

CASE STUDY: CIVIC SCIENCE

Lewis Middle School, Aldine ISD Houston, Texas

Texas Middle Schoolers Drive Their Own
Air Quality Research Investigations



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



The campus of Lewis Middle School in Houston, Texas

BACKGROUND

Michael Arratia felt called to teach and share his research skills in the classroom. His sister, who teaches in the Rio Grande Valley, suggested he apply for a teaching position, even though most teachers in that area came from the rural community that stretches along the US-Mexico border. He became the first teacher to be hired from outside the region in a time much like today with widespread teacher shortages. Mr. Arratia reflected, "I thought I would work as a teacher for a couple of years and then go back to the private sector. After 20 years, I am still a teacher, but now I am able to show students of all grade levels why research is important."

After moving to Houston in 2019, Mr. Arratia started teaching at the Lewis Middle School in the Aldine Independent School District and took the role of Science Department Chair.

Mr. Arratia participated in CELF's Civic Science program in the spring and summer of 2021, and again in spring 2022. "Being part of CELF has opened my eyes to a different type of research: Civic Science. I enjoyed the topic of air quality and discovering how students can do meaningful research at a young age." After taking CELF's professional learning program, Mr. Arratia started various water quality and air quality projects at Lewis Middle School.



LEWIS MIDDLE SCHOOL

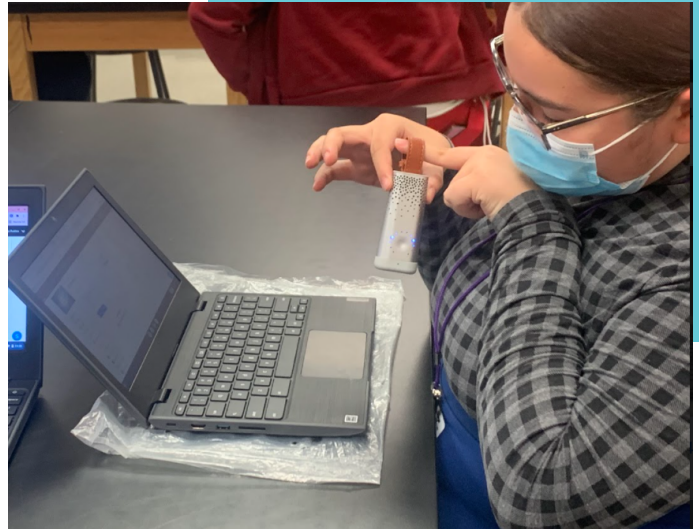
Lewis Middle School opened August of 2010 in the Aldine Independent School District in Houston, Texas. Its mission is to create a culture of learning with a combined effort of the community, parents, students and staff that fosters critical thinking, learning, and engagement in a safe environment. The school aims to empower students to achieve success as respectful citizens of society who are equipped with the skills to pursue personal and educational goals. Mr. Arratia helped Lewis students connect with the research process through direct data gathering.

Air Quality at Aldine

Mr. Arratia started the air quality unit with his students by asking the question, “Does air quality change around our school?” Students used this question to formulate their own projects using CELF’s “Inquiry to Action” framework.

The students used Plume Labs Flow Air Quality Device to measure air quality around the school. They identified areas where the air quality was poor, and used this data to brainstorm project ideas. After formulating an authentic inquiry question that could drive a project, students collected and analyzed the data to answer their inquiry question.

Mr. Arratia kept the process very open to allow for student choice and voice. “My job as a teacher is just to try and explain little roadblocks that they encounter and explain some of their findings, since much of this is very new to them.”



Students in Mr. Arratia's class used the Flow air quality device to analyze air quality in and around their school.

Student Action and Outcomes

Some of Mr. Arratia’s students wondered if vehicular traffic and idling impacted air quality at the school. They compared air quality data from the side of the building where school buses parked and sometimes idled with data collected near the front of the school where parents and the general public come to pick up students.

Students collected air quality data outside by the bus ramp at different times of day. The school leaves the side doors adjacent to the bus ramp open for an extended period of time.

One outcome of this project was understanding the change in air quality between the two different school locations at specific times of the day and deciding what actions could be taken to help improve the problem. Students are creating a plan of action to help bring awareness to the problem of idling and find a solution with the help of school leadership.

Once students started discussing the data, they realized how quickly air quality can change due to idling buses. As one student said, “I never really knew that the air quality could change from good to bad in a matter of seconds to a minute.”

The students came to understand the change in air quality between the two different school locations (front vs. side of the building) at specific times of day.

To bring awareness to the impact of idling school buses, the students have kept school leadership informed of what they are doing and what their data shows. They will continue to meet with administrators in spring 2022 to further communicate their findings and come up with a potential solution to the air quality problems caused by idling buses.

“As I motivate my students to try to do projects that might help the school or even community, I let them know that everything they do is important, no matter how simple their project is.”

- Mr. Arratia, Science Teacher, Lewis Middle School

Another group of Mr. Arratia's students studied Volatile Organic Compounds (VOCs) in the air, which they discovered emanating from cleaning products.

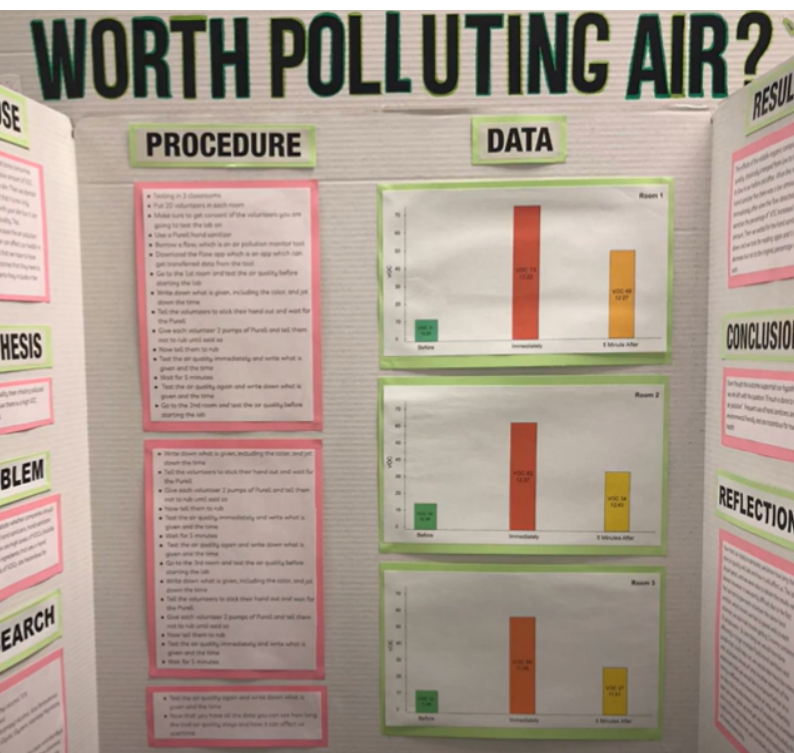
Student Yahaira explained the findings in her research abstract: "Due to the 2019 Coronavirus Disease (COVID), there has been a rising amount of hand sanitizer usage (probably because of the amount of germ killage that is being advertised). The pushing factor for this rise in consumption is that people believe hand sanitizer is the best protection against the new virus. Yes, hand sanitizer does help to prevent certain viruses from spreading - however, this usage also combats another issue: air quality. We hypothesize that the use of hand sanitizer does in fact produce harmful air quality as volatile organic compounds (VOCs) are increased due to the materials found in it. Volatile organic compounds are compounds that have a high vapor pressure and low water solubility, which may have short- and long-term dangerous health effects."



Student volunteers helped gather data on the impact of fragranced hand sanitizer on air quality.

The group investigating VOCs enlisted 20 volunteers to help gather data. "First, we placed twenty volunteers in a room and measured the room's air quality using a Flow device. Next, we asked our volunteers to hold their hands out and receive two pumps of Purell hand sanitizer. Then, we had our volunteers rub their hands together while we simultaneously measured the air quality of the room. After five minutes, we tested the air quality again. This procedure was then subsequently done in two different rooms at two separate times."

The results showed a dramatic increase (a five-fold increase) in VOCs shortly after the application of hand sanitizer. This group shared this data and content at the Science Fair and at a district meeting following the Science Fair.



Students presented their detailed research on the impact of fragranced hand sanitizers at the district Science Fair.

Pandemic products can generate volatile emissions that could pose risks to health; that could be reduced with fragrance free versions.
 Products intended to reduce risks on health may actually be posing risks to health.

Fragranced cleaning products are associated with:

- Migranes	- Neurological
- Headaches	- Gastroin Testing
- Asthma Attacks	- Respiratory
- Exacerbation	- Dermatologic
	- Immune System

Hand-written student notes

THE LEARNING CONTINUES ...

Mr. Arratia and his colleagues at Lewis Middle School plan to extend air and water quality projects over a period of three years:

- As described above, in the spring of 2021 students collected air quality data on the school grounds.
- For the 2021-22 school year, students are carrying forward projects started in spring 2021, and continuing to monitor air quality around the school. Others are designing their own devices to measure water quality data.
- In the 2022-23 school year, students will begin to collect data on soil, in addition to air and water.

Over the course of three years, students will gain an understanding of potential hazards found in the air, water and soil surrounding their school campus, and will pursue solutions. These place and project-based learning units offer students the opportunity to dig deeper and view projects from different perspectives for authentic research.

As of spring 2022, there are five groups of students looking at different aspects of air quality, including two continuing research started in 2021:

- A group of students will continue to collect data related to idling near the front and side doors of the school. They will compare this data to the data collected last year.
- Another group will use the Flow device to collect more data on indoor air quality, as it relates to VOCs. The students are investigating how different brands of hand sanitizers, the presence of fragrance and chemical make-up can impact air quality differently.

After completing their studies, the students plan to take their findings to the principal along with their suggestions for improvement.

Mr. Arratia hopes that this research becomes a project that could include other nearby schools. With the different tiers of projects, Lewis MS can serve as a mentor school for other schools within the Aldine Independent School district.

In a Zoom session with Civic Science 2022 participants, eighth-grade students (pictured with Mr. Arratia) describe how they plan to expand their research of VOCs in its second year by comparing fragranced and fragrance-free products.

