

## CASE STUDY: CELF CIVIC SCIENCE

# Harmony School of Fine Arts & Technology Houston, Texas

Leveraging STEM Skills to Investigate  
Indoor and Outdoor Air Quality in School



CELF's Civic Science Program is made possible in part with the support of the National Geographic Society, Linde PLC, & the San Diego Foundation.



*Harmony School of Fine Arts and Technology campus in Houston, Texas.*

## BACKGROUND

Patty Kulow is a science teacher at the Harmony School of Fine Arts and Technology in Houston, Texas. "I became a teacher to make a difference," says Ms. Kulow. "I want to model and influence my students to love and respect our environment and community. It is important for me to bring awareness of sustainability so students will be equipped with skills they need to make good choices for their future as adults." So when Ms. Kulow's principal sent her an email about CELF's Civic Science Inquiry to Action program, she immediately applied.

"I was attracted to the CELF Civic Science Program because of my passion to help the environment and teach sustainability to my students. I am very thankful and appreciative of this experience."

As a new teacher and environmental steward, Mrs. Kulow is eager to learn the best practices and new ways to bring environmental awareness into the classroom.

The Harmony School campus is situated in an industrial area and at times, the air may smell like chemicals or car exhaust. Ms. Kulow and her students felt it was important to find out whether or not the pollution levels are hazardous to our students' health. Using the Plume Labs Flow device, Ms. Kulow and her students collected air quality data and discovered that there are short periods of time when fine particulate matter (PM 2.5) was very high. Particulate matter is an air pollutant that has been linked to health issues like asthma and decreased lung function.



The Harmony School is a K-8 Charter school focused on Science, Technology, Math and Engineering (STEM). The school's instructional approach provides a rigorous, challenging curriculum that focuses on formative assessment, and creating a culture of high expectations and support. The school values Project Based Learning (PBL) and has a department that supports teachers with PBL ideas and recommendations. "Our students, parents, and staff work in harmony to create a strong community of success," says Ms. Kulow. "We guide our students to value integrity, show respect, and be responsible. Every student graduates with a strong understanding and appreciation of STEM and how it connects to the real world."

## Air Quality Civic Science at Harmony School of Fine Arts and Technology

The COVID pandemic created unexpected challenges to conducting a place-based experience. “We had a couple of obstacles to overcome during our project,” says Ms. Kulow. “I was sensitive to the fact that the students sat behind a screen all day. In addition to experiencing a global pandemic, Winter Storm Uri delayed the shipment of our air monitoring instrument and our campus was closed for a week. It took some time to learn the ins and outs of the instrument, specifically how to download the data.”

Ms. Kulow worried about the added time students would spend online. To engage students who were working remotely, Ms. Kulow used a variety of online tools:

- Live Nearpod lessons online
- Direct verbal communication
- Shared access to a Google Slide presentation.

“I used interactive Nearpod lessons to teach the students about air pollution and the four air pollutant indicators picked up by the Plume Labs Flow air quality monitor. The students learned how to use the air monitoring instrument and interpret the data.”

“During the month of March 2021, Ms. Kulow collected the outdoor morning air readings

before entering the school. She kept the air quality monitor on her desk during the day to collect indoor air readings and brought the instrument outside during afternoon recess.

My students noticed a spike in numbers when someone used hand sanitizer or cleaning wipes in the classroom. There were also spikes outside during lunch/recess time when eighteen-wheelers passed by our school. The data for the morning outside air readings stayed fairly consistent with little to no spikes in the data.”

After the students understood the data, they worked on a Google Spreadsheet to analyze and present their findings. Ms. Kulow’s split the students into three smaller groups, each assigned a different data set:

- One group organized and analyzed the indoor air quality
- Another group looked at the morning outdoor air quality
- The third group tackled lunchtime and recess outdoor air quality.

Throughout the process students were able to see each other’s work and discuss their findings. Students also practiced presenting their slides and research to each other.



*Left: A student demonstrates a color-coded air quality reading on the Flow device.*

*Right: An outdoor playing field and its surroundings at the Harmony School of Fine Arts and Technology.*

## Performance indicators and Outcomes

To measure the success of the project, Ms. Kulow defined three performance indicators:

- Students gained a better **understanding of air pollution** and what causes indoor and outdoor air pollution.
- Students learned **technology skills** such as analyzing data, working with Google Sheets, and making a Google Slide presentation.
- Students improved the character values: accountability, responsibility, effective communicator and team player.

These metrics determined how successful the project was at creating an engaging learning experience.

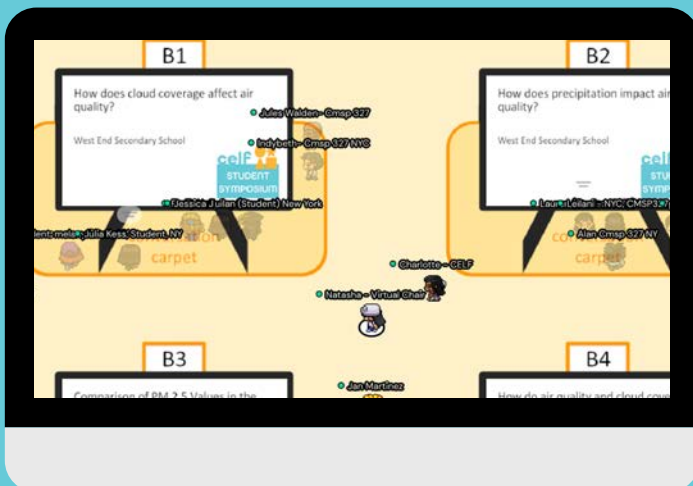
The students participating in Ms. Kulow's 2021 air quality research identified the following project outcomes:

- We have an air quality issue outside our campus during the noon time frame.
- The use of chemicals and hand sanitizer does impact our indoor air quality.
- The levels of air pollution in the early morning times do not seem to be a serious health concern.

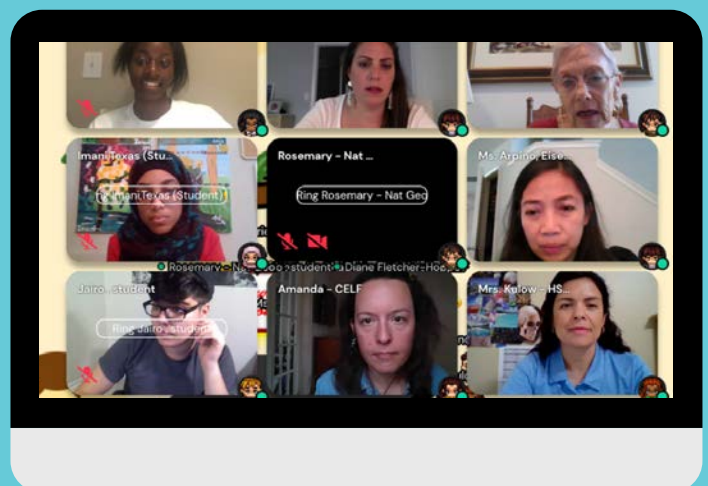
In May 2021, Ms. Kulow's students presented their research to teachers, school administrators, fellow students and policy makers from across the country at the **CELF Virtual Student Symposium**. The Symposium was hosted on the Gather platform, a fully customizable interactive space with an intuitive game-like interface.

To help her students prepare for the symposium, Ms. Kulow created for them a custom Gather space with games and interactive videos to experience and explore. "Since CELF used Gather for the Student Symposium it was helpful that my students were familiar with how to navigate the space during the symposium," remarked Ms. Kulow.

Other teachers participating in the CELF Civic Science program discovered the creative ways that Ms. Kulow had introduced her students to Gather and asked her to schedule training sessions. These teachers met with Ms. Kulow regularly on Monday evenings to discuss ways to incorporate Gather into their current lessons.



*Using the Gather platform, students, teachers and policy makers navigated a virtual poster session using playful avatars. On view was work by students from around the country.*



*Approaching any poster would open a live video discussion, in which students presented their findings. Ms. Kulow and two of her students are included in the picture above.*

## Morning Outdoor Air Quality

**Driving Question:** What are the pollution levels at our campus in the morning?



### Student Takeaway:

There are multiple institutions around our school that could be affecting our air quality. Based on our data, the air quality in the morning is good. We can conclude from the lunch outdoor air quality data that pollution levels outside of our campus spike later in the day.

### Our Interpretation of Data:



### Presented by:

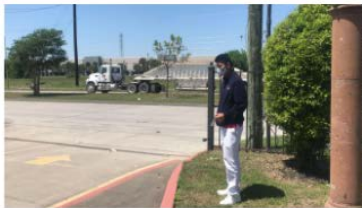
Stacy C. and Heidi M.  
Mrs. Kulow  
Harmony School of Fine Arts and  
Technology  
8th grade

### Driving (Inquiry) Question

What are the pollution levels at our campus?



## Lunch Outdoor Air Quality



Why do we study the air quality by the road?

We study the air quality by the road of our campus to see what the air quality would be, which was not very good as expected.

### March 2021



Presented By:  
Steven R & Zion C  
Mrs. Kulow  
HSART  
8th grade

### April 2021



## Indoor Air Quality

### Driving Questions :

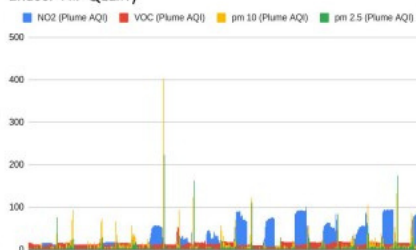
1. What are the air pollution levels at our campus "indoors"?
2. What causes spikes in the Air Quality?



### Indoor Air Quality :

Air pollutants such as hand sanitizer, perfumes, air fresheners, chemicals used for cleaning and even mold can play a big role in creating hazardous air quality. People coming from outside can trail in pollution and bring it inside, may it be from the items they bring in the campus or from their clothes.

### Indoor Air Quality



### Presented By:

Dymon R, Imani M & Haliya A  
HSART  
8th Grade  
Mrs. Kulow

