

Kids Making Sense®



Hilary Hafner, Tami Lavezzo, and
Alan Chan
Sonoma Technology, Inc.
Petaluma, CA

for

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Outline

- What Is Kids Making Sense?
- Why Kids Making Sense?
- Kids Making Sense History
- Successful Implementations
- Package Options
- Future Plans



What Is Kids Making Sense?

Kids Making Sense – An educational program to teach youth how to measure pollution using air quality sensors and to interpret the data they collect.



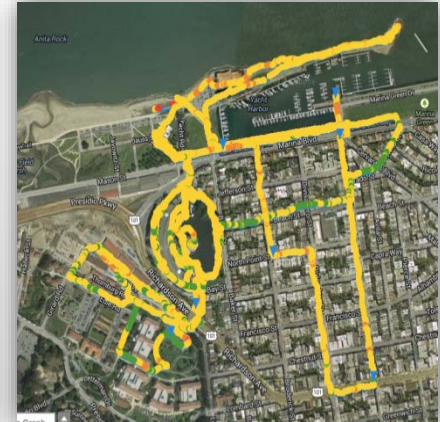
Learn



Measure



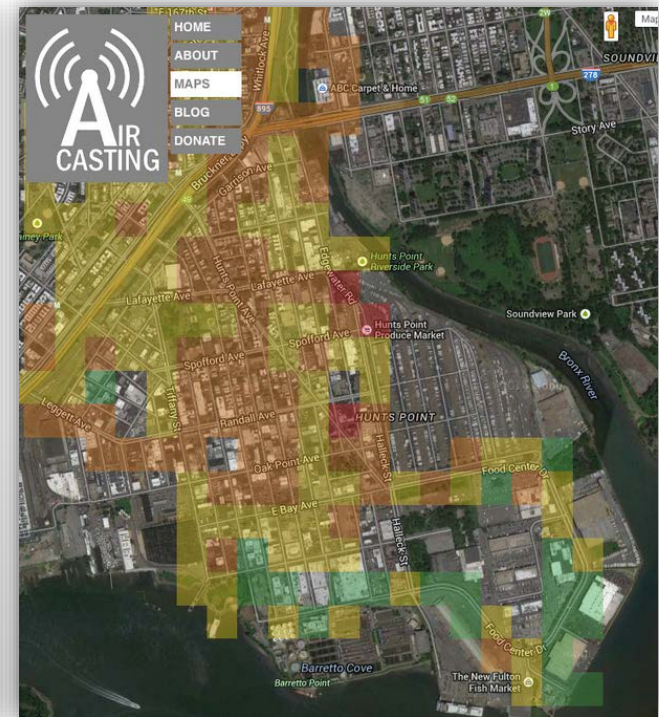
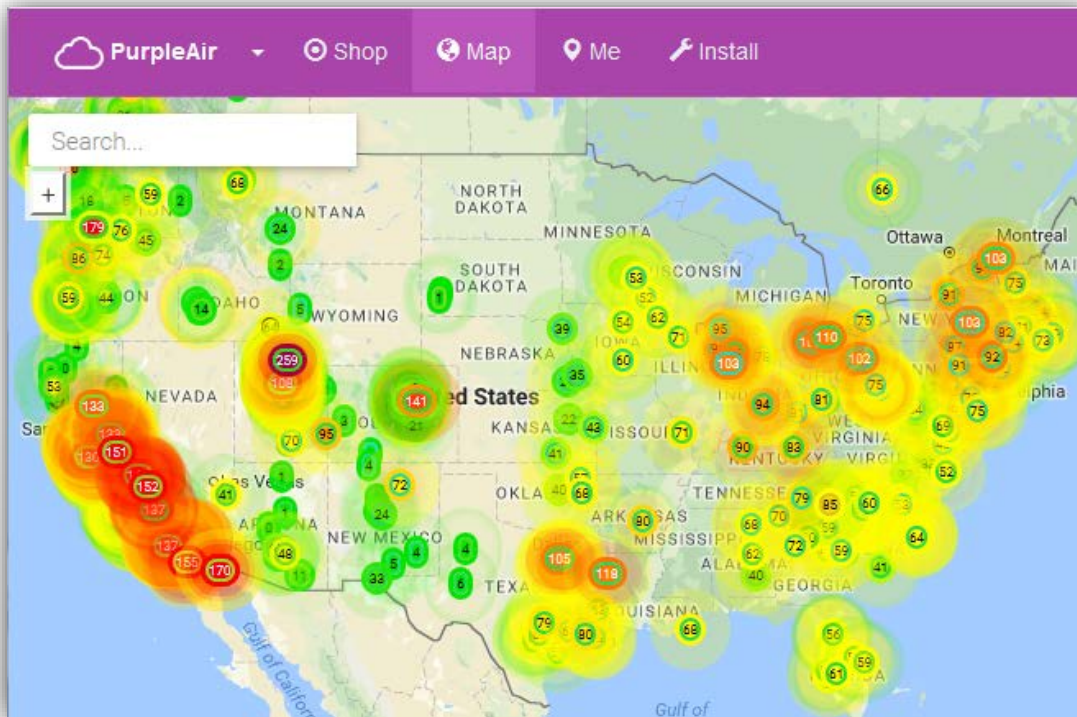
Discover



Interpret

Why Kids Making Sense?

1. Public Adoption of Low-Cost Sensors



2. Community Air Monitoring

- Example: California Air Resources Board AB617
 - Enhanced community-level air monitoring
 - Emphasis on community participation
 - Statewide strategy to reduce emissions, especially for disproportionately impacted communities
- Air districts are in a position to educate communities about small sensor capabilities and limitations



3. Curriculum for STEM education applications

- Provides an opportunity to engage middle and high school students with a hands-on STEM experience
- Helps students be a part of solving air pollution problems in their community

Standards

Kids Making Sense addresses many of the standards for Common Core and the NGSS as listed below.

Middle School NGSS

- MS-ESS2-5 Collect data to provide evidence for how air masses result in changes in weather systems
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.
- MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century
- MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials
- MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals

Middle School Common Core ELA Standards

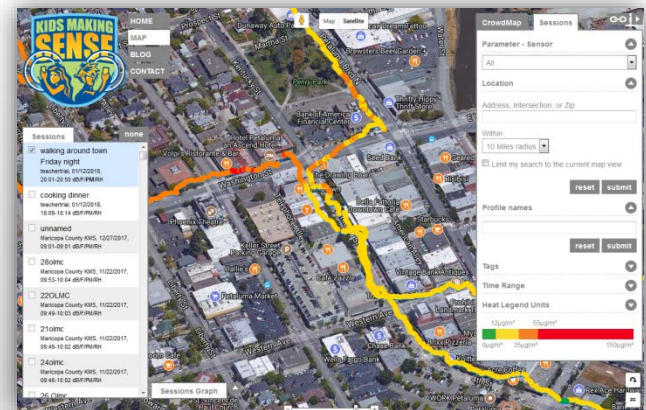
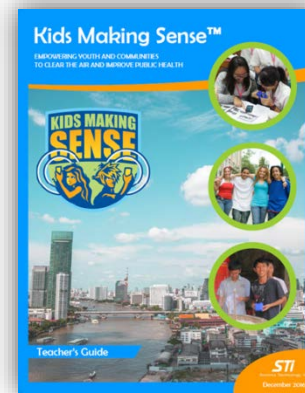
- CCSS.ELA-LITERACY.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts
- CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks
- CCSS.ELA-LITERACY.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics
- CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table)
- CCSS.ELA-LITERACY.RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text
- CCSS.ELA-LITERACY.RST.6-8.9 Compare and contrast the information gained from experiments.

NGSS = Next Generation Science Standards

CCSS ELA = Common Core Science Standards English Language Arts

Components of KMS

- Training materials
 - Student Workbook (soon to be K-12)
 - Teacher's Guide
 - Labs and experiments
 - Aligned with STEM
- Small sensors
 - Particulate matter
- Website
 - Data exploration
 - Online resources



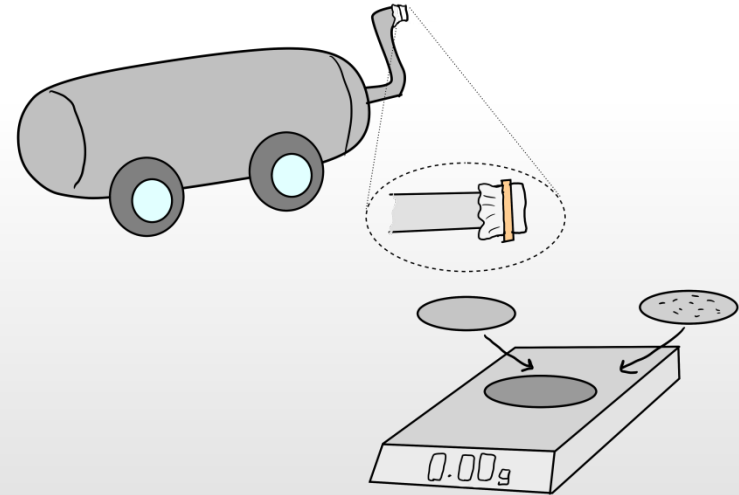
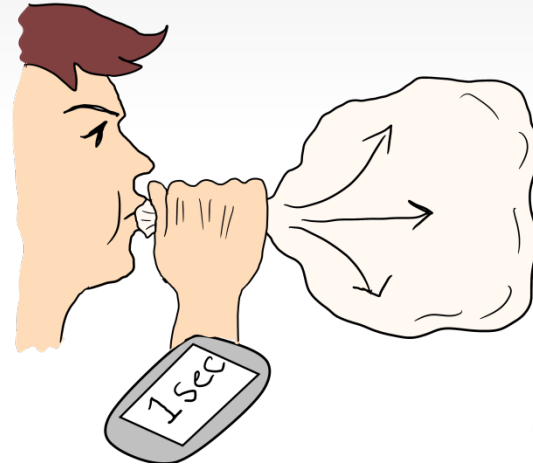
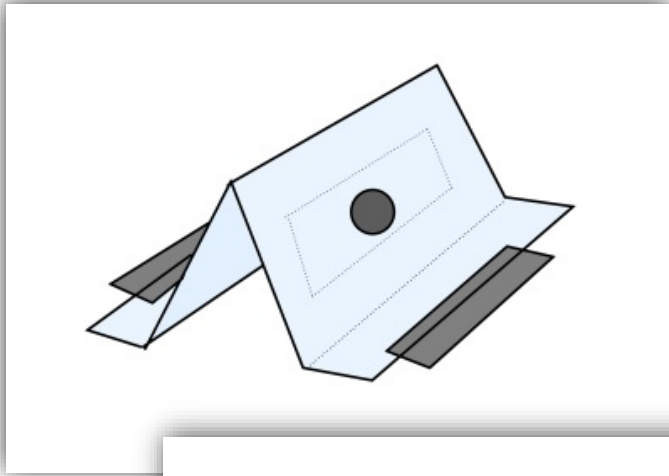
Teacher's Guide

- Each chapter has
 - Pre-Lab Guiding Questions, Potential Sources of Error, Cautions and Adjustments
 - Materials Needed and Time Required
 - Introduction, Procedure, Data, Observations, Calculations, Making Sense of Your Results, Going Further, On a Personal Note
 - Post-Lab Discussion
- Full program takes 10 50-minute class periods
 - There are recommendations for what to cover if you have 2, 4, or 6 hours of class time

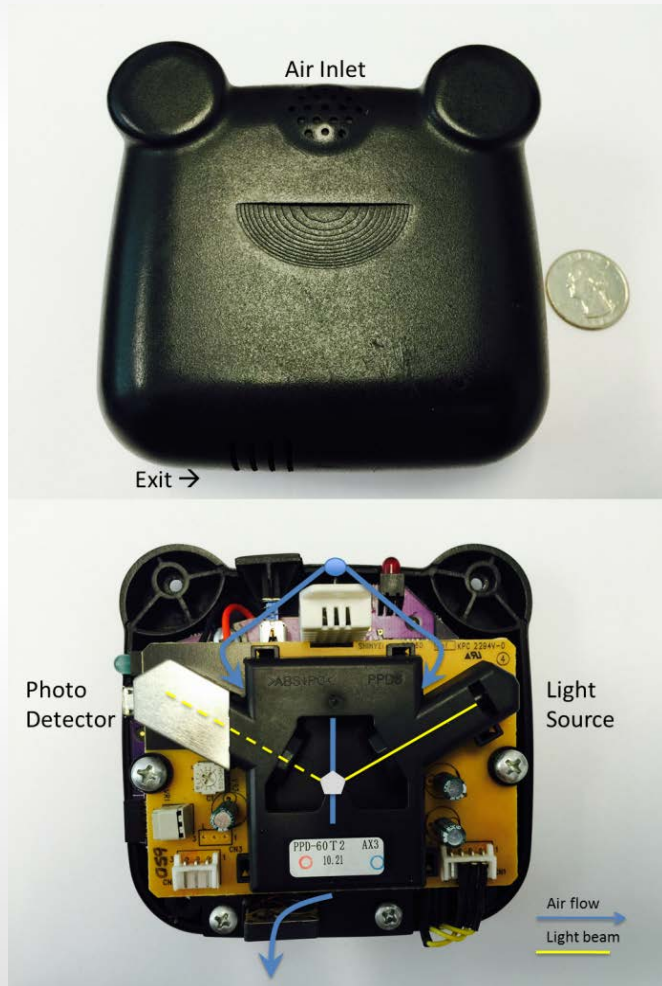
Kids Making Sense Kits



Labs and Experiments



The AirBeam Sensor



Known Issues

Light sensitivity

Does not work at high humidity (greater than 90%)

Upper detection limit (between 300 and 400 $\mu\text{g}/\text{m}^3$)

Sensor lifetime and reliability unknown

Sensor maintenance unknown

Website

The screenshot displays the Kids Making Sense website interface. On the left, there is a navigation menu with buttons for HOME, MAP, BLOG, and CONTACT. The main area features a map of the Western United States, including California, Nevada, Utah, Arizona, New Mexico, and parts of Wyoming and Texas. A heatmap overlay is visible on the map, with color-coded areas indicating sound levels. A legend on the right side of the map shows a color scale from 20dB (green) to 100dB (red), with intermediate markers at 60dB and 80dB. The control panel on the right includes tabs for CrowdMap and Sessions, a dropdown menu for the sensor type (currently set to Sound Level - Phone Microphone), a location input field with a 'show' button, a profile names input field with 'reset' and 'submit' buttons, and dropdown menus for Tags, Time Range, CrowdMap Resolution, and Heat Legend Units. The Google logo is visible in the bottom left corner, and map data is attributed to 2018 Google, INEGI, and Terms of Use in the bottom right corner.

Website

The screenshot displays the Kids Making Sense website interface. On the left, a navigation menu includes links for HOME, ABOUT, MAPS, BLOG, and DONATE. Below the menu is a 'Sessions' list with various entries, including 'Nelson's boarding trip.' which is selected. The main area features a satellite map with a yellow and orange path representing air quality data. A 'Sessions Graph' at the bottom shows a line graph of particulate matter levels over time, with a callout for a specific session on 02/20/2015 at 17:39:42-17:39:44 showing a reading of 59 $\mu\text{g}/\text{m}^3$. On the right, a control panel allows users to select the 'Parameter - Sensor' (Particulate Matter-AirBeam), location, profile names, tags, time range, and heat legend units. The heat legend shows a color scale from 0 to 150 $\mu\text{g}/\text{m}^3$.

Chat with a Scientist

- Provide opportunity for students to talk directly with an air quality expert
 - Answer questions about air pollution, pollutant sources
 - Discuss study design, controls, findings
 - Describe how we became scientists
- Provide teacher support

Typical 1-Day KMS Workshop

- Half-day lecture/training on air quality concepts
 - Sources of pollution
 - Particle sizes
 - Health effects
- Half-day air pollution measurements
 - Hands-on activity using handheld air sensors
 - Discover pollution sources and cleaner areas
 - Data collected by students sent to a website
 - Guided discussion and data interpretation



KMS History

- Six-year history with over a dozen pilots and projects
- Support and involvement from EPA's Office of Environmental Education and air districts (e.g., Sacramento AQMD and Maricopa County AQ Department)
- Several international workshops (Taiwan, Thailand, and South Korea)
- Started in classrooms and expanded to air district training
- New community education kits based on feedback



Successful Implementations

- Maricopa County, AZ
 - Two-day training for educators and air agency outreach personnel
 - Curriculum customizations by Maricopa staff to meet AZ standards
- Dana Middle School, San Pedro, CA
- John North High School, Riverside, CA
- Bay Area Air Quality Management District, San Francisco, CA
 - Staff training on KMS kit
 - Set up public lending library



Standard Package Options

Classroom Package

Sensors, supplies, and support for multiple classes of 10-35 students.

- 10 air sensors, 10 mobile phones, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- In-person teacher training workshop
- Google Hangouts with an air quality scientist
- Phone support

Small Group Package

Sensors, supplies, and support for groups of 5-20 students.

- 5 air sensors, 5 mobile phones, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- In-person teacher training workshop
- Google Hangouts with an air quality scientist
- Phone support



Real science. Real fun.

kms@SonomaTech.com | KidsMakingSense.org

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New Options

Classroom Package

Sensors, supplies, and support for multiple classes of 10-35 students.

- 10 air sensors, 10 mobile phones, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- In-person teacher training workshop
- Google Hangouts with an air quality scientist
- Phone support

Small Group Package

Sensors, supplies, and support for groups of 5-20 students.

- 5 air sensors, 5 mobile phones, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- In-person teacher training workshop
- Google Hangouts with an air quality scientist
- Phone support

Air Quality Action Kit

Sensors, supplies, and support for 3-15 students at a time.

- 3 air sensors, 3 mobile phones, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- Phone support

Citizen Scientist Kit

A single kit that can be shared and reused.

- 1 air sensor, 1 mobile phone, and access to the KMS data-viewing website
- Citizen Scientist Curriculum[©]
- Phone support

Backyard Kit

A complete air quality and weather sensor kit.

- 1 hand-held air sensor, 1 stationary air sensor, 1 outdoor weather station, 1 mobile phone, and access to the KMS data-viewing website
- Teacher's Guide and Student Workbook[©]
- Phone support

Benefits of Kids Making Sense

- Increases awareness of air pollution exposure within communities
- Empowers youth to drive positive change during a time when they are forming their own transportation and consumption habits
- Provides students and community groups with opportunities to interact with air quality scientists
- Includes information on recommended actions and interactions with policymakers
- Helps build capacity among air district staff



The Future

- **New sensors** – AirBeam2, PurpleAir, other?
- **New parameters** – gases such as ozone, meteorology
- **New lessons** – meteorology
- **Expanded reach** – K through 6
- **Additional teaching approaches** – Maricopa County updates
- **More collaborators**

Contact Us



Hilary Hafner

Senior Vice President
hilary@sonomatech.com



Tami Lavezzo

Manager, Kids Making Sense Program
tami@sonomatech.com



Sonoma Technology, Inc.
Innovative Environmental Solutions

707.665.9900

sonomatech.com

@sonoma_tech