Education for Sustainability

local, place-based activities
that use schools as practice grounds for environmental education,
focused on interdisciplinary initiatives that seek solutions to problems

School grounds + educational programs

Urban School Districts' Engagement with EfS (n=81)

|	Educational Programs	
Facilities (Resource Management & School Grounds)	YES	NO
YES	27 school districts	43 school districts
NO	0 school districts	38 school districts

Source: Web scan of 81 largest U.S. urban school districts, July 2019
Dissertation proposal Carine Verschueren

Children's Environmental Literacy Foundation

# Engaging Students in Citizen Science: Guiding Inquiry to Action

Developed and Presented by,
Vicky Garufi, Director of Education
Lisa Mechaley, Educator & Professional Developer
**Children's Environmental Literacy Foundation**
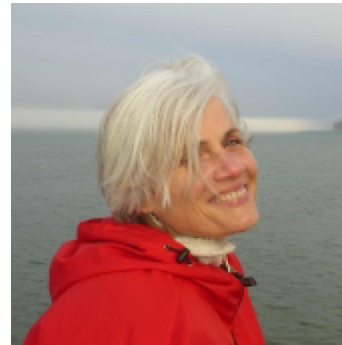
Who we Are

The mission of Children's Environmental Literacy Foundation is to establish sustainability as an integral part of every child's K-12 learning experience.

"Give me a lever long enough, and a fulcrum on which to place it, and I shall move the world."
- Archimedes

K-12 Education

Education for Sustainability
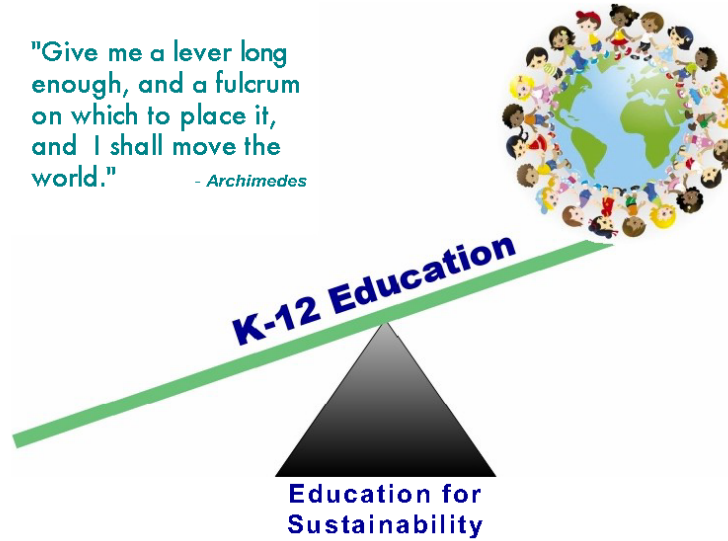
Preparing Future Citizens and Leaders

We teach students how to balance economic, social and environmental systems to create sustainable communities.
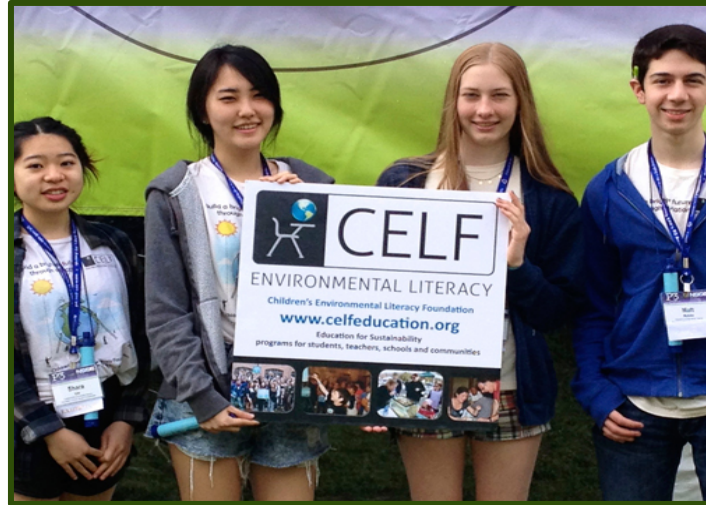
Our Approach
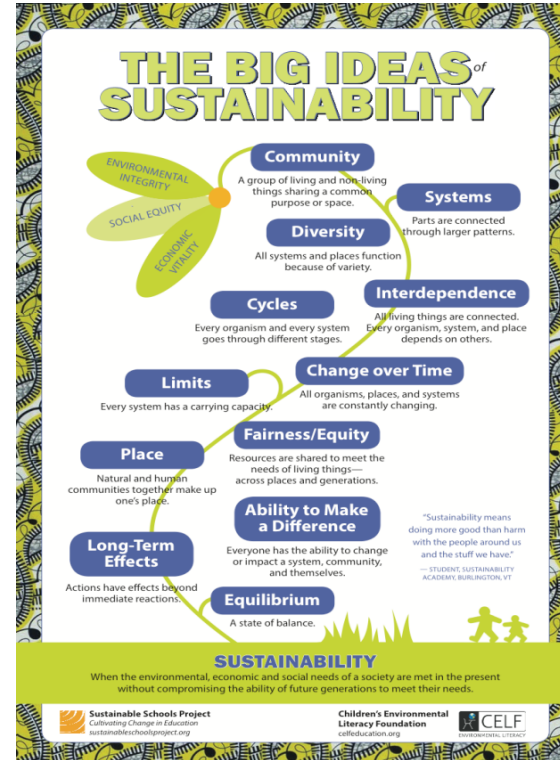## Leading Practice to Foster Sustainable Communities

CELF's integrated approach **transforms learning** into an **authentic exploration** of real-world problems, centered in and around the school community. Using sustainability as a guiding framework, project-based learning is embedded in existing curriculum, across all subject areas

SYSTEMS THINKING

EXPERIENTIAL LEARNING

PLACE BASED

SUSTAINABLE SCHOOL COMMUNITIES
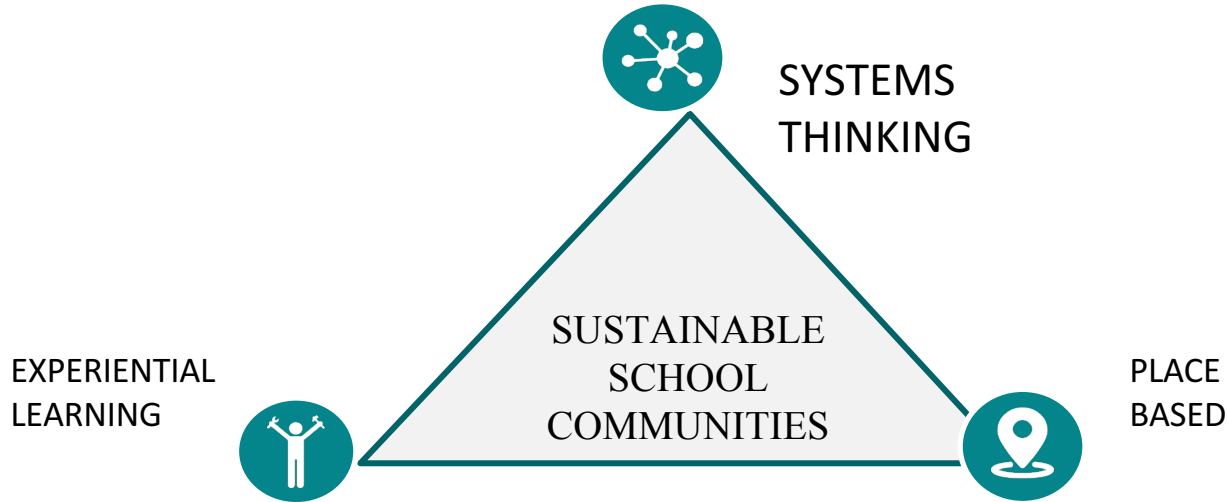
Big Ideas of Sustainability

Teachers learn to design programs that integrate the **Big Ideas of Sustainability** into their existing curricula while creating EfS classroom and school-wide learning opportunities.

THE BIG IDEAS of SUSTAINABILITY

ENVIRONMENTAL INTEGRITY

SOCIAL EQUITY

ECONOMIC VITALITY

Community
A group of living and non-living things sharing a common purpose or space.

Systems
Parts are connected through larger patterns.

Diversity
All systems and places function because of variety.

Interdependence
All living things are connected. Every organism, system, and place depends on others.

Cycles
Every organism and every system goes through different stages.

Change over Time
All organisms, places, and systems are constantly changing.

Limits
Every system has a carrying capacity.

Fairness/Equity
Resources are shared to meet the needs of living things— across places and generations.

Place
Natural and human communities together make up one's place.

Ability to Make a Difference
Everyone has the ability to change or impact a system, community, and themselves.

"Sustainability means doing more good than harm with the people around us and the stuff we have."
— STUDENT, SUSTAINABILITY ACADEMY, BURLINGTON, VT

Long-Term Effects
Actions have effects beyond immediate reactions.

Equilibrium
A state of balance.

SUSTAINABILITY
When the environmental, economic and social needs of a society are met in the present without compromising the ability of future generations to meet their needs.

Sustainable Schools Project
Cultivating Change in Education
sustainableschoolsproject.org

Children's Environmental Literacy Foundation
celfeducation.org

CELF
ENVIRONMENTAL LITERACY

CELF Core Services

We make the pathway to sustainability accessible.

Professional Learning

Citizen Science

Summer Institute

Three-tiered professional learning model customized to meet the needs of school or district.

Students learn how to address the environmental science issues and policy affecting their lives and communities.

Accredited multi-day immersive Education for Sustainability workshop for K-12 teachers in all content areas.

Pick your entry point. What makes sense for your school, your students. We'll meet you there.

CELF Citizen Science

Professional Learning: Enhance understanding of project-based learning and place-based education pedagogical principles and practices within the context of the school community.

Technology Training: Program participation includes technology and training on apps to support an in-depth exploration of the impact of pollution on health.

Curriculum Connections: Seamless connection to Next Gen Science Standards while students identify causes and solutions for different types of pollution. Opportunities for interdisciplinary crossover!

Civic Engagement: Science and policy intersect as students learn about modes of change and legislative processes while developing action plans to share with community leaders.

Community Partners

Program Timeline

Blended Learning:

Teacher Training on CELF's Inquiry to Action Framework

Citizen Science Implementation:

Data Collection & Analysis with Students

Onsite Support:

CELF Site Visits to support implementation

Student Symposium:

Data Sharing Event to the community
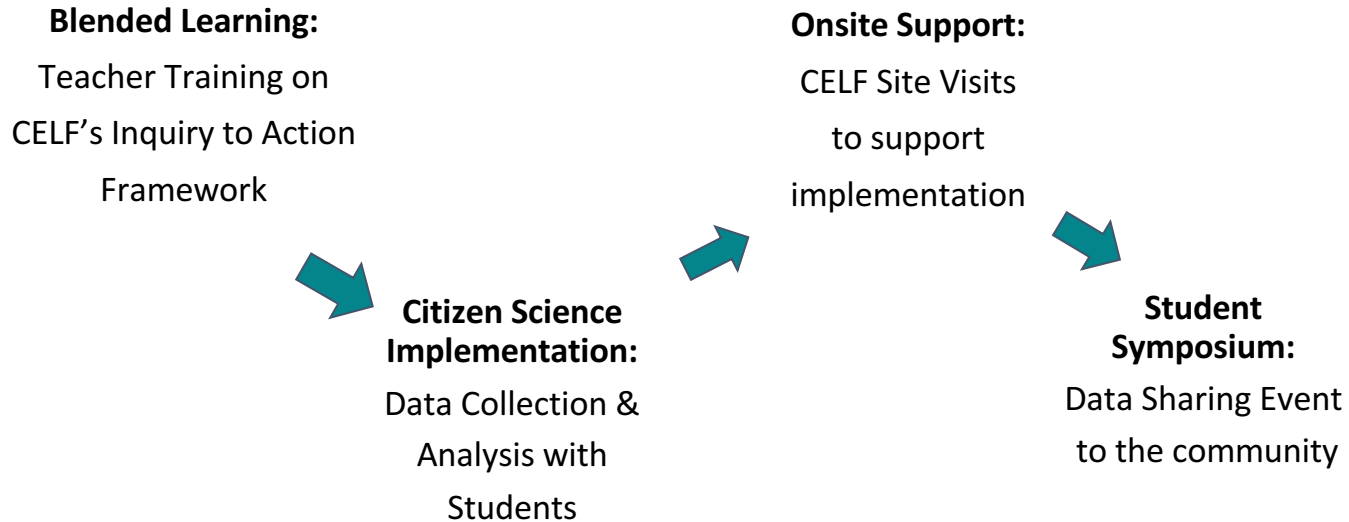
The Process

Our framework engages in 21st century skill-building by leading students through a multi-step process:
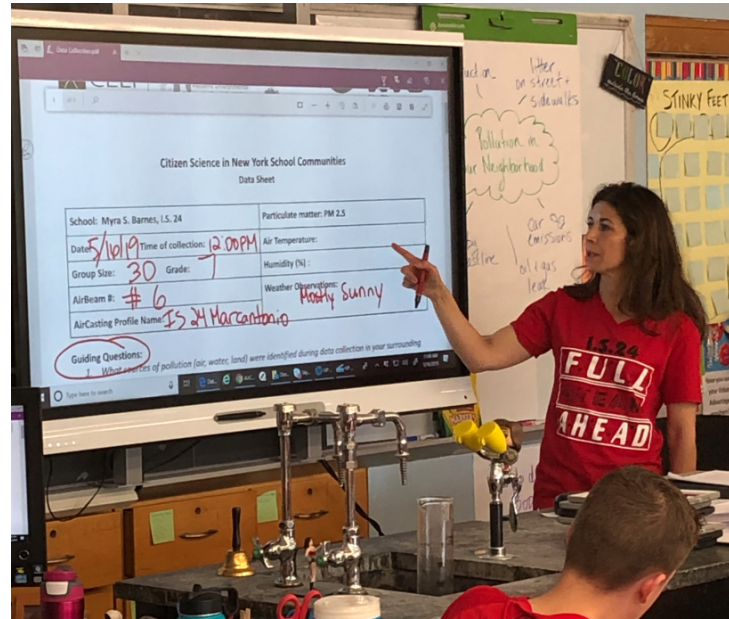
INQUIRY → ACTION

Inquiry

Develop an "inquiry question" focused around the school community or specific place.

- What topic do you want to investigate and explore?
- What local environmental issues are of most concern?

(ex) Water quality, air quality, soil, biodiversity, garden, etc

Collection

How will students gather information to support the inquiry?

- What information do you need?
- What can you research?
- What data can you collect?
- What tools do you need to collect your data?

Collection
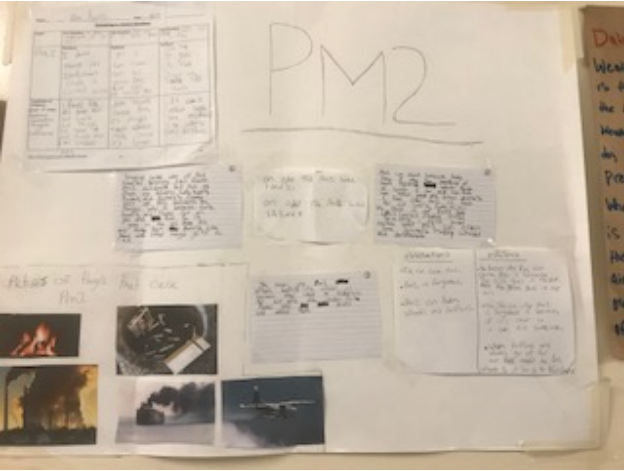
Analysis

What does the data imply?

- What conclusions can you make about your data and research collected?
- What did you discover and what impacted your data?
- What patterns and trends can you identify?
- What evidence can you find to support your inquiry?
- What are the environmental, equity and economic implications to your findings?
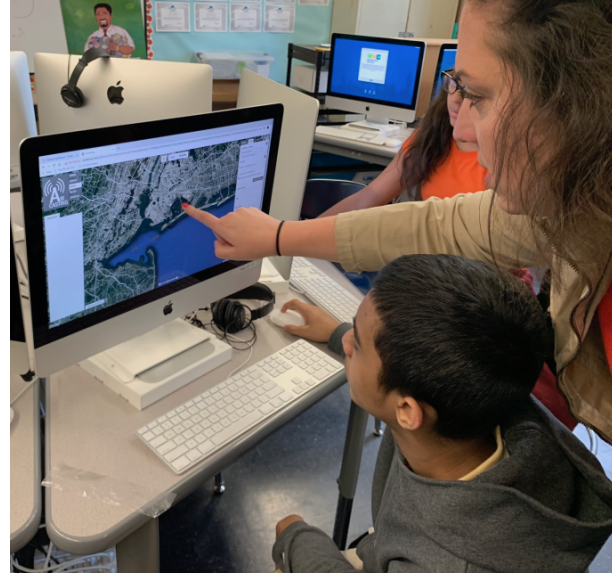
Analysis   Aircasting.org
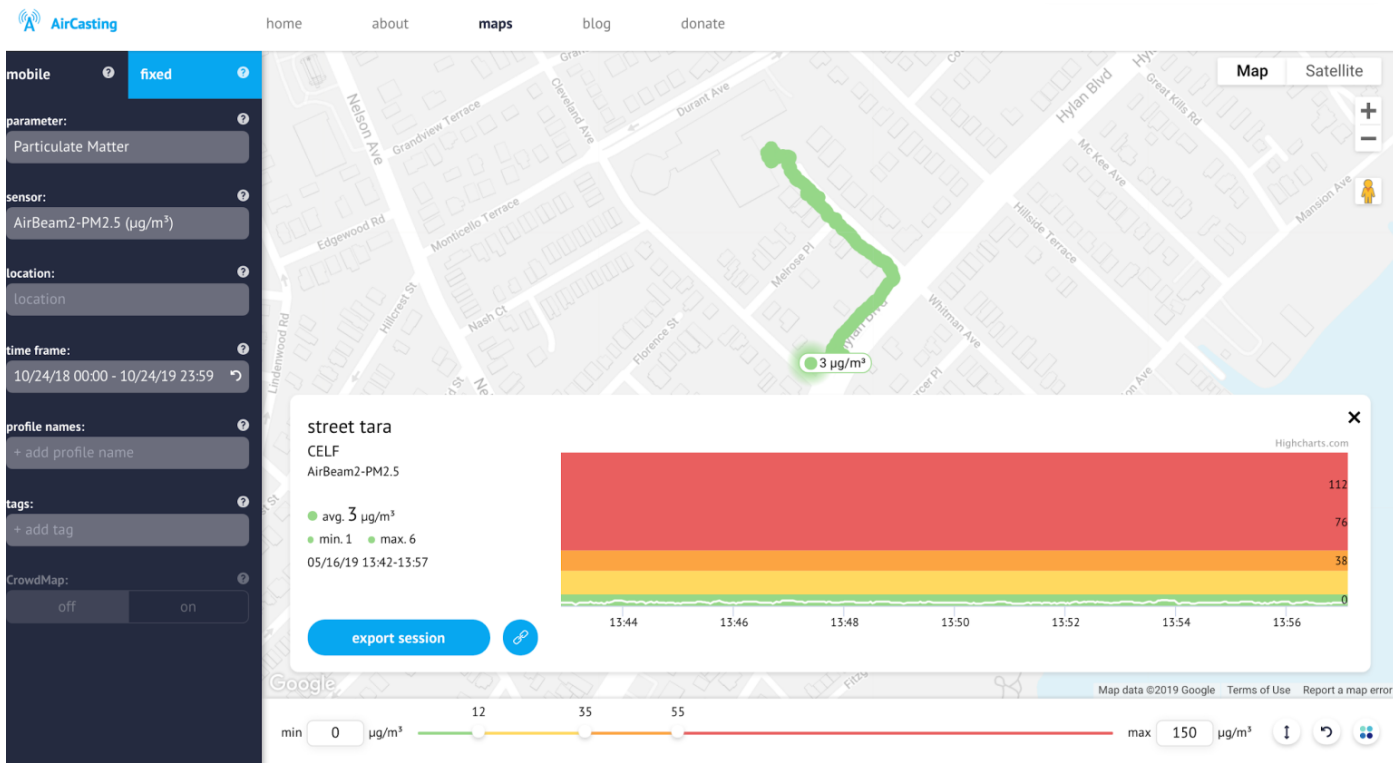
Analysis
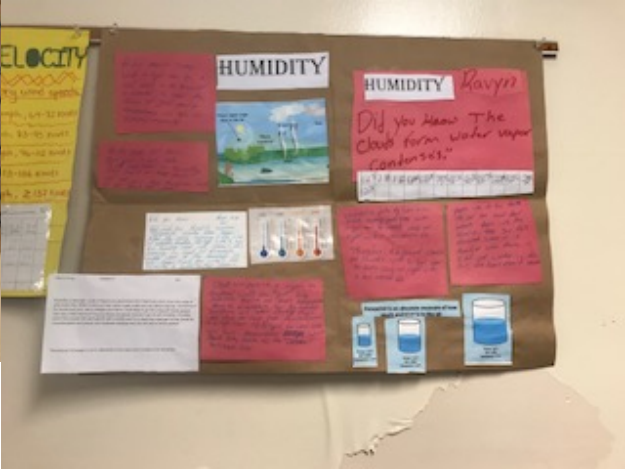
Collaboration

Student Collaborate and discuss findings:

- What is the answer to your question?
- Do you need more information?
- What other questions do you have?
- Have you considered all perspectives?
- Collaborative reflection
- How can you engage with field experts to support your research?

Innovation

How can student construct solutions to their findings?

- What does this environmental challenge require?
  - Ex) A new invention? A new law? An advocacy plan?
- Using creativity and design thinking formulate a remediation plan to your problem.
- How can you display and visualize your data?
  - Ex) storytelling, presentations, modeling, mapping, etc.
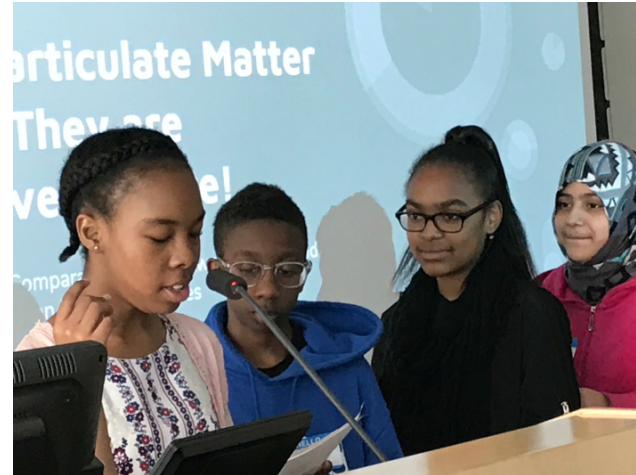
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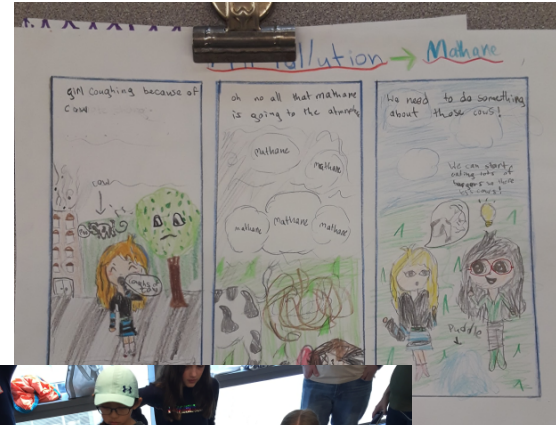
Innovation
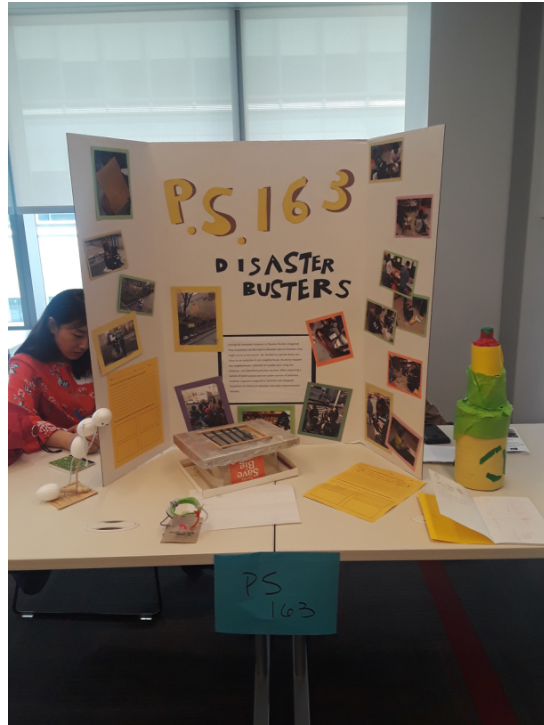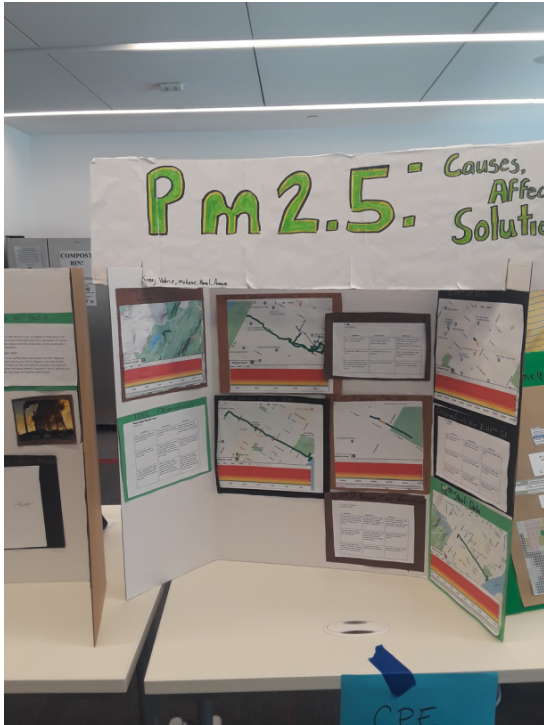
Action

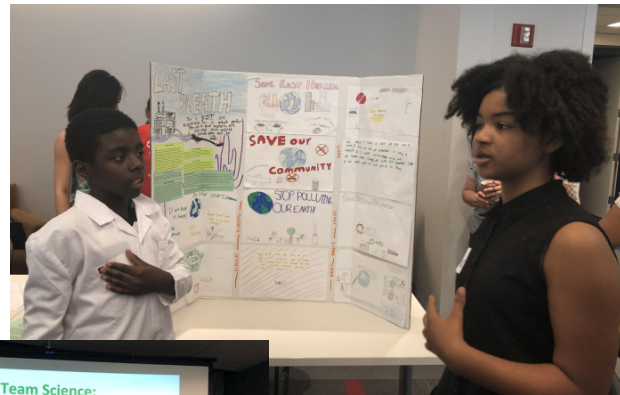**How can you present your findings to an authentic audience?**

- Identify the audience you need to reach to enact change?
  Ex) local city council rep
- How can you raise awareness of your issue?
- How can you act to empower change?

CELF Student Research Symposium at CUNY School of Law

Action (symposium link)

Program Take-Aways

CELF's Citizen Science program is….

- Supportive of teacher training and implementation of the AirBeam technology and apps

- Accessible to CELF toolkit & resources

- Collaborative

- Student and teacher driven

- Cross disciplinary

- A long term study

Implications for Teaching

- Teachers implement a project based STEM learning unit

- Apply CELF's Inquiry to Action framework customized to classroom curriculum

- Students engage in a local community issue and activate change

Save the Dates!

- **NYC Outdoors Environmental Education Expo**
  - Nov 20, 6-8 pm
  - NYU Wallerstein Collaborative

- **CELF Summer Institutes**
  - July 13-16, 2020 at Manhattanville College
  - NYC dates coming soon!

Staying Connected:

www.celfeducation.org

@ChildrensEnvironmentalLiteracyFoundation

@celfeducation

@CELFeducation

*You can join our **CELF Education for Sustainability Group** to keep the conversation going and build a community of learners.*

The Chapin School

Class 5 Science Air Pollution Project (2017-18)

By Alma A. Padilla, MS Science Teacher

Inquiry to Action: Our experience

1. Preparing The "Stuff" (i.e. logistics)

2. Preparing The People

   a. Teacher & Students (Personal purpose / motivation)

   b. Social & Environmental Justice Issues (External purpose / motivation)

3. Citizen Science: Data & Results

4. Citizen Science-to-Action: Data-based recommendations, present findings to the community

Preparing The "Stuff"

- Used CELF resources as a springboard; altered existing and developed new materials specific to my classroom's needs.
  (e.g. Data sheets, created sampling station procedures and kits)

- Deep search for additional air pollution and environmental justice-related resources specific to NYC
  (e.g. NYC Community Health Profiles Atlas – excellent!)

- Scheduling: taking students outside is simple - in theory!
  (e.g. Weather, recruiting chaperones, competing schedule demands, finding enough class time to complete data collection)

Preparing The People

- Information: Causes of air pollution in NYC? My neighborhood? Other neighborhoods?

- Context: How does it affect me? Others? Is the impact equal? What is being done? (Social and Environmental Justice)

- **Instill sense of urgency - without scaring (challenging)**

- Possibility of agency: counteracts feelings of despair, fear

*Agency = ability to take action

Eye-opener from CELF AP workshop:

Children's breathing zones are close to the ground – closer to the sources of pollution. They receive more concentrated doses of pollutants than adults do!

Additional personal investment:

Impact on pregnant women & their babies

Source: https://www.momscleanairforce.org/wp-content/uploads/2017/07/how_air_po

Impact on Kids

"Children are far more likely to be harmed by air pollution than grownups are, UNICEF said. Air pollution can permanently damage children's health.

*It can also keep their **brains** from developing properly."*

Source: https://newsela.com/read/toxic-air-kids/id/23593/

Schoolchildren rally in support of the odd-even formula introduced by the Delhi government for controlling pollution in Janakpuri in New Delhi, India, December 30, 2015. S Burmaula/Hindustan Times via Getty Images

Three hundred million children live in places where the air is dangerously polluted, a new study found. The air they breathe is more than six times as dirty as what is considered safe. Such children face serious health risks.

The new study was carried out by the United Nation Children's Fund (UNICEF). It shows that 2 billion children live in places with dangerously high air-pollution levels. Altogether, that is 9 out of every 10 children in the world.

UNICEF said air pollution kills 600,000 children a year.

Children are far more likely to be harmed by air pollution than grownups are, UNICEF said. Air pollution can permanently damage children's health. It can also keep their brains from developing properly.

36

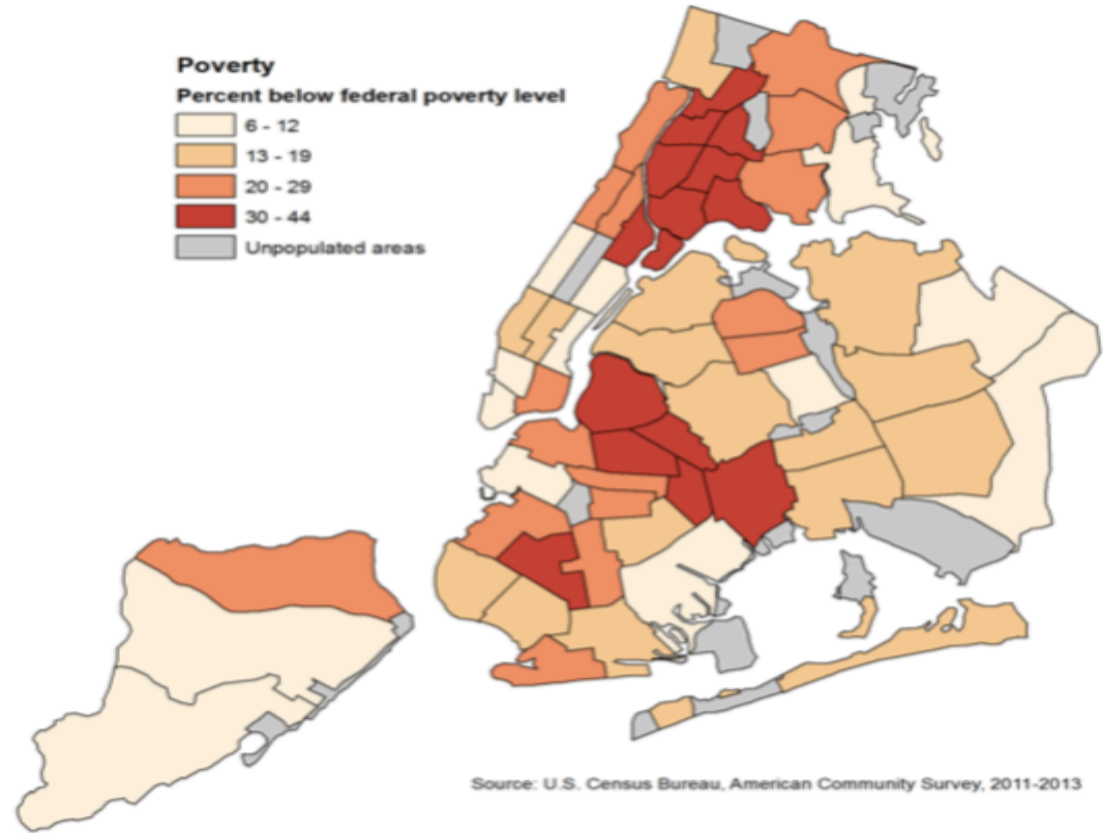# Buy-in achieved

In their own words...

Poverty

Percent of individuals living below the federal poverty level. For more information on the poverty level, please visit the U.S. Census Bureau's website.

Highest		Percent
1	Morrisania and Crotona	44
1	Belmont and East Tremont	44
3	Mott Haven and Melrose	43
3	Hunts Point and Longwood	43
5	Fordham and University Heights	42

Lowest		Percent
59	Tottenville and Great Kills	6
58	Upper East Side	7
56	Financial District	8
56	Greenwich Village and Soho	8
55	Bayside and Little Neck	9

Borough	Percent
Bronx	31
Brooklyn	24
Manhattan	18
Queens	16
Staten Island	12

Poverty
Percent below federal poverty level
- 6 - 12
- 13 - 19
- 20 - 29
- 30 - 44
- Unpopulated areas

Source: U.S. Census Bureau, American Community Survey, 2011-2013

NYC Overall: 21%

(Maps from NYC Community Health Profiles Atlas, 2015)

LEARNING

We learned about what air pollution is and why it is so harmful, especially to children.

We walked around our neighborhood to find potential sources of air pollution, and who they might affect.

We had a "crash course" in Design Thinking to help us as we began brainstorming our pollution solutions.

DATA COLLECTION

We collected data at four different stations:

Noise Pollution

Traffic:
Moving & Idling

Soil Chemistry

MORE DATA SAMPLING

RESULTS (measured)

- PM2.5 was surprisingly low around our school block.

- PM 2.5 was highest around the park. We predict this is due to the FDR, even though there are more trees. PM2.5 would probably be higher if the park was not there.

- Sound pollution seems to be the biggest problem. Peak noise pollution always surpassed 85dB, which is the limit for causing hearing damage.

- Soil chemistry tests did not show a pattern. We think it is because the soil is replaced often in the tree and flower beds.

RESULTS (observed)

- Traffic was busiest around lunch time, and also at the end of the day near our dismissal time. Even though the buses are forbidden from idling, many private vehicles idle in front of the school. We never saw anyone tell them to turn their engines off.

- We noticed more idling vehicles when it is cold. We think it is because people want to keep the heater on. The same thing probably happens when it is hot, with the AC.

- On several outings, people turned their cars off when they saw us walking by with clipboards and cameras. **This made us realize that people know idling is illegal, but they only turn their cars off if they think someone is watching them.**

BRAINSTORMING SOLUTIONS

- After collecting data and learning even more about air pollution, we started brainstorming ideas to help us fight pollution.

- We tried to keep our ideas as local as possible. We have learned that air pollution does not affect all people equally.

- **Because of this, we tried to come up with ideas that are "fair", meaning that all people would share costs and benefits fairly.**

CLASS 5 RECOMMENDS:

Our most common ideas for addressing AP in our community:

- Filter attachments for vehicle exhausts (cars, commercial trucks)

- Reach out to leaders and businesses to add pressure to change.

- Educating people about the effects of AP on health, especially for children. **We think that because deaths from air pollution are not "dramatic", people don't realize they are a top danger.**

Specific / Unique Ideas from Section 5M

NYC-TUBE CHANNEL

Make a YouTube channel that educates watchers about the air quality data in different neighborhoods in NYC.

USE ECOSIA AS A SCHOOL

We proposed to our head of technology that we want to change the default search engine to Ecosia; it plants trees with its ad profits

EDUCATIONAL INSTAGRAM

Make an account on Instagram to inform people on what they can do to help stop air pollution, in a creative and interesting way.

LIQUID EXHAUST

We made a filter that turns exhaust from a car into liquid form. As a liquid, where it ends up can be controlled more

Specific / Unique Ideas from Section 5A

PHOTOSYNTHESIS & EXHAUST

A filter inside a car exhaust pipe that takes out CO_2 and particulate matter, using photosynthesis.

CO_2-POWERED BATTERIES

A solar powered machine that will turn CO_2 into energy that will power batteries.

PROMOTING A PLASTIC-FREE LIFE

This idea is still being developed but promoting reusable items such as water bottles, bags, and straws.

FAKE PHOTOSYNTHESIS FILTER

A filter that turns CO_2 into oxygen using artificial photosynthesis. The filter is placed on top of the exhaust pipe of a truck.

Specific / Unique Ideas from Section 5T

FRESHDIRECT™ BOYCOTT

Organizing boycotts of polluting companies. We will be targeting FreshDirect™, for polluting poor communities.

THE SIMPLES...

Posters about air pollution and the simple things you can start doing to help the earth :)

LILIES FOR CLEAN AIR

Writing to people with power to plant peace lilies and trees to improve air quality indoors and outdoors.

CC+H

A small, portable, battery-operated heater / AC for your car. This is so you can stay comfortable, without idling the engine.

LG+SL CITI BIKES FOR ALL

Promote greater, fairer use of Citi Bikes around NYC by using a portion of the fees to offer free or cheaper membership to those who cannot afford the bikes.

Specific / Unique Ideas from Section 5H

AFFORDABLE ELECTRIC CARS

Electric cars that are more affordable with longer lasting batteries

POSTERS AGAINST IAP

Informational posters about the risks of indoor air pollution (IAP) and affordable solutions to protect health.

FILTERS 4 CLEAN AIR

A poster showing a model for filtering carbon monoxide which comes from car exhaust.

FLYERS FOR:

Anti-smoking, and Banning Nicotine Campaigns and Laws

EDUCATE AGAINST IDLING

Promote stronger enforcement of idling laws.

SOLAR UBERS

A poster showing how we can make Ubers and possibly yellow taxis electric through solar panels

Overall Student Solutions:

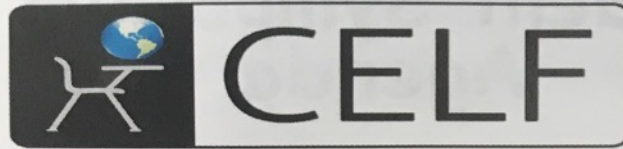Reflected various approaches to the problem:

- Scientific
- Social
- Technological
- Educational
- Legal
- Artistic
- Communication

This is how problems are solved in "real life."

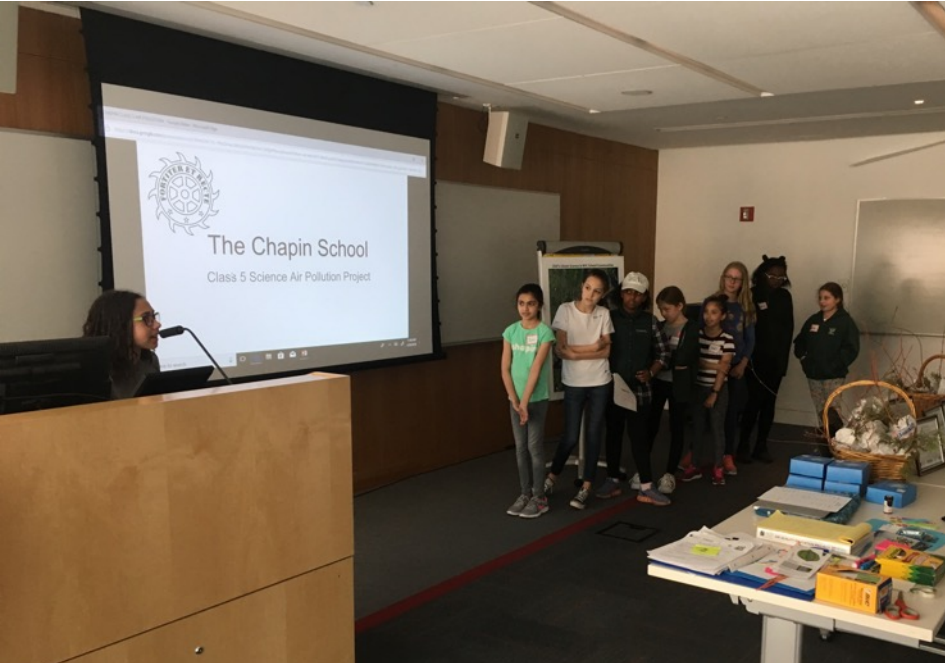# Citizen Science-to-Action...

15th ANNIVERSARY

CELF
ENVIRONMENTAL LITERACY

Citizen Science in NYC School Communities Student Symposium

April 28, 2018

CUNY School of Law

Presenting

Our Work

Sharing & Learning

Takeaways: Practical

- Finding key resources and support is essential for success.

  - **CELF – Summer Institute:** Laid the groundwork for implementing more citizen science in my classroom.

  - **CELF, NYSP2I, Mt. Sinai, CUNY air pollution workshop:** Provided knowledge foundation, open-ended tools and ideas for implementation that could be tailored to meet classroom needs/goals.

- Planning is intensive/extensive: Be flexible; do less, especially the first time around; choose depth over breadth.

- Regularly revisit the "purpose" – helps maintain focus, investment.

- **In the future:** Recruit colleagues in other subjects, start project earlier, collaborate with other participating schools, explore environmental justice more thoroughly.

Takeaways: General

- Citizen Science = Impactful.

  - It provides **context** in addition to the **facts**, and more importantly, it gives students **agency**.

- **Agency = Necessary:** Kids care and want to help!

- **Students have many unique gifts!** Citizen Science builds opportunities for all those gifts to shine. Be open to allowing "non-traditional" contributions in your classroom.

It is worth the time and effort!

Thank you!

QUESTIONS?

Or contact us later:

Carine Verschueren (cv2343@tc.columbia.edu)

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Lisa Mechaley (lisa@celfeducation.org)

Alma Padilla (alma.a.padilla@gmail.com)