xplorlabs resources into your current curriculum to build real-world science connections in your classroom, so your students can understand the importance of safety science and sustainability! Most importantly: build identity, purpose, and agency with your students, encouraging them to take action and keep their communities safe, based on real evidence and experiences! ■

Empowering 10th Graders: Addressing E-Waste and Sustainability Through Action-Oriented Campaigns

By Jasmine Coleman

STEM Educator and
2024-25 Xplorlabs Educator Fellow

Phoenix, Arizona

CAN TENTH GRADERS meaningfully impact sustainability challenges? My year with Xplorlabs and action-oriented pedagogies proves they can! By guiding students through the complex life cycle of lithium-ion batteries — from extraction to e-waste — we moved beyond theoretical discussions into genuine, consequential community actions.

Why action-oriented pedagogy?

Traditional teaching often stops at understanding and assessment; AOP pushes students toward active change-making. During my yearlong fellowship, I chose to connect climate education to safety science, and students explored the real-world implications of climate challenges like lithium-ion battery production, use, and disposal. Introducing roles — such as innovators, advocates, and solution stewards — empowered students to envision sustainable futures, deeply understand multiple perspectives, and undertake authentic actions in their community.

Image on page 29:
Volt for Change: Students with their first battery recycling bin in front of their Earth science class at Maricopa Institute of Technology in Phoenix.

Implementing the action campaign

Our campaigns unfolded in several stages. My Earth science class was a perfect opportunity to implement the Xplorlabs framework since the environmental impacts of the lithium-ion supply chain were evident in students' communities. Initially, students explored local geological processes, such as soil stability, to grasp the environmental impacts of mineral extraction. Building from soil stability tests and mineral research projects, students transitioned to investigating lithium-ion batteries, focusing on the life cycle from extraction to e-waste.

Students identified sustainability challenges within each stage of the life cycle, considering ethical implications and community impacts. They adopted roles in their working groups to foster multiple perspectives — working collaboratively to plan advocacy campaigns targeting tangible community outcomes, thus creating real positive consequences beyond the classroom.

Student advocacy in action

Battery Savers
Students facilitated Socratic discussions and produced engaging videos and infographics highlighting the dangers and proper disposal methods of lithium-ion batteries. They educated peers through dynamic digital campaigns that reached the broader school community.

Students sharing information on campus about lithium-ion battery disposal.

Volt for Change
Students developed visually impactful social media campaigns and successfully initiated a permanent e-waste disposal program on campus. Students transitioned from artists creating compelling visuals to implementers who installed and managed the disposal bins, leaving an enduring legacy at the school.

ChargeCore
Students conducted interactive STEM workshops to educate peers about the environmental and social impacts of battery production and disposal. This proactive approach empowered students to educate others, spreading awareness through direct peer-to-peer interactions and educational pamphlets distributed schoolwide.

Implementing AOP wasn't without challenges. Initially, students struggled with the complexity of sustainability issues and identifying tangible actions. Often, students questioned how they could make any impact since this problem is a global issue. Sharing other students' stories helped them see how making small changes in their community could make a world of difference.

Also, with such a large-scale project, some students struggled without a clear destination in mind; however, scaffolded assignments like the soil excavation and mineral research projects within the Xplorlabs Science of Extraction to E-Waste pathway prepared students for deeper engagement. Student reflections revealed increased confidence and a profound realization of their ability to enact change, confirming the power of connecting classroom learning to authentic community action.

Educators, Xplore action-oriented pedagogy!

Implementing action-oriented pedagogy transformed our classroom, empowering students to not only learn facts and state standards about climate and sustainability issues but to actively participate in addressing them. ■

When tenth graders discover their voices as advocates, innovators, and leaders, they are no longer just students — they become change-makers dedicated to creating a sustainable future.

Infographic from Battery Savers

By Leo DeGreef

Wings Over the Rockies Volunteer and 2024-25 Xplorlabs Educator Fellow

Denver, Colorado

How Xplorlabs Helped Increase Battery Charging Safety at Wings Over the Rockies

Regis Jesuit High School -
Science and Innovation Center

AT WINGS OVER THE ROCKIES, an aviation museum in Denver, students participated in a safety science lesson with an instructor to better understand the safety risks of drones that are powered by lithium-ion batteries. Through exploration, they came to understand safe charging and usage of lithium-ion batteries. Students were challenged to demonstrate the proper charging and safety techniques for their lithium-ion battery-powered drones. Students will be responsible for charging and monitoring their own batteries as part of drone competitions.

Image on page 32:
Wings Over The Rockies - Air and Space Museum

When the students started asking questions about proper charging techniques and safe handling procedures, it was obvious they were engaged and intently interested. They needed to learn the proper charging techniques or they would not be able to compete in the drone competitions.

The students watched a number of videos that demonstrated what could happen when a battery is not properly charged and thermal runaway results. They were very impressed to see the destructive power of a lithium battery in thermal runaway. The instructor relayed the importance of safe battery practices as a way that students could make their communities safer.

Regis Jesuit High School

I will soon be working with science classrooms at Regis Jesuit High School to discuss with students the future of human-space flight and the need for lithium-ion battery safety in this pursuit. Regis Jesuit High School recently opened a Science and Innovation Center where they focus on current and evolving technologies. These technologies must be developed in a safe manner and when deployed in space, must have additional considerations when human lives are at stake. I plan to talk with science classes about future space travels and the need to understand and mitigate the issues surrounding the use of lithium-ion batteries.

The future of lithium-ion battery safety

Over the last year, I have learned so much about the need for lithium-ion battery safety and education. A lot still needs to be learned, and that knowledge needs to be disseminated and formulated into useful procedures. I would like to thank UL Research Institutes and Xplorlabs for highlighting this critical educational need and for giving me the opportunity to become more educated about lithium-ion battery safety. ■

I will continue to spread the need to develop and implement safety procedures in the aviation and space community.

Xplorlabs: Bringing Real Science in Real Time

By Ann Marie Dubick

8th Grade Physical Science Teacher and 2024-25 Xplorlabs Educator Fellow

Smyrna, Georgia

MY LEARNING about Xplorlabs began during the STEMaploooza summer conference in my county. A chance to bring real science problems and solutions to my eighth grade physical science students sounded like an opportunity I couldn't miss.

I was ready and excited to begin with Xplorlabs, then COVID-19 hit. Everything was on hold, including engaging students in authentic science teaching and learning. We scrambled to make science education engaging for the students. Fast forward to 2024, I was ready to start up again and the opportunity for the Xplorlabs Educator Fellowship presented itself!

The students were curious! Fire, heat transfer, lithium-ion batteries, thermal runaway, problems and solutions

We had just finished Xplorlabs' fire forensics lessons and the students were eager to learn more, so we began Xplorlabs' Science of Thermal Runaway pathway. As my students watched the scenario of the e-mobility device fire and the window blowout, they had so many questions. To better understand their own curiosities, they created a model of their initial ideas in groups and the exploration began — trying to figure out what happened and why. We explored gas laws, lithium-ion batteries, thermal energy, specific heat capacity, and chemical reactions.

The students were engaged in the real-world problem surrounding the e-scooter, lithium-ion batteries, and thermal runaway. As they began to understand what happens with lithium-ion batteries and thermal runaway, it was time to start thinking about a potential solution to thermal runaway.

Solving problems through engineering design challenges

Students were able to connect their understanding of lithium-ion batteries and thermal runaway to their everyday lives. They talked to friends and family about thermal runaway, what causes it, and how to avoid it. They checked the chargers in the classrooms and at home, and invited the school secretary to class to learn more. Then, the engineering design challenge began. The goal? Find a way to stop thermal runaway.

With their new knowledge, various materials, a couple of hand warmers to simulate battery heat, a plastic container, and some thermometers, they were on their way to developing a solution! In collaborative groups of three to five, students researched materials, developed initial designs, and then built their battery enclosure aimed at preventing thermal runaway. Next, they tested their devices and collected data.

As the students compared data with other groups to see if their device passed the test, the discussions centered around why their device passed or failed "safety standards" for heat management.

What materials were used? What was the thermal conductivity and specific heat of the materials? How could they make it better? Most importantly, I frequently heard the question, "why is thermal runaway not a well-known problem?"

Make learning relevant and engaging for your students!

Check out what Xplorlabs has to offer to change the way we teach and learn science and science safety. ■

By Luis Fregoso Arias

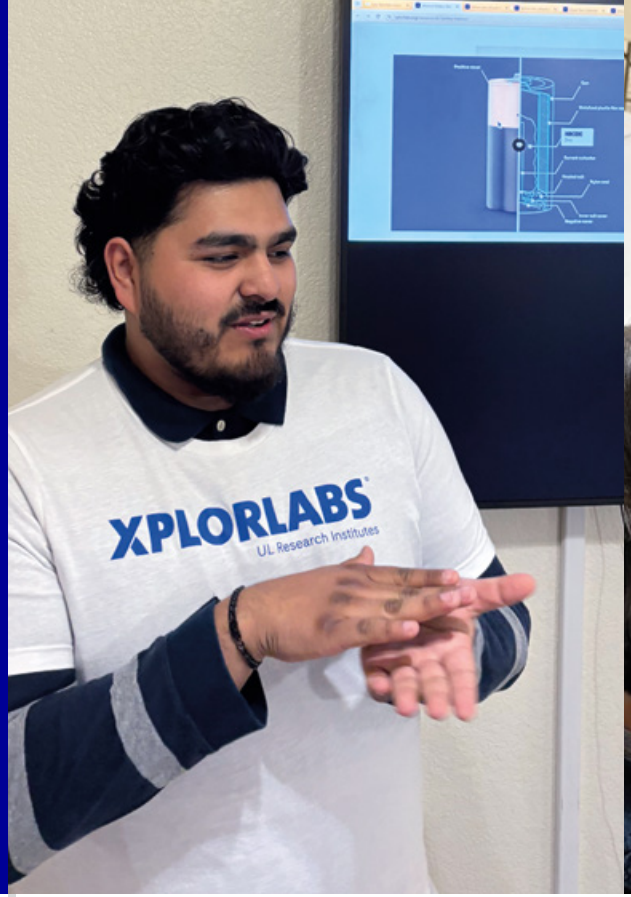
Salud en Balance Community Center Educator and 2024-25 Xplorlabs Educator Fellow

Phoenix, Arizona

Engaging and Empowering Young Students Through Safety Science and Sustainability Learning

AS EDUCATORS, we often discuss engagement and empowerment in the classroom, but what does that really mean? As an informal educator, I am frequently considering these things in order to develop my approach to teaching.

By participating in the Xplorlabs Educator Fellowship, I've come to realize that engagement and empowerment can mean many things but have something critical in common: engaged and empowered learners don't merely absorb information. Rather, they actively shape their own learning — and my students did just that when learning about safety science and sustainability this school year.

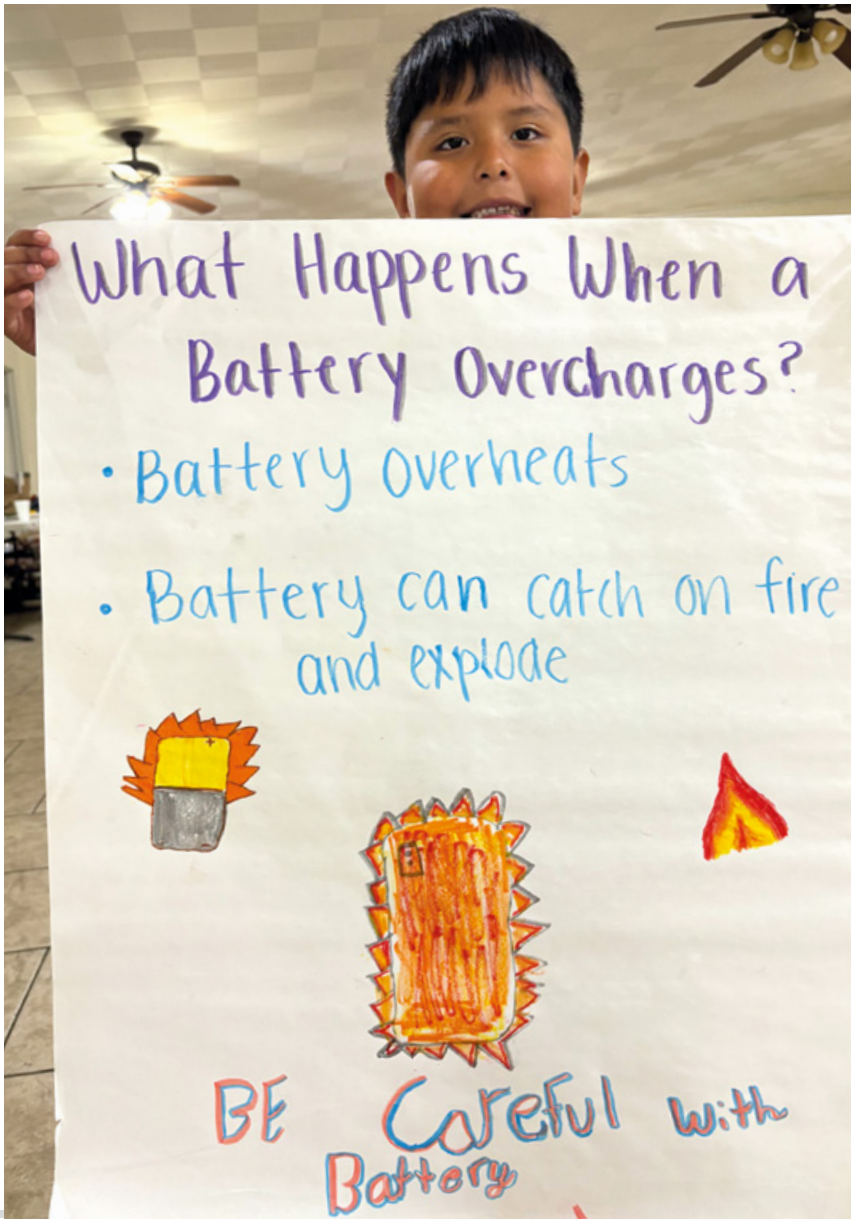


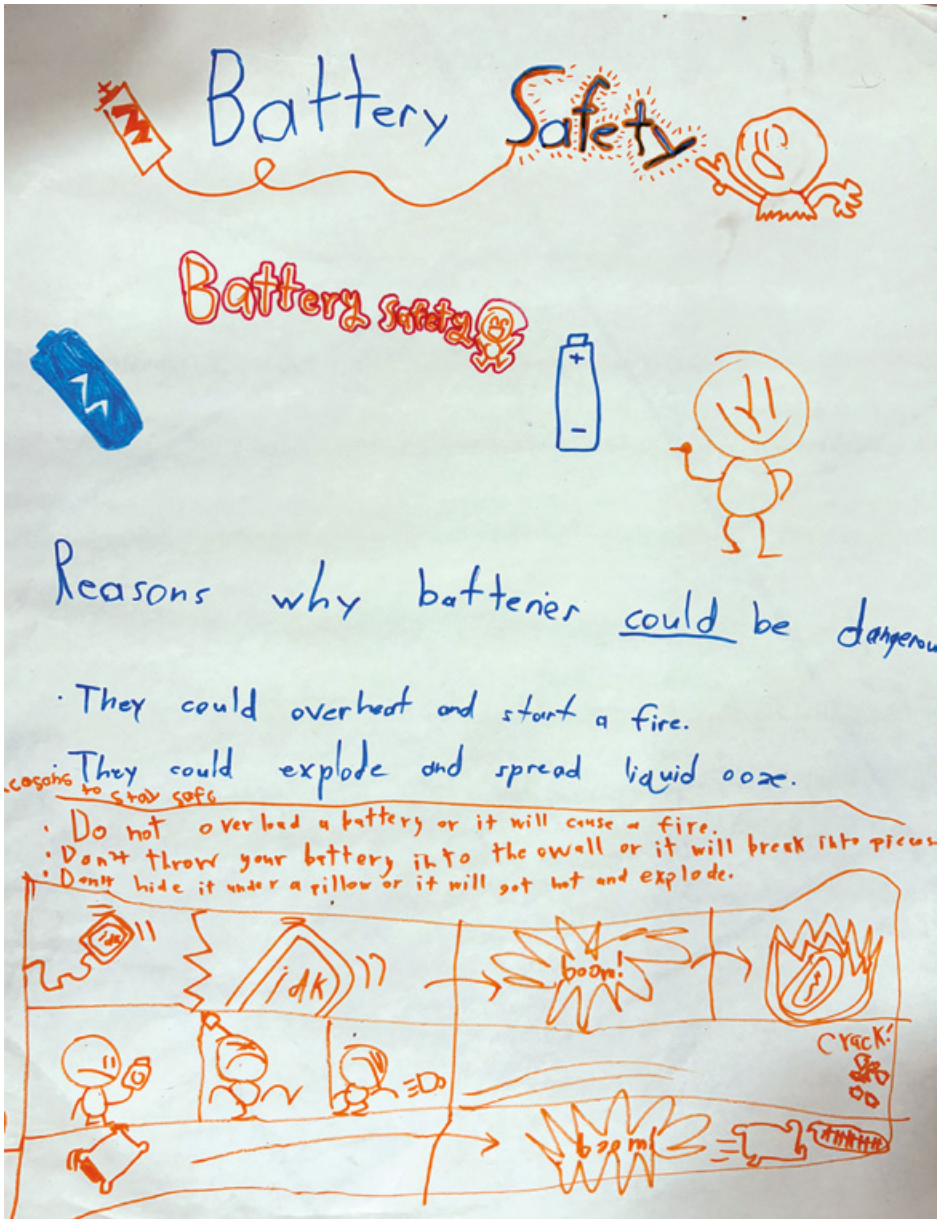
Luis helping learners from the Salud en Balance Youth in Action program learn about battery safety. Children using Xplorlabs' virtual cityscape resource.

Learning and teaching students about lithium-ion batteries

My elementary-age learners from the Salud en Balance Youth in Action program embarked on a journey with me this year, exploring lithium-ion batteries (LIBs) with the help of Xplorlabs' resources. I knew I wanted to focus on a topic that would speak directly to each student's everyday experiences, and these batteries are an incredibly common but often overlooked component of daily life. We began simply — activating students' prior knowledge and having discussions around questions like, "Where do you see batteries in your daily life?" and "What do you know about safely using and disposing of batteries?"

We deepened our exploration using Xplorlabs' virtual cityscape resource. This tool allowed students to visually recognize just how pervasive lithium-ion batteries are in their communities — they are in phones and laptops, and even our solar-powered garden station at school.

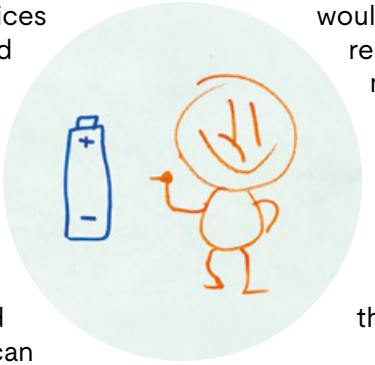




Children's battery safety posters

Discussions grew more profound as students began to recognize not only the benefits of these devices, but also their hidden dangers, such as thermal runaway and environmental contamination due to improper disposal.

We began connecting this foundational knowledge to the real world, starting with safety scenarios that young children would readily understand, such as damaging LIB devices through rough play. We then expanded our discussion to include larger issues, such as how improper electronic disposal, or e-waste, affects local environments like our community garden. Students were surprised and concerned when we linked improper battery disposal to issues such as soil contamination and biodiversity loss — issues that can directly impact the health and sustainability of their communities. It was remarkable to observe them genuinely engage in this content and transition into advocates for their families and communities.



Student engagement and empowerment: insights from the fellowship

Prior to participating in the Xplorlabs Educator Fellowship, I approached teaching in a more traditional way. I was taught that an educator's job is to lead, inform, and more often than not, provide clear answers to students. I was also taught that if students approach learning in a particular way, they will retain information and be successful.

While this can be true, the fellowship has opened my eyes to successfully teaching in different ways, such as action-oriented pedagogy. With some of my students being as young as 6 years old, my first reaction was uncertainty — how would my students react to having more responsibility? Could I trust them to make choices in this way?

One of my biggest "aha" moments this school year was realizing that children can — and should — take active roles in their learning, guiding some of their own inquiry rather than simply following directions.

Not only was this the biggest perspective shift that I experienced as an Xplorlabs Educator Fellow, it was also the most rewarding. It was amazing seeing the participants work together to translate their new awareness of lithium-ion battery issues into tangible action.

Using Xplorlabs' resources, the children created their own safety posters to educate their community members about proper battery use and safe disposal methods. They even designed simple but impactful pamphlets about how to safely operate our community center's photovoltaic garden power stations, demonstrating their understanding of battery technology and their growing commitment to community safety.

Looking ahead: beyond the classroom

In the future, I envision children in the YLA program continuing to engage deeply with safety science and sustainability issues, seeing themselves not only as learners but also as community leaders. Already their enthusiasm has rippled outward, influencing their families' practices around safe battery use and disposal. I am excited to see what they do next.

If you are considering incorporating safety science and sustainability into your classroom, I wholeheartedly recommend that you embrace student agency in the process. You can start small: invite students to identify an issue that they care about in their community. Then, use safety science concepts to explore potential solutions. You may be surprised, as I was, by the insights and motivation that even your youngest learners bring to the table. ■

Our classrooms can be powerful spaces where students take meaningful action for their safety, their communities, and our shared futures if we give them a chance.

A Mission for the Future

By Jaleah Hamilton

High School Student
and 2024-25 Xplorlabs
Youth Fellow

Glendale, Arizona

THROUGHOUT MY ENTIRE LIFE, I have been trying to figure out what I wanted to do to help the world. I have jumped from lawyer to teacher, and everything in between. No matter what the career was, I knew that I wanted to help people in some capacity.

As a high school senior, it's been heavily emphasized over the last three years that I need to find a career before going to college, so I decided to major in psychology to better understand and help people, until I stumbled upon a way to benefit others with an immediate impact.

The beginning of my fellowship journey

As a senior at Glenview College Preparatory High School, I became a tutor to fulfill my community service hours with National Honors Society. When I started tutoring, the class was learning about the risks of lithium-ion batteries. Knowing so much about such a common item in my life made me look forward to tutoring, not only for the kids, but also for myself. One day, I started to wonder how common battery-related house fires really were. I was shocked to find that the answer was a lot higher than I thought. During this time, the teacher I tutored for — Ms. Janet Ankrum, who is also an Xplorlabs Educator Fellow — told me there had been an exceptionally high number of fires in our area alone. This fact really put things into perspective for me because things become a lot more real when they are so close. This was when I realized there actually was something that I could do about it.

Joining the fellowship

Early into the first semester of my senior year, my counselor introduced me to a scholarship called the Build a Better Future Scholarship, which centers on creating a better future for your community. This was my way to help. The next week, I went to Ms. Ankrum and asked her if I could use the things that we were learning in her class for this scholarship opportunity. She agreed with so much enthusiasm, and it made me feel very seen. From then on, I fully immersed myself into this idea of making a difference in this world and it excited me more than I ever would have thought. I started by speaking to the local fire station to see if they could help teach the students I was tutoring about fire safety protocols.

While at the fire station, the firemen gave us a tour and even showed us how they perform their rescues. This solidified everything for me. It all started to feel real at this moment and showed me that I was making real progress toward my goal to help people. After our meeting at the station, Ms. Akrum and I immediately scheduled a meeting for the firefighters to speak to the students.

The more excited I got, the more excited Ms. Ankrum got too, and pretty soon she was asking me to join her and two of the girls in her class for a meeting with the Xplorlabs Educator Fellowship. This meeting was so important to me because it gave me a glimpse into the real impact that was happening in front of me. These educators from all across the country allowed me to voice my opinions so openly and everyone there made me feel so welcome. Meeting with the Xplorlabs Educator Fellows turned out to be one of the most positive experiences I have ever had.

My work so far

This incredible experience with the Xplorlabs Educator Fellows got the ball rolling for me. Ms. Ankrum told me they were doing a battery drive to not only spread awareness of the dangers of lithium-ion batteries, but also to try and help remove that danger from the homes of students. With the help of our school principal, I was able to distribute a flyer that detailed the dangers of batteries, and share information about collection buckets in every classroom for students to turn their batteries in to be properly recycled.

This entire experience has shown me that change starts with me, and I plan to change a lot more in this world.

Find a problem in your community and think of a solution. Solutions start small and grow from there, so do not be afraid that you are not doing enough. Any step toward change is a step toward a better future. ■

Xploring the Safety and Sustainability of Mycelium

By Lauren Hubert

Science and Sustainability Teacher and 2024-25 Xplorlabs Educator Fellow

Phoenix, Arizona

SIMPLY PUT: Being a part of the Xplorlabs Educator Fellowship has improved my classroom.

Not only has Xplorlabs introduced my students to safety science through interesting and fun resources, it has helped me understand the interconnectedness of safety with sustainability. I've been inspired to explore new topics and gained useful information at UL Research Institutes' Annual Research Symposium, and monthly fellowship meetings with my peer educators.

A significant "aha" moment for me was realizing lesson units need to be action-oriented so students connect their learning to having control over their future. When I create new lesson units, I try to include real research, current events, safety, and sustainability so students can see how these aspects work together. Since fall 2023, I've used Xplorlabs resources to create units on the wildland urban interface and megafires as well as material safety testing of mycelium as a green building material.

My role in sustainability

I've been teaching science for 26 years at Camelback High School in Phoenix, Arizona. For the past five years, I've been very interested in sustainability and am currently piloting a project-based sustainability course at my school for dual enrollment credit. As an Xplorlabs Educator Fellow for the past two years, I have learned a lot about safety science and how it supports sustainability.

At first, it was a somewhat difficult connection to wrap my head around. I knew UL Solutions for its work in testing and certifying products for safety, but I had no idea UL Research Institutes tested and promoted safety in many areas including lithium-ion battery safety, fire safety beyond plug-in electronics, and even the safety of new materials.

Attending ULRI's Annual Research Symposium in Chicago in 2023, and in Atlanta in 2024 provided me with an insider's view of the variety of research related to safety science.

In addition to learning more about the work being done by ULRI's researchers and scientists, touring the Cobb County Safety Village in metro Atlanta, where ULRI's Office of Research Experiences & Education will be opening an interactive classroom, helped me better understand how ULRI is bringing safety science into the classroom through Xplorlabs.

In addition, the fellowship meetings online and in person through Arizona State University provided me insights to make my lessons more action-oriented. By creating lesson units that tie together my curriculum with safety science and sustainability, I believe my students are getting a more thorough understanding of the "why" behind what they are learning.

Connecting learning to real life

As my students have been learning about the wildland urban interface, fire safety, material safety, and lithium-ion batteries, they are starting to see the connections between their safety, environmental sustainability, and the impacts on their health.

When my students performed a combustion experiment on mycelium, it wouldn't burn. They had just watched the video "Organic vs. Synthetic Fuels" and expected smoke and flames, but it didn't burn like they expected. To prove it wasn't a trick, I let them burn some cardboard. It burned, smoked, and stank up the room.

This was a great hands-on experience showing the difference between different materials and how safe they are in a fire situation.

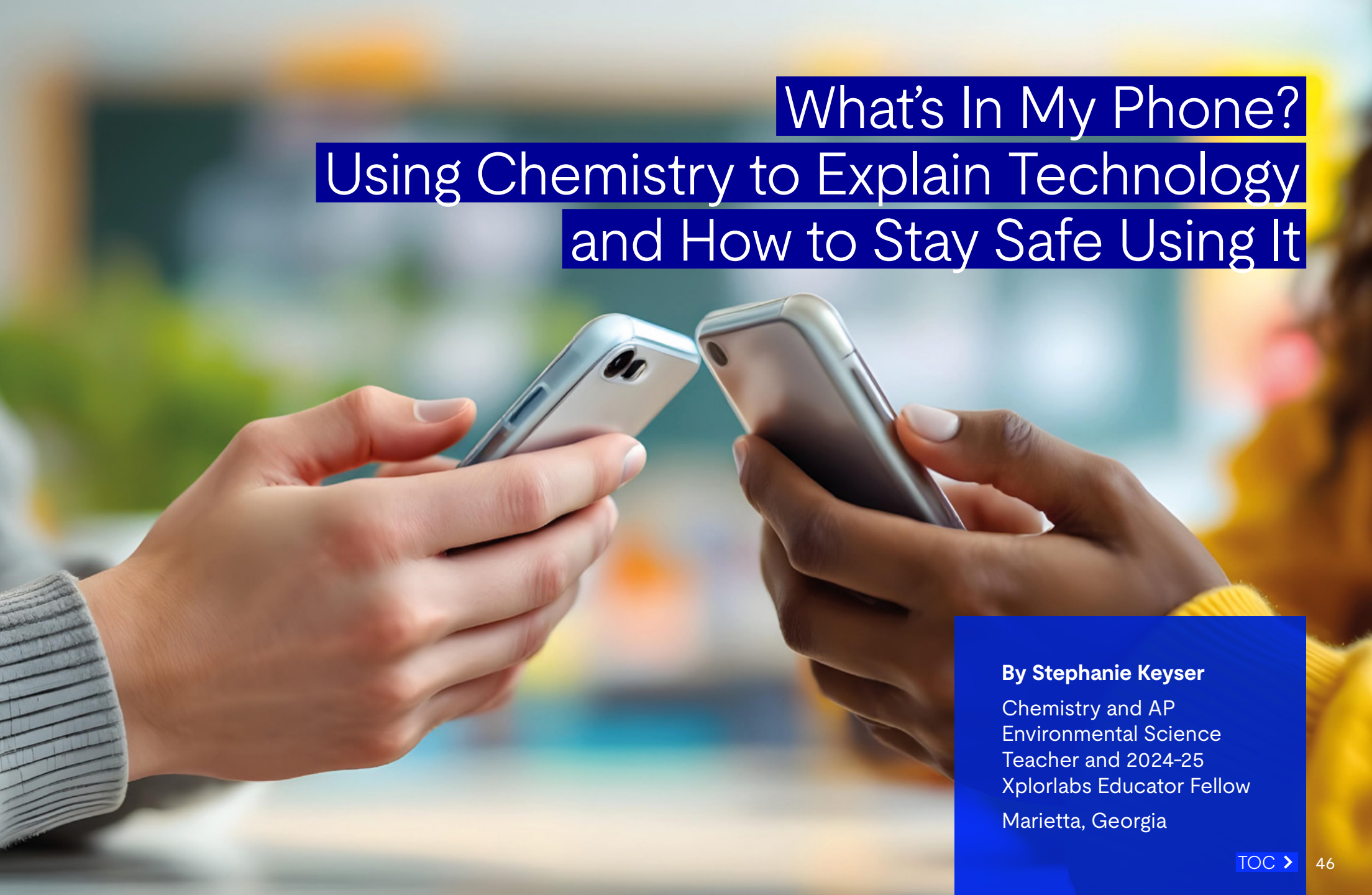
In the future

My teaching has already been impacted by the people I've met through this fellowship, the amazing ideas and resources they've shared, and how I think about sustainability and action-oriented pedagogies. Next year, I plan to create a unit on green energy that incorporates Xplorlabs' resources on lithium-ion battery safety and the impact of mining on the environment. As teachers, we work diligently to cover our curriculum and provide enriching activities.

At the end of each day, do your students actually get the "why" of their daily lesson?

Do they have opportunities to connect the lesson to a future career, a sustainable society, their daily lives, and the actions they can take to make the world a better place? Xplorlabs provides opportunities to help bridge the real-world "why" with your daily lessons. ■

What's In My Phone? Using Chemistry to Explain Technology and How to Stay Safe Using It



By Stephanie Keyser

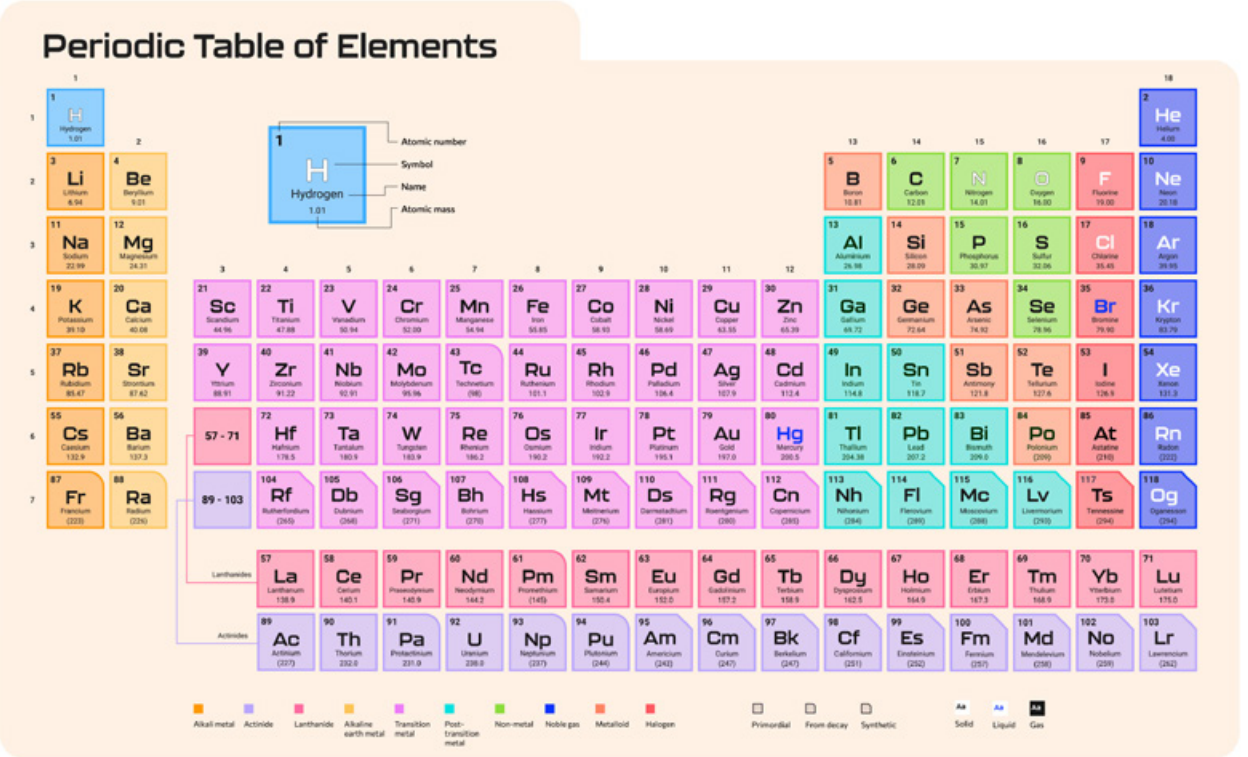
Chemistry and AP Environmental Science Teacher and 2024-25 Xplorlabs Educator Fellow

Marietta, Georgia

Learning about the technology that powers cellphones

Students became completely engaged in learning about the periodic table once I shared that several elements are essential to the technology that powers their phones — the lithium-ion battery. In order to hook students, I used an EpiPen training device with voice commands that are powered by a lithium-ion battery. Then, we discussed what other things may use lithium-ion batteries and attempted to estimate how many lithium-ion batteries exist in the school.

Some products were surprising, like our badges that alert law enforcement and administrators if activated, in addition to ones we all use everyday like cellphones, watches, and listening devices. Through inquiry-based questioning, students explored the difference between metals and nonmetals, interactions of metals and nonmetals, and possible alternatives to the lithium-ion battery all while learning about the periodic table.



Students used a gallery walk to explore different metals and their characteristics. This tangible exploration allowed students the opportunity to make sense of the way the periodic table is arranged. They also learned where metals were mined and the destruction that may have on the environment. Students visited the Tellus Science Museum in Cartersville, Georgia, to see what different metals can be found in our state. Students also learned about mitigation of natural resources and reclamation of the land, possible recycling methods, and where to take used batteries.

During the exploration of metals and nonmetals, we kept returning to the lithium-ion battery, and in the next unit, we learned how ionic compounds were named. The students were taught that ionic compounds have a metal and nonmetal component which helped them make sense of what other materials are needed to complete a battery. Students were asked to solve a problem of finding a possible alternative to the lithium-ion battery if there are other readily available sources.

The widely used lithium-ion battery was a connection my students were able to make to their daily lives. I noticed the increased use of scientific vocabulary and overall engagement through learning about the periodic table and naming of compounds. Assessment scores increased in comparison to previous years, and I credit some of this to bringing real-world phenomena to the classroom.

Thermal energy and safety of lithium-ion batteries

In addition to learning how and why a lithium-ion battery works, I also introduced the safety of using a lithium-ion battery while teaching a thermodynamics unit.

Although students had heard about the dangers of batteries, we were able to further explore why thermal runaway occurs as we learned more about how heat travels as energy transfer. We used Xplorlabs to investigate thermal runaway and the causes. Students were able to take away safety precautions while using the many products powered by batteries. I had never thought to bring the safety science of everyday life into the classroom, but this pathway was a perfect way to get students exploring ways to keep themselves safe in their environment.

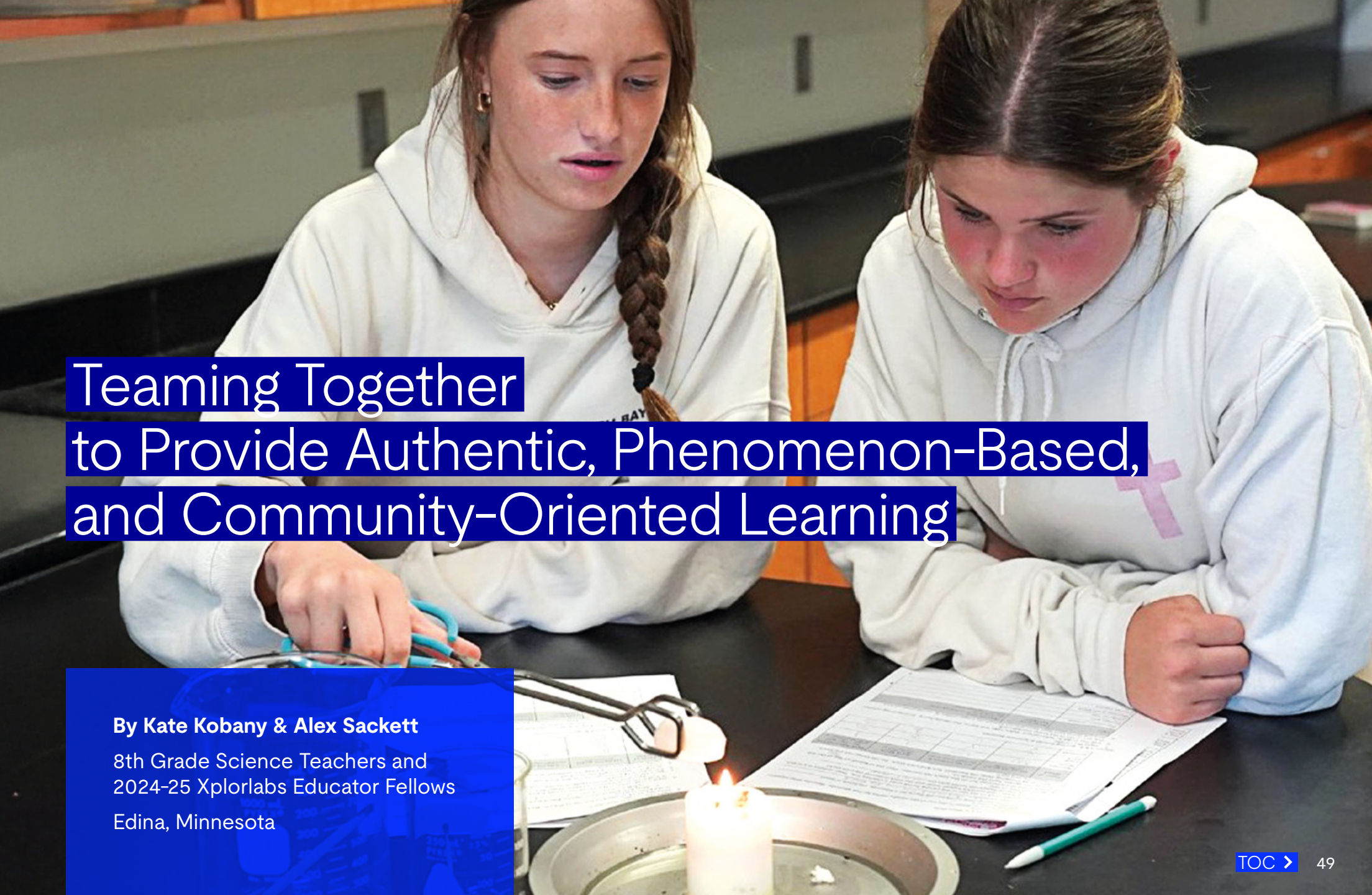
While learning about the phenomena of thermal runaway and fire, students explored what actually burns (gas) and the phase changes that all matter undergoes while exposed to extreme heat.

Pedagogical strategies to use across all curriculums

Lastly, it was such a unique experience to work with other educator fellows from around the country, across different subjects, and in diverse teaching environments. Having input and discussions from multiple viewpoints gave me a lot of perspective on how my students and colleagues think. The different pedagogical methods I found most useful were the gallery walks, authentic real-world explorations, and the different protocols that the facilitators put in place for us to use while discussing experiences.

The real-world explorations of mining techniques, metal explorations, and thermal runaway brought life to my lessons.

I was able to make connections for my students, and they were able to learn content and comfortably use scientific vocabulary because we kept using it daily. They were also able to relate these lessons to things they already knew, so the learning did not feel like such a stretch for them. Students explored taking action within their own homes and communities by making safety posters and helping their families correctly dispose of lithium-ion batteries. ■



Teaming Together to Provide Authentic, Phenomenon-Based, and Community-Oriented Learning

By Kate Kobany & Alex Sackett

8th Grade Science Teachers and
2024-25 Xplorlabs Educator Fellows

Edina, Minnesota

IT WAS THE SUMMER OF 2023, and we had a new principal leading our school. Because we do everything together, our eighth grade science team decided to jointly meet with our new principal. There, the principal told us about an opportunity to partner with our local fire department and teach a unit called fire forensics from Xplorlabs.

The opportunity to teach our state standards in an authentic, phenomenon-based way while partnering with the fire department was incredibly appealing. We couldn't resist bringing this unique learning opportunity to our students.

Within a week, we had our first meeting with Megan O'Keeffe, an Xplorlabs senior education specialist with UL Research Institutes' Office of Research Experiences & Education. We were excited to learn more about the fire forensics pathway and bring it to life. A former eighth grade teacher herself, she shared how the fire forensics resources could challenge students to apply concepts like energy, transformations, heat transfer, and chemical reactions to the real-life work of a fire investigator.

Xplorlabs K-12 Program Manager Becki Rowan also connected us with the local fire department and helped us source materials to bring fire forensics to our students. The fire forensics pathway was authentic, hands-on, and brought real-world safety scenarios to students, and thanks to the Xplorlabs team's support we also brought local fire personnel into our classroom.

Through our work with Xplorlabs and the fire forensics pathway, we have had the pleasure of collaborating with the local Edina Fire Department. This has been a wonderful partnership and marks the first time we've partnered with community members outside of our school and district staff.

The Edina Fire Department's presence has increased the authenticity and fun of the fire forensics experience. Students are able to see how science is a subject that is not confined to the classroom, nor is it something only practiced by doctors and researchers. The fire team is able to share their expertise and personal stories, which has improved student engagement. We are looking forward to our continued friendship and work with the Edina Fire Department in future academic years.

The spring of 2024 was our first time implementing the fire forensics unit with students and immediately, we received lots of positive feedback from students, their families, and firefighters alike. The response was so amazing, our school administration reached out to the other middle schools in our district to help them incorporate Xplorlabs into their eighth grade science classes. The fire department was thrilled to expand the partnership within our school district, and we are excited to see how this program will continue to grow in the future.

Personally, we plan to expand our use of Xplorlabs' materials to include more resources and pathways within our classrooms. Because the fire forensics module hit every mark from authentic learning to phenomenon-based science, community partnership, and hands-on activities, we know other Xplorlabs pathways will benefit students too. During our yearlong educator fellowship, we learned more about Xplorlabs' science of safety and sustainability resources for students.

We chose to use the Extraction to E-Waste pathway with our accelerated students studying Earth science. This unit taught students about the impacts of the battery supply chain on Earth. Much like fire forensics, the work was authentic and engaging. We also invited students to take steps toward sustainability by researching ways to resolve problems associated with the supply chain. In the future, we would like to push students toward action; creating opportunities for kids to not just research solutions to human impacts on Earth but implement them as well.

Our work with Xplorlabs reminds us how important teamwork is in benefiting students and its impact on their learning.

We both feel lucky to work with each other. Our team values innovation — seeking new opportunities for students, and improving learning experiences for our students every year so all students can succeed. We are very grateful to have found our way into the work we have experienced with Xplorlabs. ■

Safer Communities Through Education: My Aspirations for an Arizona Safety Village

By Wendy Landis

Middle School STEM Teacher and
2024-25 Xplorlabs Educator Fellow

Chandler, Arizona

WHEN I BECAME an Xplorlabs Educator Fellow, I never imagined how deeply it would transform my approach to teaching, or the bold vision it would inspire in me for the future. This year, my classroom has become a launching pad for discovery and community action for both me and my students.

Learning from experts and peers in Georgia

One of the richest experiences of the fellowship was attending UL Research Institutes' Annual Research Symposium in 2024. The symposium provided networking opportunities with safety science experts and, most memorably, gave me a chance to explore the Cobb County Safety Village in Marietta, Georgia.

Touring the Safety Village was an eye-opening experience. This is a place where students learn emergency preparedness and safety skills in an immersive environment. The experience showed me the potential of such learning environments to effectively teach young people practical safety skills, but the reality is there are only 23 safety villages in the U.S. Being in that environment myself and hearing testimony from the facilitators, I knew instantly that I wanted to replicate it for my own community.

Image on page 51:
Wendy conducting a lithium-ion battery lesson using Xplorlabs resources with 8th grade STEM students.

Sparking curiosity with AOP and Xplorlabs resources

Inspired by the symposium, I returned home with the intention of building a safety village tailored to the specific needs of my school community. I imagined an interactive space where students and their families could explore fire safety, battery hazards, and sustainability issues in a memorable way. My first step would be getting my students on board!

I chose to begin by exploring lithium-ion batteries with my students because I saw a lot of potential within that topic for students to make connections to their own lives. We began with a simple lesson on thermal runaway, engaging students' knowledge about their everyday lives, and inviting them to list household items powered by these batteries. Their responses surprised even me: Teslas, scooters, gaming consoles, tablets, and vacuums. Immediately, students connected classroom concepts with real-life events, sharing personal anecdotes, and online videos depicting the potential risks associated with batteries.

A simple classroom investigation using batteries and bologna vividly illustrated how stored electrochemical energy inside a battery could be transformed into dangerous amounts of thermal energy. Students dropped a small amount of saline solution onto a lithium primary battery cell that was resting on the bologna. Students observed that after a short time the bologna was chemically altered, discolored, and stuck to the batteries. I really got their attention with this one! Frankly, they were disgusted but the experience was unforgettable! From there, we dove into the inner workings of these devices, discussing how rechargeable lithium-ion batteries, while convenient, can pose fire risks when improperly charged or damaged.

From classroom experiments to Safety Village dreams

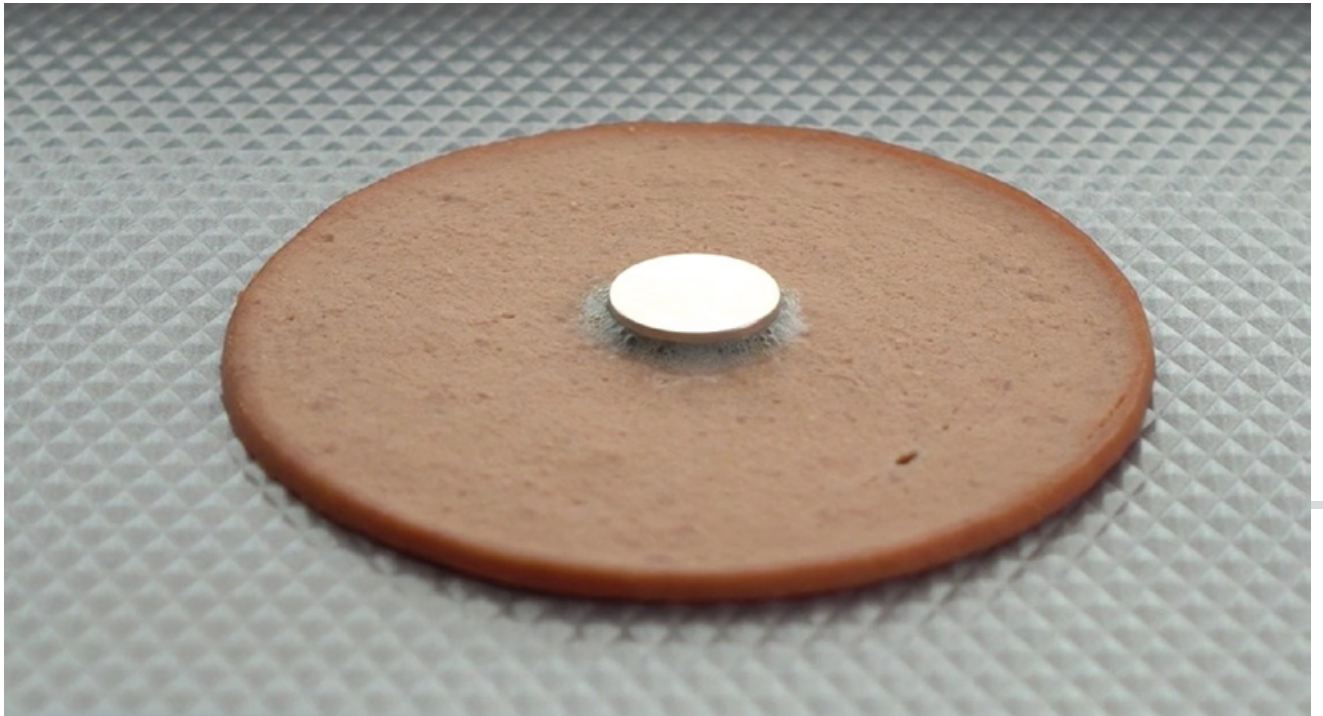
Once I knew students were interested, I began exploring action-oriented pedagogies in earnest, looking for ways to bring my goal of building a safety village to fruition. The student STEM Ambassadors Club and I have been working toward this vision, designing small experiences that will allow young people to explore safety science and sustainability in fun and accessible ways. Since we know a permanent safety village is an incredibly large goal, we're planning to start with a community outreach event called "Fire Safety Town" focused on a single Xplorlabs pathway. During this event, my oldest students will have the opportunity to educate younger students on safety and sustainability practices, facilitate learning experiences, and share their learnings about fire and lithium-ion battery safety. In doing so, I hope my students begin to see themselves as teachers and community leaders in addition to their role as learners.

The path toward establishing our safety village won't be quick or simple, but I'm committed to my vision because I've seen firsthand how incredible such an environment can be. My Xplorlabs Educator Fellowship experiences have shown me that this type of education isn't just about imparting knowledge — it's about empowering students and communities to act on what they learn. Although the fellowship is ending, my work is far from over.

To my fellow educators:

If you are looking for a sign to start pursuing that project you can't stop thinking about, this is it. Start small, but dream big. ■

Together, we can create safer and more resilient communities — one student at a time.



In an Xplorlabs hands-on investigation, students are able to observe energy transformations from a battery.

Safety Science Community Action: Student Voice and Agency

By Jenny Mendoza

High School Senior and 2024-25 Xplorlabs Youth Fellow

Tucson, Arizona

HOW DOES ONE MAKE a difference in their community? Better yet, how can students make a difference in their community? Too often, students don't understand their own capabilities or power to make change. I have had the support of my teacher, Ms. Melany Coates, who has helped expose and connect me to opportunities that have given me confidence to take charge in action projects.

The Xplorlabs Educator Fellowship has opened my eyes to safety science issues, the real applications of community action, and student agency. My hope is through this blog, students can feel empowered learning about safety science and the process of community action, as well as for educators to understand the youth perspective and provide the best support for their students.

Xplorlabs and the discovery of safety science

This year, my journey in community action began with my discovery of safety science. Although many of my past activities have involved STEM and research, the Xplorlabs Educator Fellowship introduced me to real-world safety science issues including fire forensics, e-waste, and thermal runaway.

I myself have experienced the effects of thermal runaway, when my earbuds overcharged and caught on fire! My partner, Ella, and I were shocked to learn about the potential dangers of devices that we use daily, including phones, laptops, tablets, and earbuds. Oftentimes, families use mismatched wires or dispose of old devices in the trash. Various news articles as well as the Xplorlabs resources showed us how damaged, overcharged, and improper disposal of devices can cause dangerous fires and pose great safety risks.

Ultimately, we decided to act on our learning surrounding lithium-ion batteries and spread awareness to our school and community.

Experiencing authentic community action

The process of our community action wasn't easy: it required deep consideration, patience, and collaboration with others. Although I have had previous experiences participating in community action, this safety science project brought a deeper awareness of the many factors to consider when conducting a community project. These factors included finding the relevancy of various issues, determining the feasibility of a project due to limitations like time and legal policies, as well as contacting and communicating with all stakeholders. These are the steps I encountered when conducting this project:

1. BRAINSTORM: One of the first steps in any community project is brainstorming the ways your community can benefit. In our project process, Ella and I considered ideas ranging from the replacement of school Styrofoam for environmentally friendly materials to a collaboration with the Tucson Fire Department for a fire awareness campaign.

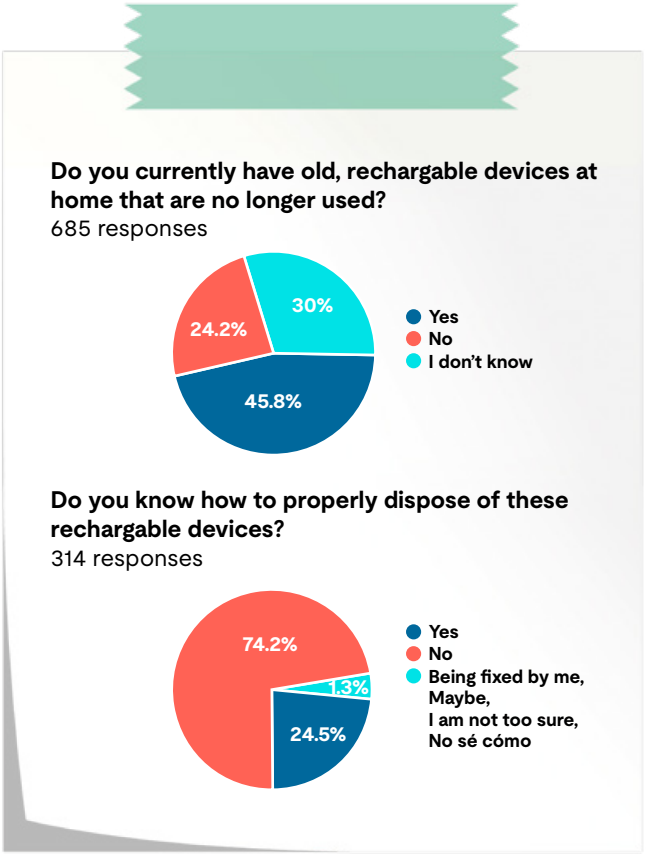
2. RESEARCH: At this point, we needed to research our ideas in several ways. One way was to find which projects were most feasible

given our resources and time. Replacing Styrofoam at our school would require more time for approval by our school board, as well as state and federal associations to affirm the replacement is safe for student use.

We also connected research through a school-wide survey to see if one idea was more relevant in our community. Thanks to the support of our school, we had great data signifying the need for lithium-ion battery awareness and accessible disposal. Ultimately, through the results from our research, as well as our own personal experiences and those of the community, Ella and I decided to conduct a lithium-ion battery awareness campaign and host a battery collection event.

3. TALKING WITH STAKEHOLDERS: One of my biggest takeaways from planning this project was the amount of people I needed to communicate with. To host a collection event meant finding and communicating with the right people who could help us dispose of these batteries properly. As lithium-ion batteries are found in many devices, including our school laptops, we sought the support of our IT department to learn how our school typically disposed of these batteries and if they would be willing to help us.

After many calls to various district and city staff, we looked to our principal for help. We discussed what we were hoping to accomplish with this project, and she helped us find the information we needed. We also worked on a formal proposal which outlined the specific details of our collection and our posters for the social media campaign. Upon our principal's approval, Ella and I spread the news about lithium-ion battery safety and our collection event.



4. EXECUTING THE PLAN: The last step was hosting our collection event. We set up a tent, a table, and a box to collect the devices. Through the support of students, parents, and teachers, we held a successful event that not only provided a place to drop off their devices but learn about the safety risks of lithium-ion batteries.

Many families went home more aware of which chargers they were using with their devices, how damaged devices can be more susceptible to fire, and the dangers of throwing devices in the trash. Within the first five minutes, we were happy to see our first drop off, with as many as six old devices!

Student leaders and action-oriented classrooms

As a senior in high school, this experience has brought two key realizations. One is the necessity of creating a curriculum and environment of real-world action and application in schools. The other is the amount of work and consideration it takes to conduct an action project. Even though my teacher, Ms. Coates, helped to provide me opportunities to take community action through our STEM Club, this project has taught me all the work she has put in with our materials, partnerships, and other resources. Although guides may be helpful for many starting out in their community engagement, students need to be connected to experiences in which they become the sole advocate for change — where they still have support but also have complete agency.

NOW I PRESENT YOU WITH A CHALLENGE:
For students, visit Xplorlabs and implement a project that spreads safety science to your community. For teachers, help your students grow by sharing real-world phenomena that need innovative solutions. ■

Sparking Future Innovators: Safety Science and Sustainable Cities

By Jackie Nichols

STEM and Social Science Teacher and 2024-25 Xplorlabs Educator Fellow

Tucson, Arizona

FROM THE SMARTPHONES, laptops, and tablets in their backpacks to the EVs and scooters parked in their neighborhoods and cities, middle school students are surrounded by technology. But as our world becomes more and more digital, it's critical that young people understand how to use these tools responsibly. That's where topics like thermal runaway, e-waste, and sustainable cities come into play.

Middle school is the perfect time to learn about these important concepts in science, technology, engineering, and STEM classrooms. As a STEM Future City teacher, I work with middle school engineering students to explore ways to design sustainable cities of the future so that we can work together to make the world a better place for us all.

Future City students tackle relevant, real-world problems like sustainable energy systems, multimodal transportation infrastructure, reliable power grids, and, in this year's competition, floating cities that adapt to rising sea levels and climate change.

Let's take a look at how my Xplorlabs Educator Fellowship journey for safety science and sustainability shaped my thinking as well as the way my students think about their world — and their future (cities).

Students as agents for change

Middle schoolers are at an age where they begin to understand complex global issues like climate change. To make informed choices, students need to acquire the knowledge and opportunities for discussion and awareness-building about climate change and to help lead others in discussions.

Early in my journey with the Xplorlabs Educator Fellowship, I took part in a "Turn It Around Flashcard" exchange with fellow educators — a powerful and moving experience. Each of us chose a card that resonated personally, sparking reflection and connection.

These flashcards, created by young artists and writers from around the world, are beautiful and thought provoking. According to Turn It Around, "This deck of flashcards is designed by youth for education policymakers, politicians, and teachers to challenge them to think, see, and act in new ways."

My middle schoolers used the digital version of these cards to launch their discussions about climate change and sustainable city design for the Future City Competition. They were inspired that the flashcards were created by youth to lead change — just like them.

Artwork by Quang, 15, from Vietnam titled "I Am An Agent of Change." part of the Turn It Around! collection.

Sustainable Future City design

In September 2024, I attended a webinar entitled "Future City + Xplorlabs: Two Programs, One Goal" by Future City educator Travis Koupal, an eighth grade science teacher in Minneapolis, who was also an Xplorlabs Educator Fellow from the first cohort. He shared his experience using Xplorlabs alongside the Future City Competition by Discover Engineering, and how it has shaped his teaching. The focus was on batteries and safe cities. Combining insights gained from the webinar along with the Xplorlabs pathways on Thermal Runaway and Extraction to E-Waste helped guide and shape my middle schoolers' future city designs for emergency response infrastructure and circular economies.

In their floating city, my Future City Club students recognized the importance of redundancy and duplication in infrastructure design for emergency response systems.

One example of a city designed by eighth grade students practices duplication and redundancy in its city planning. It prepares for system failures like thermal runaway, with duplications or backup systems of critical infrastructure including:

- Multiple transportation routes, canals, and paths. If one area is blocked, citizens may take a different route
- Microgrids in mixed-use and commercial areas
- Multiple emergency evacuation routes to help people safely leave in case of emergencies
- Duplicate food systems placed around the city in case of disease/failure

A second example is a fictional seasteading community created by seventh grade students that is designed to support living spaces, tourism, and renewable energy. Through Xplorlabs pathways, such as the Science of Thermal Runaway, students creating this city gained valuable knowledge to design safe energy systems and emergency safety infrastructure. ■

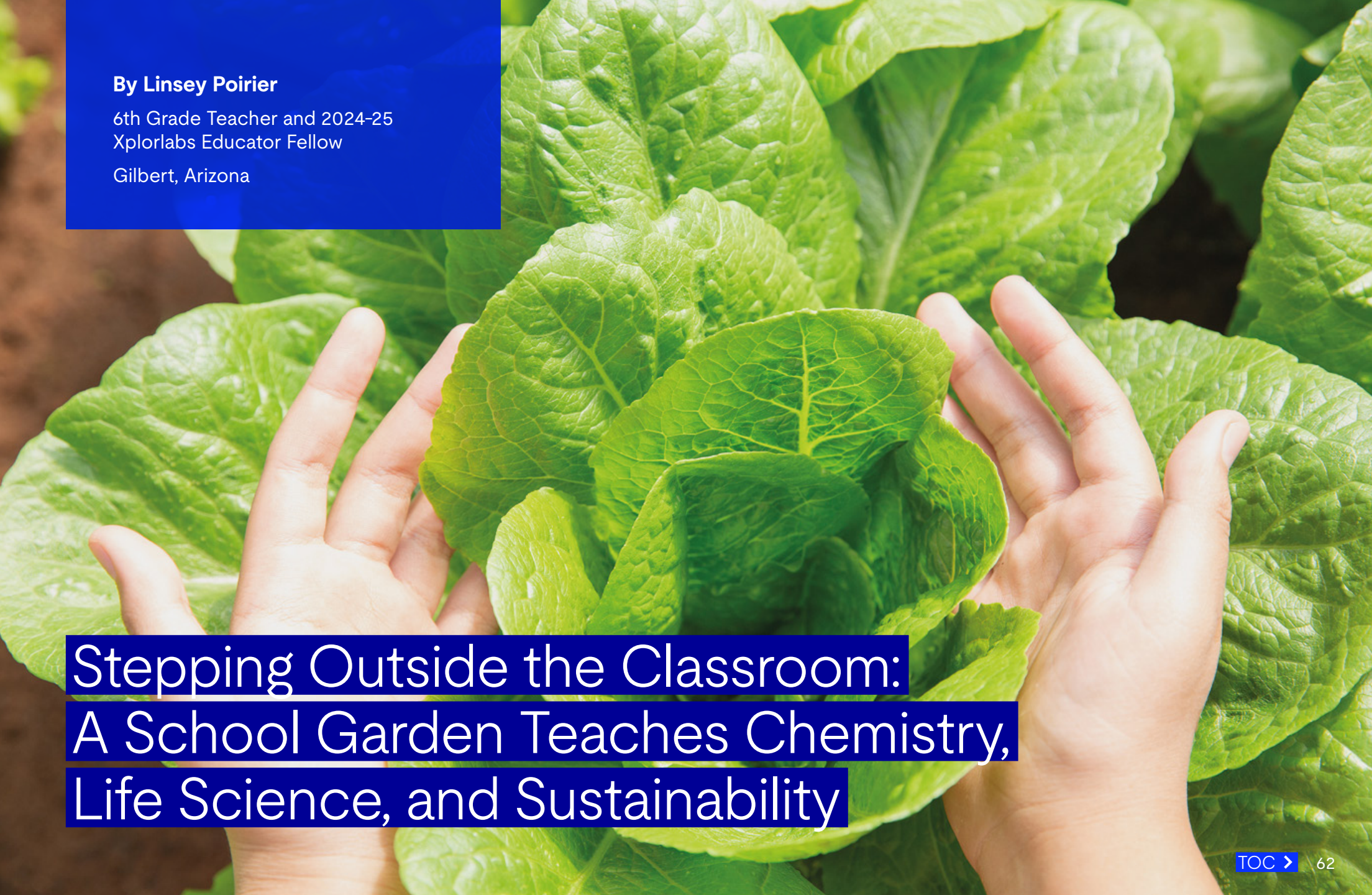
As an educator, you have the power to inspire students to become systems thinkers and creative problem-solvers and to connect classroom learning to real-world challenges.

The students who designed this city described their creation: "Smart grid technology monitors and distributes energy efficiently and safely between sources and users, optimizing efficiency and supporting the health and safety of the community. The use of renewable energy technologies reduces carbon footprint, supports safety science, and promotes sustainable living."

By Linsey Poirier

6th Grade Teacher and 2024-25
Xplorlabs Educator Fellow

Gilbert, Arizona



Stepping Outside the Classroom: A School Garden Teaches Chemistry, Life Science, and Sustainability

EVERY YEAR OF TEACHING is interesting, but this year has been particularly unique and challenging. I have spent the last several years as a gifted education and STEM specialist, rather than a classroom teacher, but I went back to classroom teaching this year. The leap was bigger than I thought it would be, and the relearning curve was steep. I felt out of my element many days, but having my school garden right outside my door made me feel at home.

I have been a huge supporter of school gardens for years, but this fellowship makes me see them in a new, more powerful way.

There are obvious science and math connections within gardening for students, but by incorporating sustainability and action-oriented pedagogies into our school year, our garden became a place that students could have a schoolwide and environmental impact.

Early in the school year, students watched "Kiss The Ground." This environmental documentary taught them the importance of sustainable agriculture. They saw that healthy soil plays an important role in the carbon cycle, and is ideally achieved through sustainable methods. Soil not treated with synthetic fertilizers and pesticides not only produces ideal plants, but also becomes a huge user and holder of carbon. With more healthy soil on the Earth sequestering carbon, less carbon is in the atmosphere acting as a greenhouse gas.

The information from the documentary easily led the students into studying the importance of reducing food waste and using vermiculture and composting as methods to create healthy soil. Students learned that food scraps that go to the landfill make methane, a particularly negative greenhouse gas. Food scraps that get composted or used as vermiculture fuel, get returned into the carbon cycle as a positive source of soil nutrients via worms, insects, and microorganism digestion.

They could essentially take a negative and turn it into a positive, so they did.

Students began by collecting food scraps from fellow sixth graders at lunchtime. The entire grade level had learned about the benefits of composting versus the risks of global warming, and the initial buy-in was strong. Students volunteered to bring large buckets and go table-to-table collecting banana peels, apple cores, and other uneaten items. They all knew not to add excessive dairy or meat, and that cardboard lunch trays were the only acceptable nonfood items. This day-by-day volunteering effort lasted for a few months and resulted in hundreds of pounds of food scraps making their way to our garden compost area, rather than a landfill.

This momentum and excitement for the food waste collection project, however, did not last.

When the slowdown happened, I introduced action-oriented pedagogies to my classroom. We discussed what makes projects work and what roles are needed. These new roles revitalized interest in the project, and students were happy to take on poster making, talking to other grade levels, and scheduling collectors. The food waste continued to flow into the garden — now with other grade levels donating scraps as well.

In mid-October 2024, this project inspired me to reach out to my neighbors via social media to ask for their used pumpkins, carved or not, to compost or use as chicken food. Throughout this process, I became more aware of my own ability to have a small environmental impact and was happy to receive 67 pumpkins in assorted sizes and species.

The pumpkins provided a fairly perfect way to study decomposition with students performing a long-term outdoor lab, learning about controls, dependent and independent variables, and making observations.

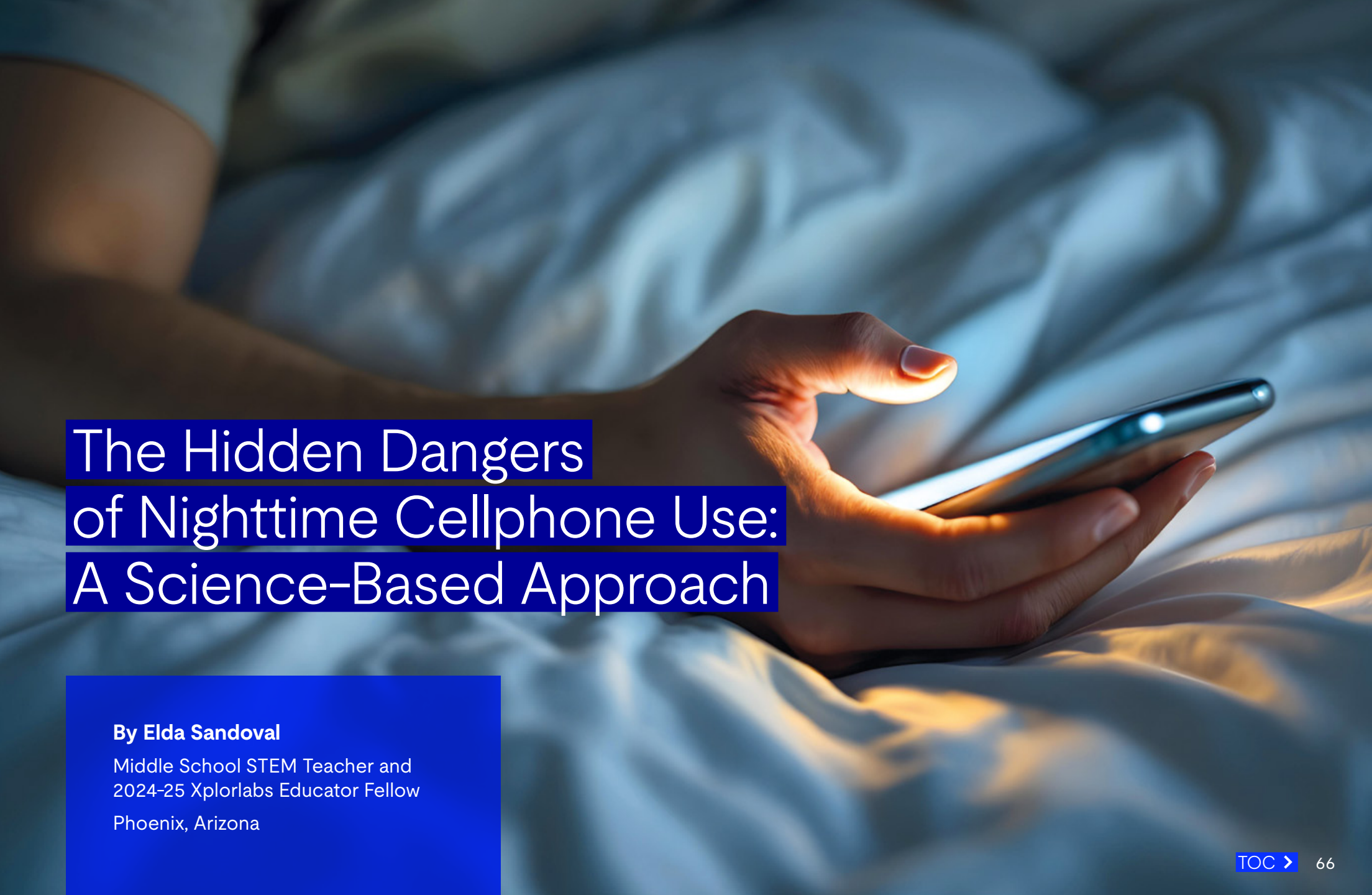
As of April 2025, our first empty garden bed turned compost pile is completely full of pumpkin vines growing straight out of their decomposed sources.

Now, students are excited to see the growth and are hoping we get to see the start of a pumpkin or two before school concludes.

As we wait, one student made the very satisfying observation of "Look at what we turned trash into! It's beautiful!"

Reducing food waste is easy, and school campuses are throwing away thousands of pounds of food. We can do our part at home and elsewhere. We can compost at home and multiply that impact by including students and school cafeterias in the process. Methane can be replaced with oxygen, and students can learn sustainability and the satisfaction of helping their own communities.

Using action-oriented pedagogies whenever valuable, can keep students focused and motivated while providing them a clear path to authentic learning. ■



The Hidden Dangers of Nighttime Cellphone Use: A Science-Based Approach

By Elda Sandoval

Middle School STEM Teacher and
2024-25 Xplorlabs Educator Fellow

Phoenix, Arizona

Transforming learning: how Xplorlabs sets the stage for action-oriented approaches to learning

As an educator passionate about student engagement and real-world applications of science, I am always looking for ways to make learning meaningful. Over the years, I have realized that students learn best when they see the relevance of their education in their daily lives. One of the most pressing issues facing young people today is their relationship with technology, particularly cellphone use.

Through UL Research Institutes' Xplorlabs Educator Fellowship, I discovered innovative ways to address this issue while also teaching about emerging safety science phenomena like thermal runaway. Xplorlabs has provided me with the tools and resources to transform my classroom into an interactive space where students develop a deeper understanding of science, problem-solving, and responsible technology use.

Using Xplorlabs to address cellphone use at night

One of the most common habits among students is using their cellphones at night, often under their pillows or blankets. This not only disrupts their sleep but also presents potential safety hazards due to overheating. To tackle this issue with students in my classroom, I utilized Xplorlabs' Science of Thermal Runaway resources to educate students on the science of battery safety and risks of thermal runaway.

Students engaged in hands-on activities that demonstrated the dangers of excessive heat buildup in lithium-ion batteries. They explored real-world cases where improper charging and overheating led to battery failures and even fires. These lessons helped them understand the physics and chemistry behind thermal runaway, making them more conscious of their own cellphone habits. After completing the unit, many students expressed that they had never considered the safety implications of leaving their devices under blankets while charging. This was a powerful moment of realization, reinforcing the importance of applying scientific knowledge to everyday life.

To further promote responsible cellphone use at night, students worked on projects aimed at educating their peers about safe charging practices. They developed creative posters and short videos, highlighting best practices such as placing phones on a hard surface while charging, using manufacturer-approved chargers, and setting up nighttime charging stations away from flammable materials. Some students created presentations that were shared during school assemblies, ensuring their message reached a broader audience. These projects empowered students to take ownership of their learning and become advocates for safer technology use.

The Science of Thermal Runaway: A real-world phenomenon

Xplorlabs' interactive resources allowed my students to analyze thermal runaway as part of a broader system of energy transfer and chemical reactions. Through the Xplorlabs resources, students gathered information and observed how excessive heat can cause a chain reaction in lithium-ion batteries. By making connections between science and personal experience, students became more engaged and motivated to adopt safer practices with their devices.

To deepen their learning, we conducted experiments using thermal gloves to simulate cellphone heat when used under pillows and also to observe heat patterns in charging devices. This visual representation helped students grasp the concept of heat buildup and the importance of proper ventilation when using electronic devices. Many of them went home

and spoke to their parents about safe use of lithium-ion battery powered devices. Seeing their work extend beyond the classroom reinforced the value of action-oriented learning.

I also designed a middle school project to help students better understand how excessive heat could potentially lead to thermal runaway risks. Using hand warmers as a heat source, students wrapped them in various materials such as cotton, aluminum foil, and plastic wrap. Then, they made observations about differences in heat retention by measuring temperature changes over time and using infrared thermometers to track heat distribution. This investigation allowed them to visualize how heat can become trapped, much like it does when a cellphone is left under a blanket or pillow while charging. The students then translated their findings into practical recommendations — creating posters and videos that provided peers with actionable steps for safer cellphone use at night. By combining scientific exploration with community outreach, they not only deepened their understanding of thermal runaway but also took initiative in promoting responsible technology habits among their classmates.

Integrating systems thinking and student-led research

One of the strengths of Xplorlabs is its emphasis on systems thinking — helping students see how individual components connect within a larger network. I encouraged my students to apply this approach by researching the life cycle of a lithium-ion battery, from raw material extraction to disposal. They created story maps using ArcGIS to visualize the environmental impact of battery production and e-waste. Some students chose to focus on the recycling process, while others examined sustainable alternatives to lithium-ion batteries.

As part of this research-driven approach, students also created educational videos about safe cellphone use at night, incorporating their findings on thermal runaway and battery safety. These videos served as engaging resources that were shared with peers, parents, and even local community groups. By producing content designed to inform and persuade others, students not only reinforced their own learning but also contributed to a broader awareness campaign.

This student-led initiative demonstrated how research and multimedia projects can be powerful tools for inspiring change and promoting responsible technology habits. Their student-led research fostered critical thinking and problem-solving skills, giving them a sense of ownership over their learning.

Moving toward solutions: action-oriented pedagogies

A key takeaway from my experience with Xplorlabs is the importance of shifting from problem identification to solution-based learning. Instead of simply teaching students about the risks of lithium-ion batteries, I guided them in exploring real-world solutions. They brainstormed practical steps, such as using designated charging stations, educating their families about safe charging practices, and advocating for school policies that promote responsible technology use.

Additionally, we explored broader environmental and ethical concerns related to cellphone production and disposal. Students engaged in discussions about sustainable tech design, responsible consumer habits, and policies that could improve battery safety standards. These conversations empowered them to think critically about their role as consumers and future problem-solvers.

A lasting impact on STEM education

Through my journey with Xplorlabs, I have gained valuable insights into making science education more engaging and impactful. The combination of hands-on investigations, real-world applications, and student-driven projects transformed my classroom into a space where learning is dynamic and meaningful. By connecting science to everyday experiences like cellphone usage, students develop a deeper appreciation for STEM and its role in shaping their lives.

As I continue implementing these strategies, I am excited to see how future students will apply their knowledge to new challenges. Whether in Earth and space science, environmental studies, or any STEM field, Xplorlabs provides invaluable resources to support educators in fostering curiosity, critical thinking, and action-oriented learning. ■

I look forward to continuing this journey and inspiring the next generation of scientists, innovators, and responsible digital citizens.

More than Just Science: Came for the Science, Gained a New Perspective

By Nancy Schunke

Pre-AP Chemistry and Engineering Teacher and 2024-25 Xplorlabs Educator Fellow

Wolfforth, Texas

AS I SCROLLED through the conference schedule, several sessions immediately caught my attention, and questions started flashing through my mind:

"What is Xplorlabs about? Would my students find learning about lithium-ion batteries as interesting as I do? Oh, they're going to love the fire chemistry, right?"

I knew I had to check it out. Over the course of the conference, I attended three sessions led by the Xplorlabs team and I was genuinely impressed. The topics were not only exciting and engaging, but I could instantly see how relevant they would be for my students. After the conference, I began integrating elements of Xplorlabs in my classroom and the response from my students was overwhelmingly positive.

Exploring safety science in the classroom:

Xplorlabs uses safety science, lithium-ion battery education, and fire chemistry to help connect students to exciting career opportunities

When I found the opportunity to apply for the Xplorlabs Educator Fellowship, I did not hesitate to submit an application. Going into the Xplorlabs fellowship, my goals were centered on deepening my understanding of the science behind safety, particularly the chemistry and engineering elements that drive innovation in the safety science field. I was eager to enhance my teaching toolkit with engaging, research-based lessons that could spark curiosity in my students.

I was also interested in expanding how I teach engineering. While robotics tends to dominate the K-12 engineering space, I've found that many students, especially those interested in fields beyond mechanical engineering, are looking for other entry points. I felt the exploration of safety science research and problem-solving would help students, especially young women, see themselves as scientists and engineers.

The Xplorlabs Educator Fellowship exceeded those expectations. Not only did I gain valuable insight into complex topics like lithium-ion battery chemistry, fire dynamics, and the development of more effective solar panels, but I also had the opportunity to explore how real-world safety science research translates into action, showing my students how engineers and scientists are using this research to improve, and even save, lives.

Aha! moments and powerful conversations:

Redefining science education through unique student-centered pedagogy

At our first in-person workshop with the fellowship, I realized this experience was something truly different. Yes, we dove into science, learning about lithium-ion batteries, how fire behavior has evolved over time, and experiencing cutting-edge research in safety science.

What caught me by surprise was the emphasis on pedagogy. The fellowship didn't just present content; it challenged us to think deeply about how we teach. We explored action-oriented teaching practices, shared perspectives, and even spent time imagining preferred futures for our students and our world. That was powerful.

In schools, we often talk about culture, about meeting students where they are. But how often do we ask them where they want to be in our shared future on this planet? Do we truly see them as passionate, concerned citizens? Are we connecting the science they're learning to how they might use it to make that future better? These were the kinds of challenges we wrestled with together.

Collaboration was at the heart of the experience. Working alongside other passionate educators, we exchanged ideas, shared classroom strategies, and supported one another in thinking beyond standards and testing. The conversations were thoughtful, inspiring, and grounded in the shared belief that science education can and should empower students to shape the world they will inherit. By doing this, they not only learn the science, they utilize it to help educate others and shape change — evidence that will go far beyond a standardized test.

The work doesn't end here. Give your students a role in shaping their future.

The experience doesn't end with the close of the fellowship. In many ways, it's just the beginning. My students' projects continue to evolve, and I'm committed to finding new ways to plant seeds of change and relevance in their learning, helping them connect even the most challenging science concepts to real-world problems and meaningful action. We are currently laying the groundwork for more conversations about sustainability and dealing with e-waste in our community.

What I have started to notice is that this is the kind of teaching that stays with students. It's not just about mastering content, it's about becoming informed, empowered individuals who know they have a role in shaping their future. And for me as an educator, it is so exciting to witness. While there's still a long road ahead, the level of engagement I've seen gives me hope. This generation is more than capable. They're motivated, thoughtful, and ready to make an impact.

As educators, it's our job to guide that energy and show them that science isn't just something we learn — it's something we use to make the world better.

This fellowship reshaped not just my lessons, but my mindset. It reminded me that science education should empower, challenge, and connect. If you're even a little curious about how safety science can transform your classroom, I encourage you to visit Xplorlabs.org and explore the resources firsthand. Whether it's the fire safety pathway, the lithium-ion battery lessons, or the eye-opening exploration of e-waste, there's something there that will spark curiosity.

Try one lesson. Just one. See how your students respond when science becomes personal, purposeful, and tied to the real world. You might be surprised by the conversations it starts and the solutions they begin to imagine. ■

Waking Up Tired Curriculum and Igniting the High School Brain

By Terri Sowa-Imbo

High School Chemistry Teacher and 2024-25 Xplorlabs Educator Fellow

Evanston, Illinois

IMAGINE THIS: I am meeting with fellow baseball parents in the town where I work and live. After the obligatory conversation about the weather, the small talk turns to jobs and I brace myself for the responses when it's my turn to share that I'm a high school chemistry teacher.

As usual, this announcement is met with bleak faces and comments like: "I hated that class," "I can't really remember anything I learned," and my all-time favorite, "Glad I never had to take it!" I respond with "you just didn't have the right teacher." I start thinking about how important it is for everyone to have a basic understanding of chemistry. At that moment, I make a promise to myself to change up my curriculum and assessments to meet the needs of 21st century learners.

Ignition: changing curriculum requires energy

A fire only ignites when enough energy is present to cause a change — or in my case — a perfectly timed email arriving in my crowded inbox promoting an Xplorlabs professional development workshop on The Science of Fire Forensics. Little did I know that this invitation would open so many doors and ignite a passion in me that I could transfer to my students. I knew embarking on a change to my resources would require energy to recreate lessons, objectives, and assessments that aligned with Next Generation Science Standards. I knew it had to directly connect with the students in my classroom. I knew I wanted the learning to stay with students beyond the test. I knew I was looking for a curriculum that could spiral throughout various units as opposed to just tested and forgotten.

The Xplorlabs workshop was the perfect starting point to ignite my curiosity. I learned alongside other educators as we experienced the pathway like we were students. The presenters from UL Research Institutes' Office of Research Experiences & Education guided us through the various resources, provided a hands-on investigation, processed each activity, and facilitated assess-

Student projects: fire safety campaigns for community groups, including a guidebook, elder care history, and family tips.

ment creation. We had opportunities to share our ideas of how fire works, carry out a heat transfer investigation, revise our models, and plan immediate connections with our current curriculum. This was the spark I needed to envision a different chemistry experience for my students.

Growth: fueling ideas, fellowship, and futures

Once a spark starts a fire, it requires a continuous fuel to stay alive. I quickly signed up for the next professional development session on the Science of Extraction to E-Waste and found myself completing the application to become an Xplorlabs Educator Fellow. The fellowship was exactly what was needed to keep the fire burning. It provided access and learning about all that Xplorlabs has to offer. There were materials, resources, and conversations to fuel ideas and connections to my curriculum. At UL Research Institutes' Annual Research Symposium, we had the opportunity to meet with researchers working daily on the same real-world safety scenarios that Xplorlabs brings into the classroom.

More important than the resources and ideas, the sustained growth I experienced during this yearlong fellowship can be attributed to the collaboration with 27 other educator fellows and the OREE staff from across the country, all equally passionate about science, safety, and STEM education. Whether in person or virtually — we share ideas, understand how the resources would be received differently with our unique population of students, celebrate victories small and large, and reflect on what works and what needs revision. We crowdsourced ideas, shared current events, and moved beyond our "teacher/school bubble" to remember there are many different ways to "do" school and engage young people in their academic journey.

The future of our society is dependent on what students do with the information they learn. The comments from the other parents at the baseball game lingered in my thoughts. Shaping better, more informed futures is why I became an educator in the first place. The idea of safety science and learning through the Xplorlabs pathways was enticing. The introduction to action-oriented pedagogy, which means taking the learning to the next level and demonstrating what you can do now that you know more, through the fellowship was the bridge I needed to embrace the curriculum shift.

Full development: using fire to ignite the high school brain

A unit has to be interesting to separate a teenager from their cellular devices and engage them in learning. Fire is the perfect ignition point in a chemistry class. Insert Xplorlabs' Science of Fire Forensics to start the school year. Students can connect to the online resources to build meaning through videos, interactives, and skill development. Supplemental resources for the pathway included hands-on investigations, material from the fellows summit and research symposium, and "traditional" labs completed in previous years to explain how a fire burns. Students concluded the unit with understanding thermal energy transfer and true collaboration to use a bow drill to start a fire without a heat source. Their full explosion of knowledge came in the form of an action-oriented project to share their fire knowledge and safety insights with their community.

Where is your match?

As educators, we are all familiar with the popular quote by William Butler Yeats:

"Education is not
the filling of a pail,
but the lighting of a fire."

Light the fire. Both the metaphorical fire inside of you as an educator to engage young minds in the present and future realities of science and education, as well as the physical fire — because what we see, we can understand; and what we understand, we can share! Start by exploring the materials already curated by Xplorlabs. You can work at a slow and steady burn, or throw caution to the wind and set your current curriculum ablaze to tie outcomes to the future rather than the ashes of the past. Students will connect with their community and see that flame grow with interest, confidence, and sense of connectedness to the content. ■

Transforming Learning: How Xplorlabs Sets the Stage for Action-Oriented Approaches to Learning

By Cody Yeakel

Earth and Space Science Teacher and 2024-25 Xplorlabs Educator Fellow

Surprise, Arizona

AS A SECONDARY science teacher, my goal is to inspire student interest in the topics and issues that will shape our planet and our future in an ever-changing global society. I want them to leave prepared with the skills they need to be future scientists, researchers, and leaders.

After spending more than 10 years as a teacher in a science classroom, there are two things that stand at the forefront of my mind. First, that engagement is the key to successful outcomes. Second, that students need meaningful opportunities to engage in critical thinking tasks about real-world phenomena to reach their highest potential.

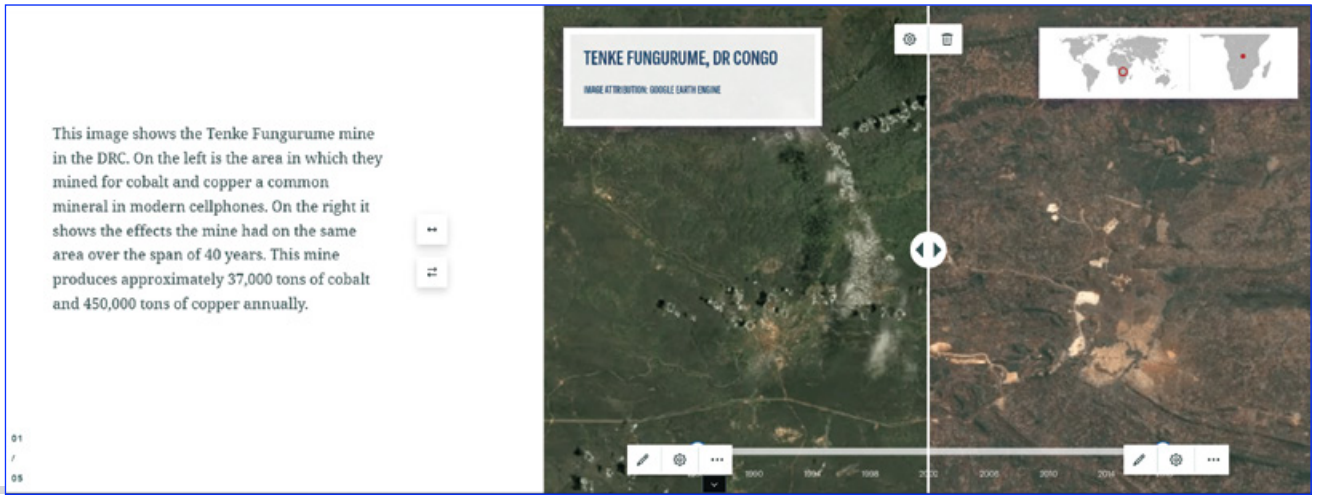
The Xplorlabs Educator Fellowship has provided me with resources and allowed me to refine my skills to accomplish both of these things. I have utilized the fellowship to help make my classroom a place where students understand complex problems on a deeper level, and are challenged to use creative thinking to solve them.

A systems-thinking approach to secondary science

The world we live in and experience is full of complex systems. We tend to view these things as singular events or objects and not individual parts of a complex system. For example, cellphones, which are so significant in our students' lives. Likely, students don't think about the dozens of unique metals that make up these devices, where those metals come from, or the impacts of extracting and disposing of cellphones often.

This is one of the many situations where an Xplorlabs resource can help students understand how something works — for example, The Science of Extraction to E-Waste. In this pathway, students are introduced to the complex system of the battery supply chain. Students are engaged by the various maps, data, images, and stories about the journey the lithium-ion battery, a critical piece of many of our favorite electronic items, takes from its creation to its disposal. The pathway can then set the stage for further action-oriented projects where students take the lead on gaining a deeper understanding of the big picture and identifying leverage actions they can take to be part of a solution.

Throughout this class unit, my students completed interactive activities on Xplorlabs to model overuse of resources, analyzed local examples as case studies specific to the battery supply chain, and used their deeper understanding to create an ArcGIS story map about a part of the extraction to e-waste system that resonates most closely with them.



A snapshot of a student story map using a time-lapse from Xplorlabs: The Science of Extraction to E-Waste pathway. The reader can swipe the image to see the changes the mine had on the land.

Space and place: Giving students a deeper understanding of the connections between science, environment, and society

With a degree and background in geography, maps and spatial data education have always been very important to me. I believe maps, data, and geographic information systems can empower students with valuable STEM skills, problem-solving abilities, and the critical thinking necessary to take on the challenges of the present and future.

My goal, which turned into one of the highlights of my school year, was teaching students to use ArcGIS and having students create story maps with the software about a chosen topic from the extraction to e-waste pathway. It was inspiring to see the different directions students took with the project, as they had a choice in what they wanted to focus on.

Some students focused on visualizing the entire process of the battery supply chain through maps, while others focused on the environmental impacts of mine sites or success stories about the environmental remediation of the sites. Some students even created a map of e-waste recycling centers closest to our high school with information and helpful links. This work led some students to create additional maps and enter a statewide story map contest held by the Arizona Geographic Information Council. It was very encouraging and motivating to see students so interested in the topic with the desire to do more.

A map image from a student story map highlighting the distribution of leading mineral producers around the world.

Action-oriented pedagogies for higher-level learning

One of my biggest takeaways throughout the fellowship was moving from a problem-oriented approach to solution-oriented approach to teaching. I wanted my students to have as many opportunities as possible to engage in real science. I have a class set of air sensors that I used to collect air quality data with students. We could then take that data, identify patterns and trends, and use it in meaningful ways.

One of my goals for the fellowship was for students to contribute that collected data through citizen-science initiatives. The Arizona Department of Environmental Quality has a program where students can submit local air quality data from their school sites. In addition, being located in the Phoenix metro area, heat is an area of focus for us. Looking at the hyperlocal heating of surfaces on our own campus was a great way to introduce students to the urban heat island effect. We could then use our data to develop potential solutions such as installing more shade structures or replacing paved surfaces with natural materials on our campus. These opportunities engage students in real science and lead to the brainstorming and development of solutions that will make a difference right in our own backyard.

An ongoing journey

After a year in the Xplorlabs Educator Fellowship, I feel more confident and equipped to implement the types of lessons in my classroom that will help students reach their highest potential as future scientists, decision-makers, and leaders. Whether you teach Earth and space science, or any other STEM field, Xplorlabs has numerous helpful resources to engage students and provides opportunities to collaborate with others and make your classroom a place where students will be engaged and become stronger critical thinkers and problem-solvers. The resources and strategies I have gained will be something I can take with me as I continue my career as a STEM educator. ■

Make your classroom a place where students become stronger critical thinkers and problem-solvers.

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Learn more at
Xplorlabs.org/Fellowship

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