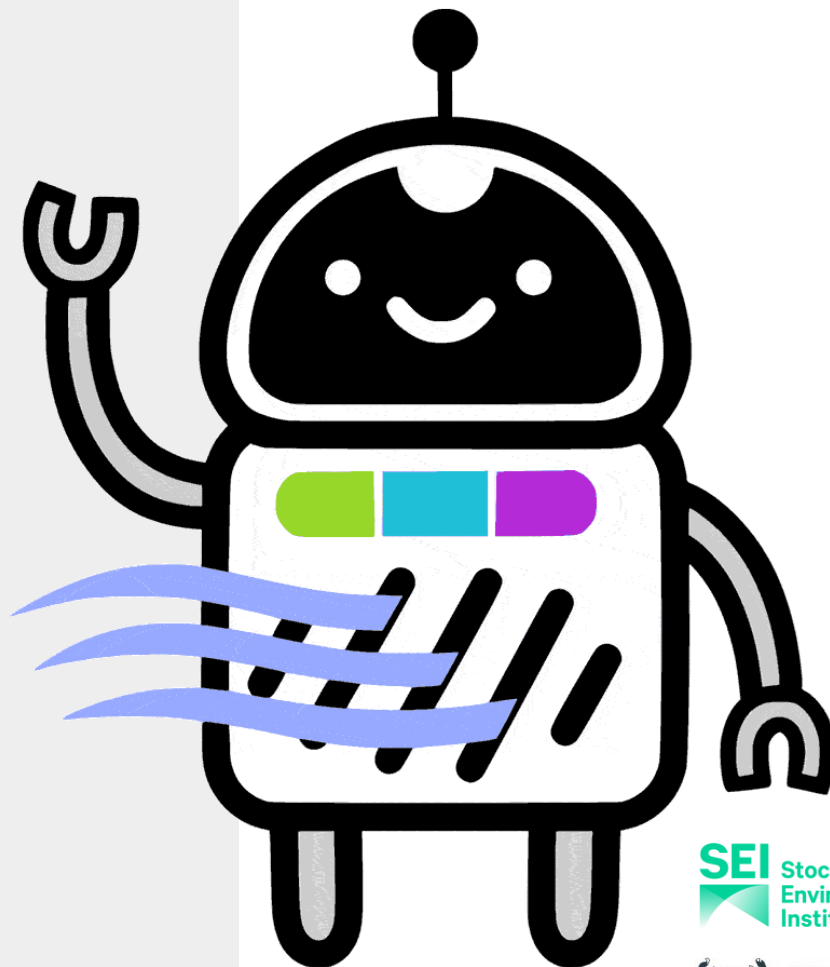


Schools' Air quality Monitoring for Health and Education

Dr. Rhys Archer
SEI York / University of York

Alice Handy
Imperial College London



IMPERIAL

SEI Stockholm Environment Institute





What is SAMHE?

- **SAMHE** stands for **Schools' Air quality Monitoring for Health and Education**.
- **SAMHE** is a research project working with **UK schools** to improve understanding of indoor air quality.
- **SAMHE** uses **Citizen Science** methods to work with teachers and pupils to contribute to this research by providing contextual data via the Web App.

What is Citizen science?

- The involvement of members of the public in meaningful scientific research
- **BUT defining citizen science is difficult! There are contested definitions of the term, what should and should not be classed as citizen science, and even debate about whether it should be defined or not!**

It is difficult to define because:

- It covers a huge range of approaches
- It spans a wide range of disciplines, including natural sciences and increasingly social sciences and humanities
- It has a diversity of purposes
- It takes places in a variety of cultural contexts
- It also overlaps with a range of other participatory research approaches

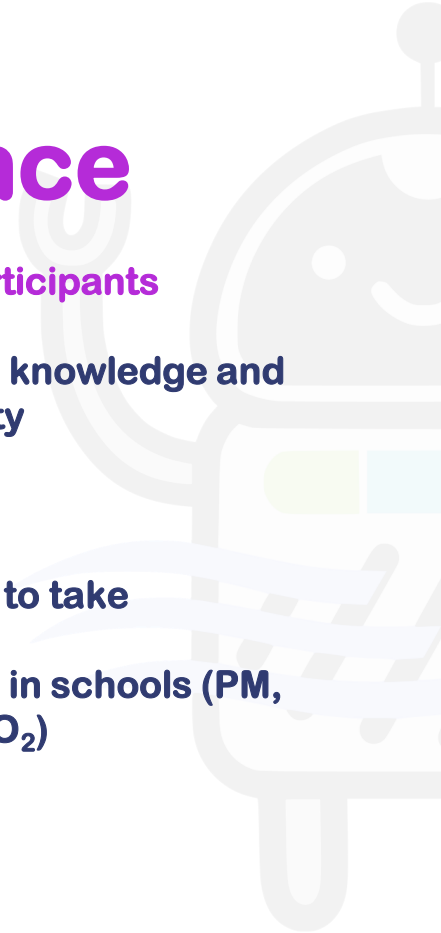




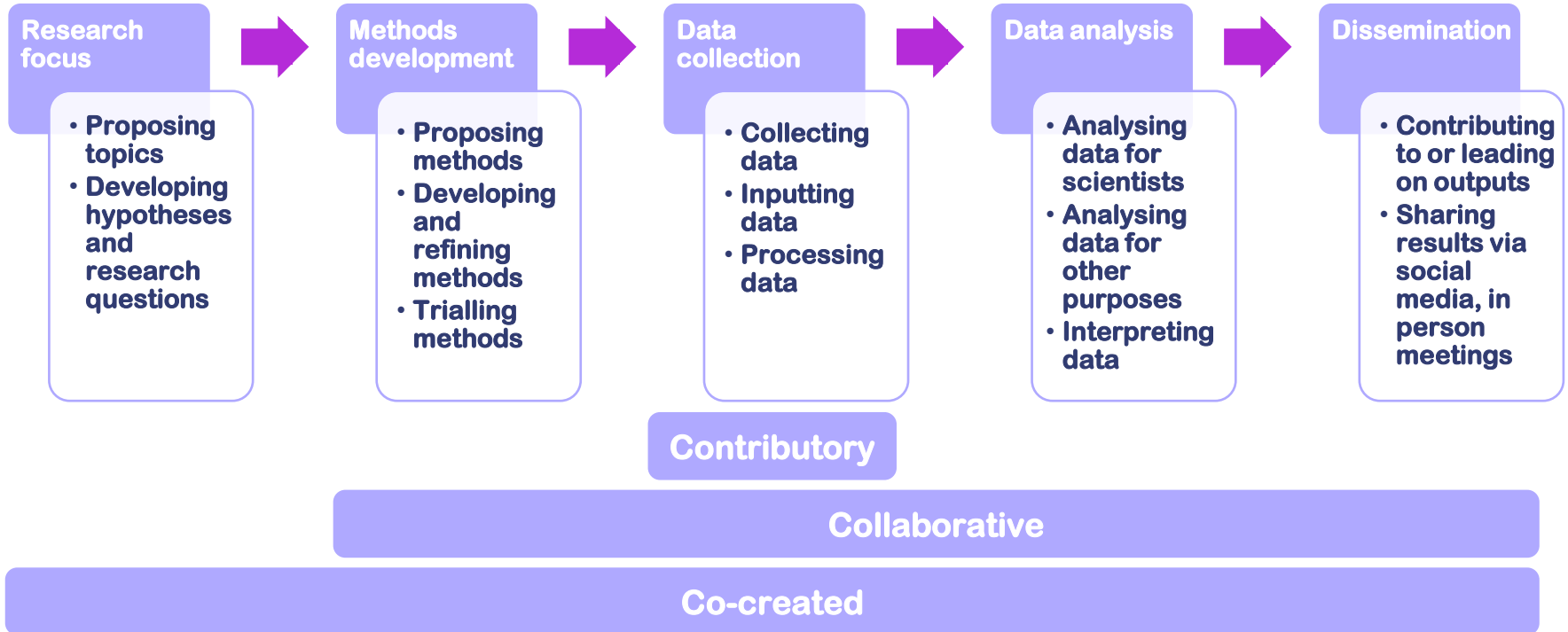
Citizen science

Benefits for science and for participants

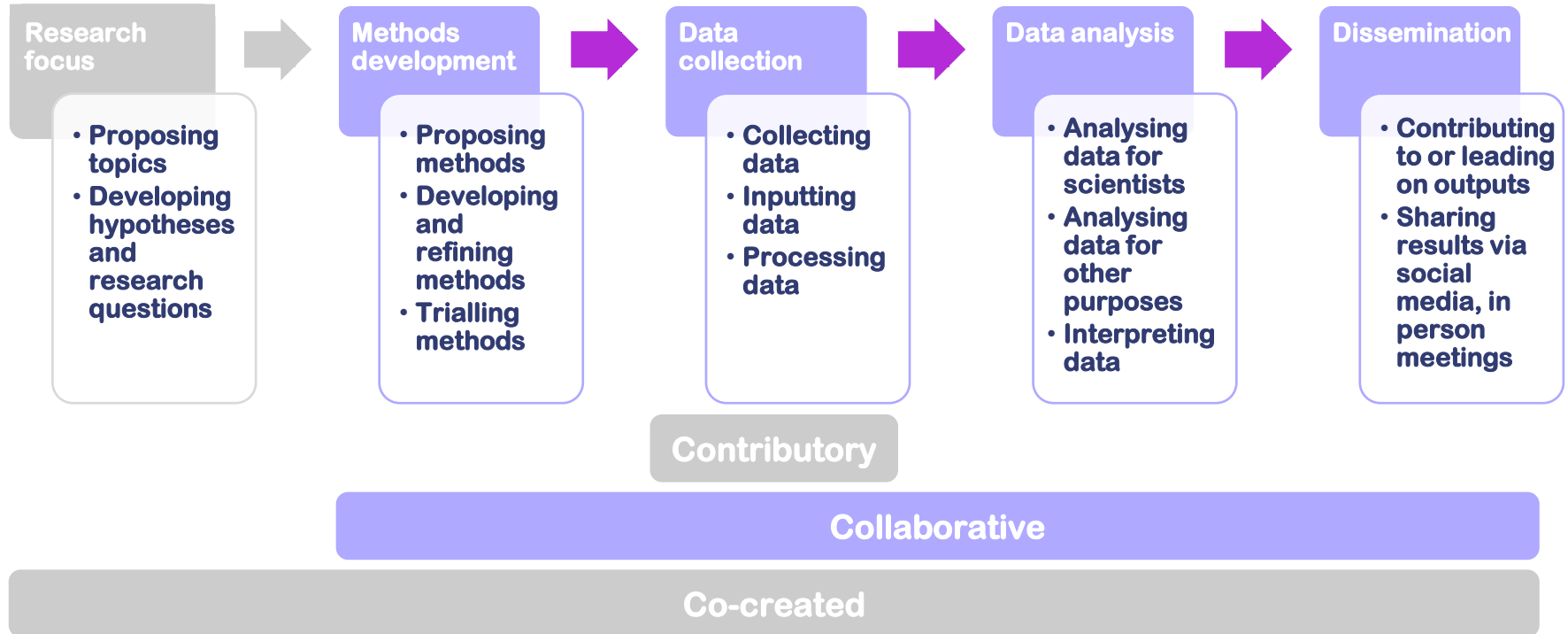
- Pupils (and teachers) gain knowledge and understanding of air quality
- Skills
- Knowledge of what action to take
- New data about air quality in schools (PM, TVOCs, temp, humidity, CO₂)



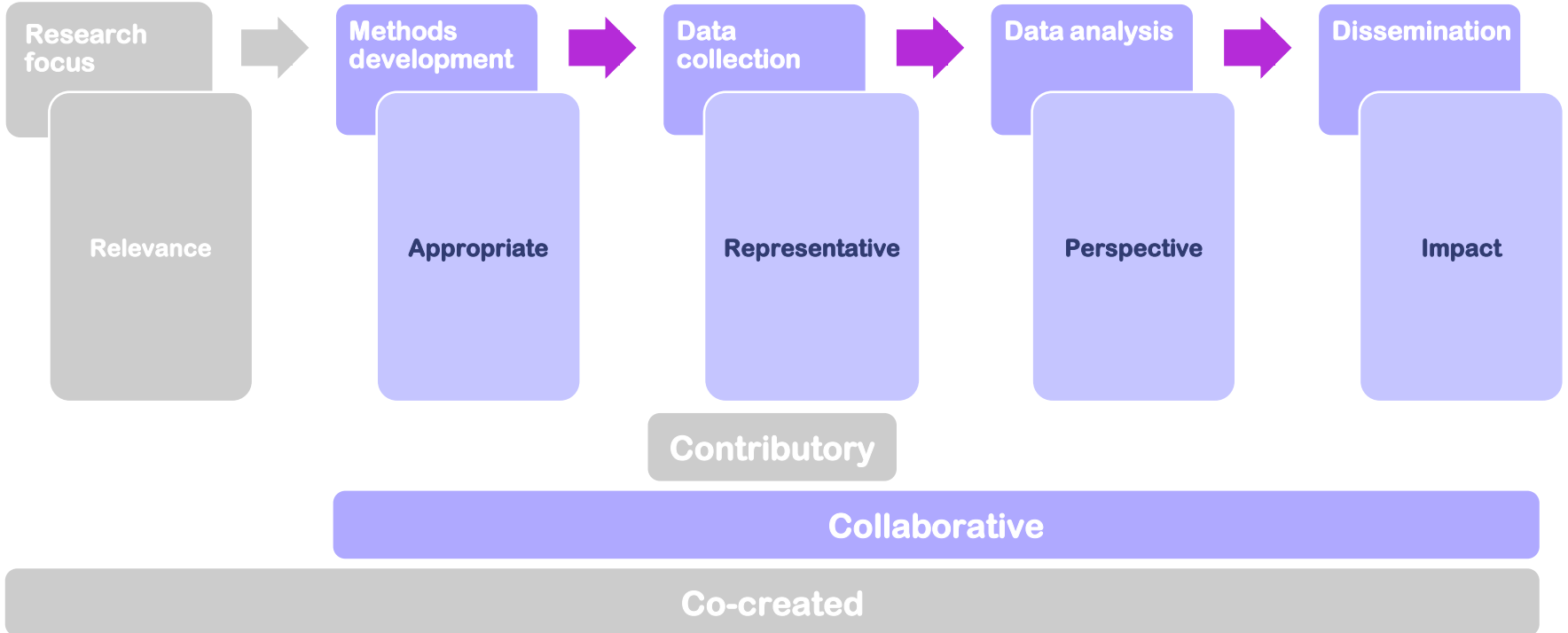
Citizen science and SAMHE



Citizen science and SAMHE




Citizen science and SAMHE



SAMHE Web App: home page

SAMHE
WEB APP


Data Activities Achievements Library User ID: 140



Hello User 140

Welcome to the SAMHE Web App! Thank you for investigating your school's air quality with us.

With the SAMHE Web App you can explore data from your SAMHE monitor, complete activities to investigate your data and learn more about the air quality of your classroom.



New to the web app?

Take the tutorial

Live Data

Use these data views to explore data from your SAMHE monitor in more detail. To understand what the numbers mean, take a look at our [guidance on interpreting monitor readings](#).

Activities

Below you will find activities to help you to explore and understand your air quality using your SAMHE monitor

🔒 Locked 📱 Ready 🔄 In Progress 🏁 Complete 🛠️ Equipment needed

SAMHE Web App: Home page



Live Data

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Activities

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🔒 Locked 📱 Ready 🔄 In Progress 🏁 Complete 🛠️ Equipment needed

👤 1 person required 👥 2 people required 👥 3 people required 📊 Count

Please note some activities may be locked for students

Survey

The SAMHE survey - for pupils

Please complete our SAMHE survey, we'd like to know what you think! This survey will ask you questions about your knowledge and understanding of indoor air quality, as well as how you feel about indoor air quality.

🕒 20mins

Survey

The SAMHE survey - for teachers

Please complete our SAMHE survey, we'd like to know what you think! This survey will ask you questions about your knowledge and understanding of indoor air quality, as well as how you feel about indoor air quality.

🕒 20mins

Tutorial

Tutorial

This tutorial covers the key features of the SAMHE Web App, such as the activities and data views, to help you find what you need and make best use of it. You can revisit this tutorial at any time if you need a reminder.

🕒 5mins

SAMHE Web App: Activities



Data

Activities

Achievements

Library

User ID:140



Activities

Below you will find activities to help you explore and understand your air quality using your SAMHE monitor.



Activity key

Locked Ready In Progress Complete Equipment needed

1 person required 2 people required 3 people required Count

Please note some activities may be locked for students.

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Survey



The SAMHE survey - for teachers

Please complete our SAMHE survey, we'd like to know what you think! This survey will ask you questions about your knowledge and understanding of indoor air quality, as well as how you feel about indoor air quality.

Tutorial



Tutorial

This tutorial covers the key features of the SAMHE Web App, such as the activities and data views, to help you find what you need and make best use of it. You can revisit this tutorial at any time if you need a reminder.



Data Analysis






Temperature changes throughout the day

In this Data Analysis activity you'll be asked to find out the maximum (highest) and minimum (lowest) values for temperature during the school day. We recommend that you complete this activity in the afternoon.


SAMHE Web App: Activities





Data Activities Achievements Library User ID:140 

Data Entry

Move your monitor


This is an activity to report movement of your SAMHE Monitor and to help keep an accurate record of where the monitor was, and when.

 5mins

Data Entry

Describe your room

Use this Data Entry activity to describe the characteristics of the classroom where the SAMHE monitor is currently being kept. This activity will give important contextual data to help scientists analyse the data from your SAMHE monitor.

 30mins

People

CO₂ levels before and after exercise

This People activity involves you and your classmates moving around in your classroom with the windows and doors shut to investigate how the CO₂ level in your classroom changes when you and your classmates exercise.

 15minsQuiz

Understanding your SAMHE monitor: CO₂

This Quiz activity involves answering questions on carbon dioxide (CO₂). Completing this activity will improve your knowledge on what can affect the CO₂ readings in your classroom, and what changes in CO₂ readings can mean.

 15minsData Detectives

Data Detectives

If you see patterns in your SAMHE data that you didn't expect, use this Data Detectives activity to further analyse this data and investigate potential causes. This will help scientists understand how changes in your classroom affect the data.

Quiz

End of term SAMHE Quiz

This Quiz activity involves answering questions on indoor air quality. Completing this fun activity will improve your knowledge and understanding of indoor air quality.

Data Entry

Describe your building

Use this Data Entry activity to describe the characteristics of your school building. This activity will give important contextual data to help scientists analyse the data from your SAMHE monitor.

Quiz

SAMHE careers activity

This Quiz activity involves reading our 'A Day in the Life of the SAMHE team' booklet and answering questions to discover more about science careers.

SAMHE Web App: Data Views



Data

Activities

Achievements

Library

User ID:140

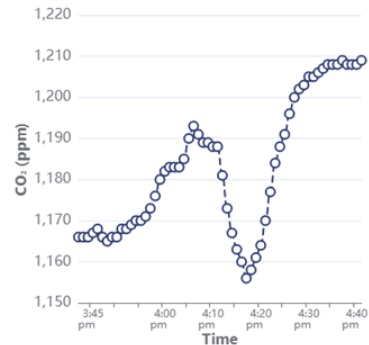


SAMHE Web App - Data Views

Use these data views to explore data from your SAMHE monitor in more detail. To understand what the numbers mean, take a look at our [guidance on interpreting monitor readings](#).

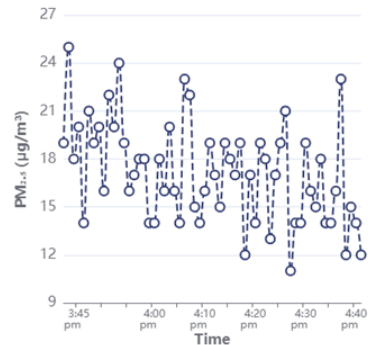
Line plot (CO₂)

Simple Plot of: CO₂
Now: 1209ppm



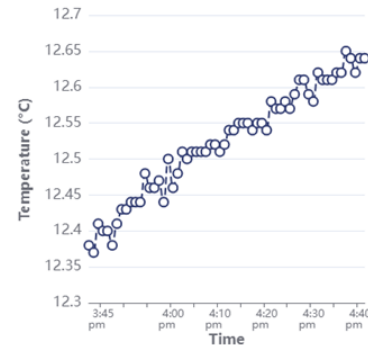
Line plot (PM_{2.5})

Simple Plot of: PM_{2.5}
Now: 12µg/m³



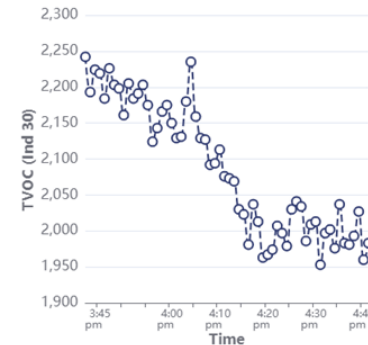
Line plot (Temperature)

Simple Plot of: Temperature
Now: 12.64°C



Line plot (TVOCs)

Simple Plot of: TVOC
Now: 1983Ind 30



Line plot (Humidity)

Simple Plot of: Humidity
Now: 69.23%



Single axis scatter plot (CO₂)

Monday

Single axis scatter plot (PM_{2.5})

Monday

Single axis scatter plot (Temperature)

Monday

SAMHE Web App: Data Views



Data

Activities

Achievements

Library

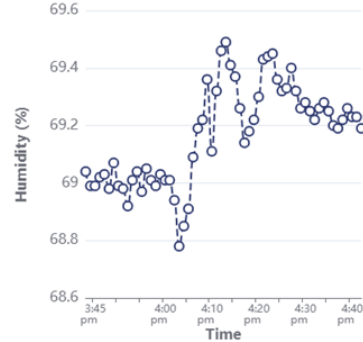
User ID:140



Line plot (Humidity)

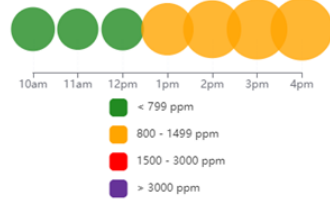
Simple Plot of: Humidity

Now: 69.19%



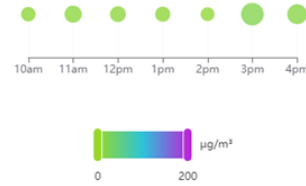
Single axis scatter plot (CO₂)

Monday



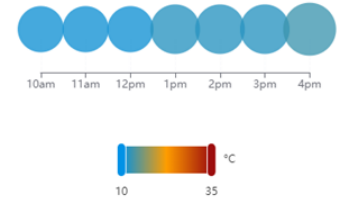
Single axis scatter plot (PM_{2.5})

Monday



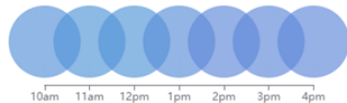
Single axis scatter plot (Temperature)

Monday



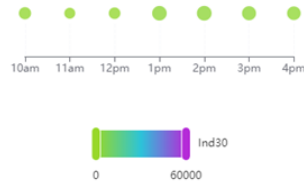
Single axis scatter plot (Humidity)

Monday

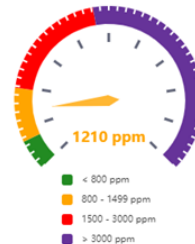


Single axis scatter plot (TVOCs)

Monday



Gauge chart (CO₂)



Gauge chart (PM_{2.5})



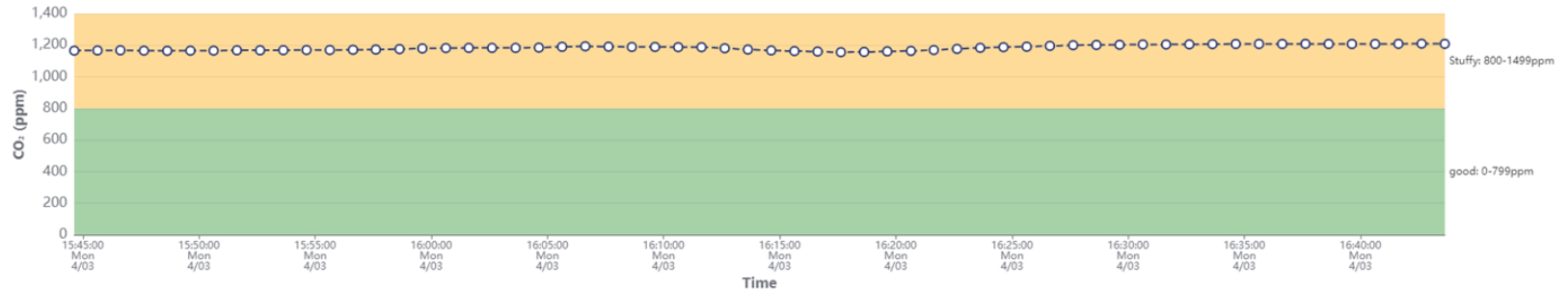
SAMHE Web App: Data Views

Line plot (CO₂)

A simple line plot of CO₂.

Show Description

Data CO₂ Air Quality



Data Refreshing

Select when your data should reload

Refresh data

Live Update

Plot View Options

Select how your data is plotted

Start Y axis at 0

Show Min and Max

Show Average

Select your date range

This is the range of data that will be shown in the graph below.

Last Hour

Showing all available data from: 15:44:09 04/03/2024 to 16:44:09 04/03/2024

Select the interval of your data.

For example select 5 minutes to show the average value every 5 minutes.

No aggregation



123

Schools in our
Co-Design and
Pioneer
phases



1070

Schools
signed up so
far



2,000

Target
schools
across the
UK

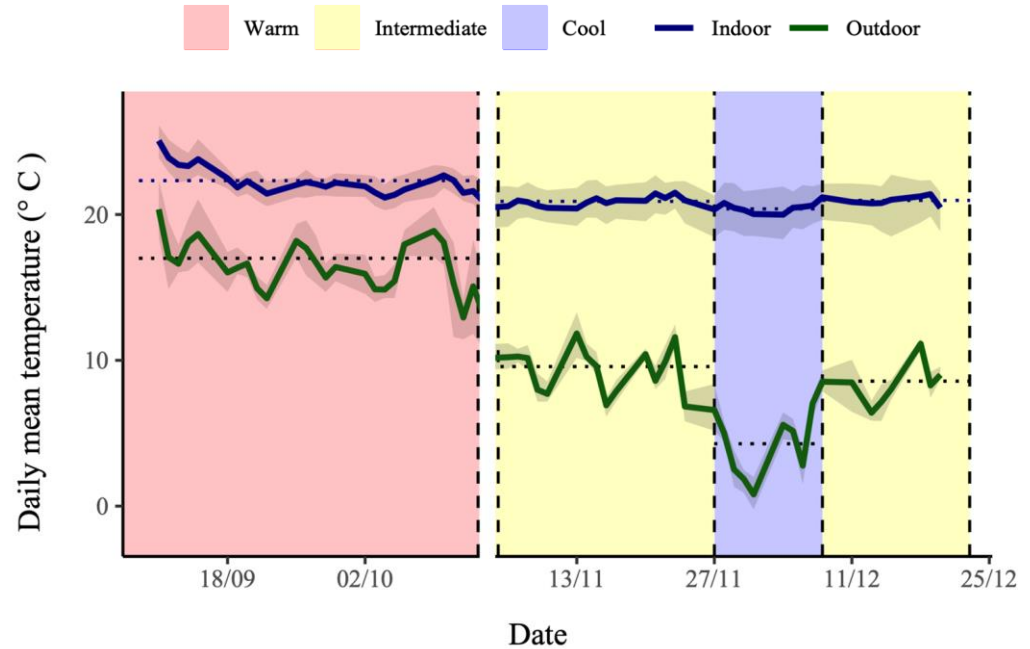
The SAMHE monitor and app have provided our Y4/5 science group with a wealth of data to interrogate and analyse. The children's enthusiasm has been infectious and there is tangible excitement at being able to access the data in real time...We are now determined to continue, working towards earning all the achievement badges

Teacher, SAMHE Co-Design school



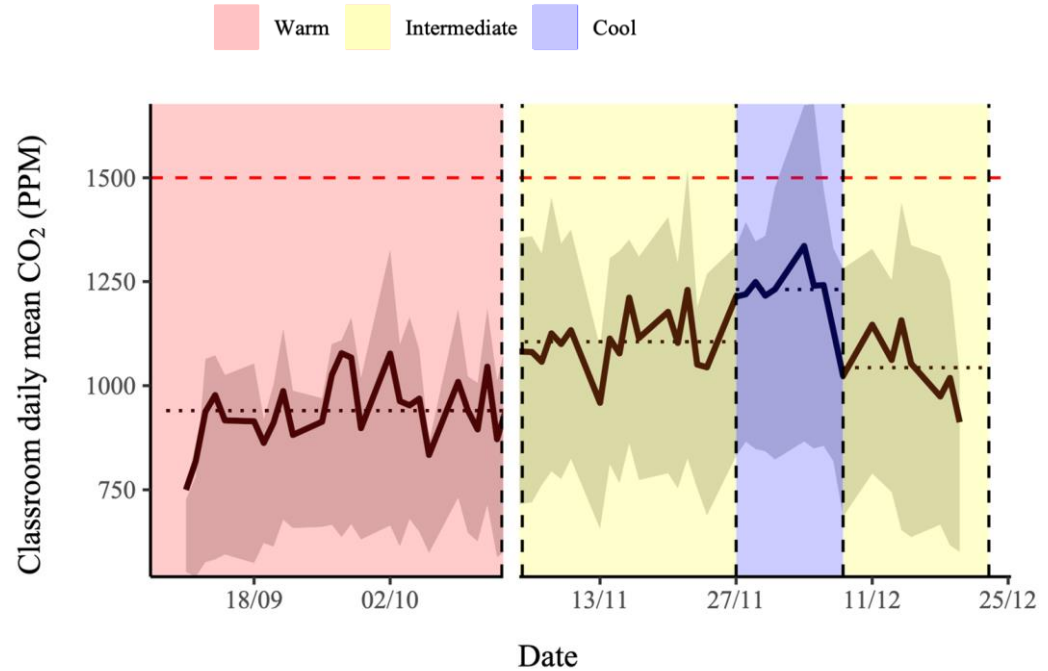
Autumn term data: temperature

- Mean temperature across 193 SAMHE schools
- Four weather periods based on outdoor temperature
- Indoor temperature stable between intermediate and cool periods



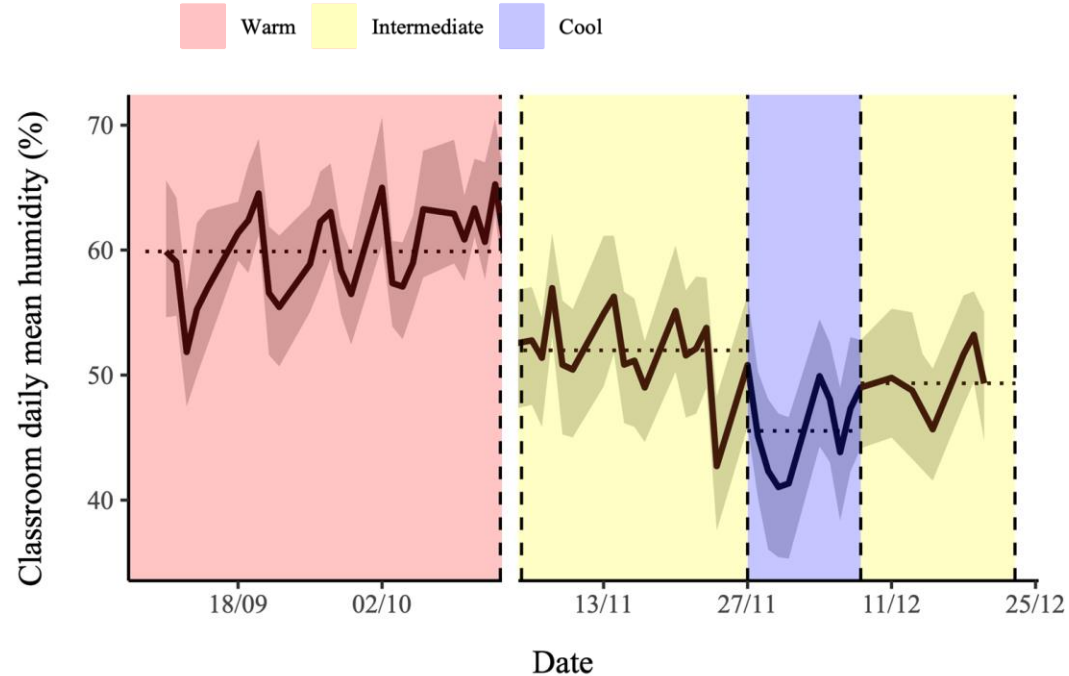
Autumn term data: CO₂

- **BB101 threshold of 1500 ppm not exceeded during warm periods**
- **During the colder period many school days exceed BB101 threshold**



Autumn term data: humidity

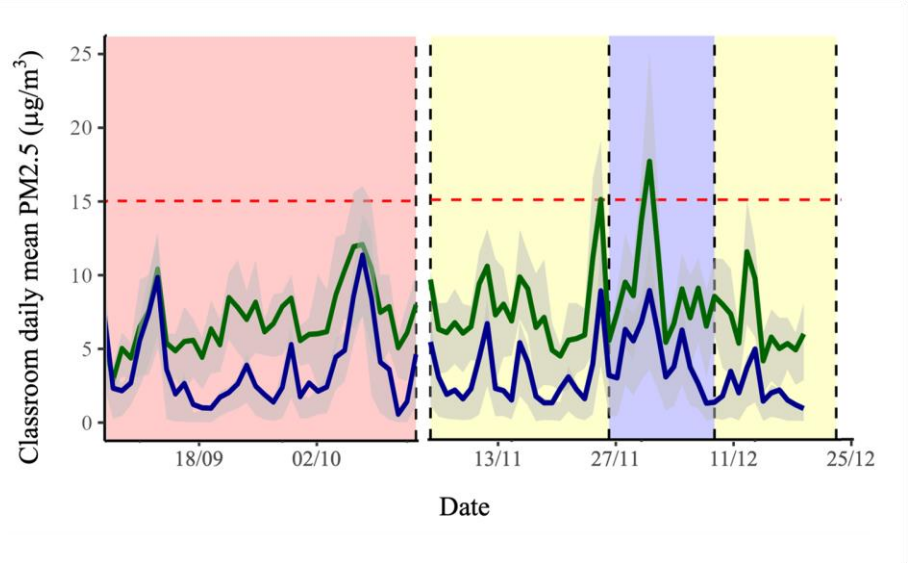
- Humidity lower during colder periods
- Humidity varies differently to different temperature periods to CO₂
- Affected respiration and outdoor humidity



Autumn term data: PM_{2.5}

- All school days below WHO guideline
- Indoor particulate matter closely correlated to outdoor levels

Warm Intermediate Cool Indoor Outdoor



Challenges for improving IAQ

- Air quality is largely invisible
- Children are particularly vulnerable
- Ventilation is very important - but challenges with rising energy costs
- Raising awareness is critical
- Tailored advice about actions is needed
- Schools/ teachers under resourced



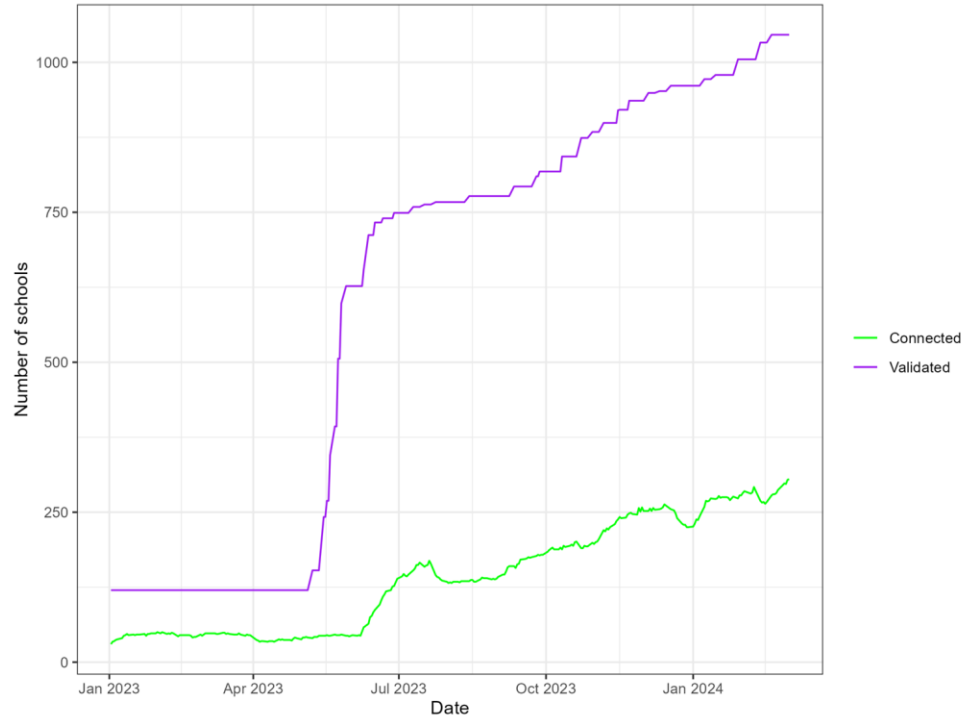
Challenges for improving IAQ

Connectivity challenges:

- Teachers have a lack of time
- Network issues

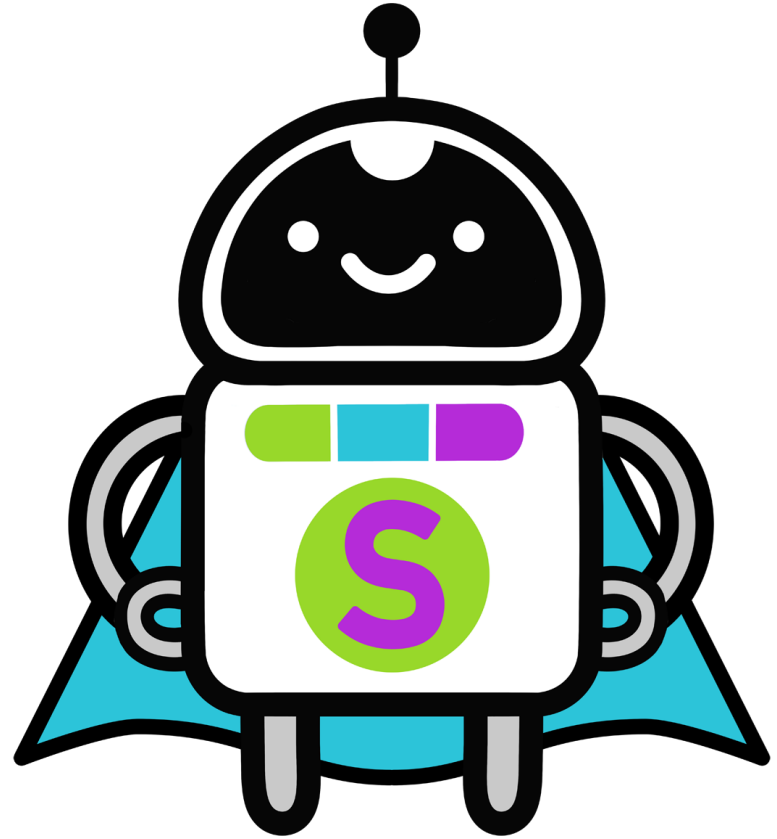
Connectivity initiatives:

- Connectivity sessions
- Comms: calling schools, emails, social media
- Connection competitions
- SAMHE champions ...



SAMHE champions

- Local authorities, educational charities, not for profits
- 'Boots on the ground' approach
- Mutually beneficial engagement
- 'Term in data' reports
- Could you help us?



Get in touch!

www.samhe.org.uk

hello@samhe.org.uk, rhys.archer@york.ac.uk



IMPERIAL

