

# SUSTAINABLE DEVELOPMENT GOALS IN EDUCATION

projects that show how STEM can contribute to achieving the SDGs

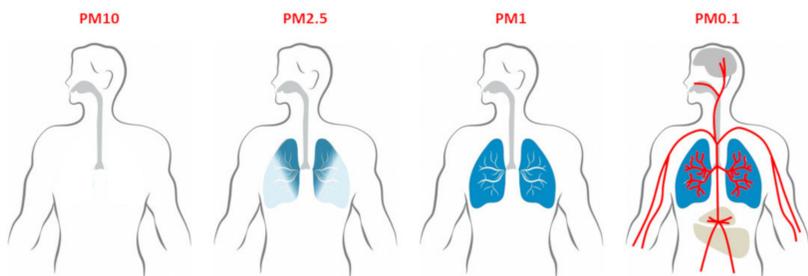
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Students research the amount of particulate matter in the air and its effects on health, with a sensirion SPS30 sensor

In September 2021 the WHO (World Health Organization) issued a new advice about air pollution. Because major health problems arise from air pollution, even if the air quality meets current legal standards. More than 8 million people worldwide die prematurely because of poor air quality, according to the WHO. In Europe this concerns 440,000 people and in the Netherlands 12,000. With this project we try to make young people more aware of the air in their environment. After all, our air makes the earth habitable. Without air there is no life for us, while the current air quality can make us sick this very moment.

The WHO guidelines work with a classification based on size, because it says something about the ability to penetrate into the human body. Particles larger than 10 µm get stuck in your upper respiratory tract. Particles with a size of 2.5 to 10 µm remain in the mucous membranes of the airways. Particles smaller than 2.5 µm can penetrate deep into the lungs and can enter the bloodstream through the alveoli.

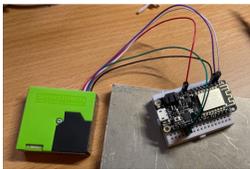
Particulate matter does not only have an impact on humans, but also on all other organisms and on our natural living environment. In general you can say that there is a correlation between climate change and air quality also. The relationship is complex and a lot of scientific research is still needed to understand the relationship. We know that certain pollutants such as (black) elemental carbon give rise to an increase in temperature through heat adsorption. Elemental carbon is part of particulate matter and mainly comes from incomplete combustion processes. More particulate matter also leads to more clouds: it gets warmer under the cloud cover, but the white clouds at the top reflect the heat radiation from the sun back into space, thus cooling them down.



## Methods

### Idea

Students make a team of four persons. Every team member chooses the role of an expert. For example; one is a doctor, the other an environmentalist, another a data analyst and an engineer. Within their expertise they do small research. They ask themselves a research question for example; what's the influence of particulate matter on human health or how does a sps30 sensirion sensor works or what are sources of particulate matter in the school surroundings? They will also look at the various emission sources; the natural sources, but also the anthropogenic sources.



### Plan

The particulate matter sensor that students use distinguishes between particle sizes of PM2.5 (all particles smaller than 2.5µm) and PM10 (all particles smaller than 10 µm). After the exploration, students formulate a research question. They have to make a research plan (method), e.g. they look at the influence of wind on particulate matter movement (sometimes several hundred kilometers), in relation to the location of their sensor.

### Implement

When their work plan is approved by the teacher, students can assemble their sensor kit (sensor, microcontroller, power supply, cables, housing). They learn to program the microcontroller and adapt it to their situation, for example to program their WiFi access. With a power bank and their phone's hotspot, they can use the sensor kit at any desired location in their city and in the field to collect their data. Material is available for this.

### Analyse

Students analyze their own data and compare their data with the data of the Grafana website. They also make a graphical overview of the most interesting results.

### Evaluate

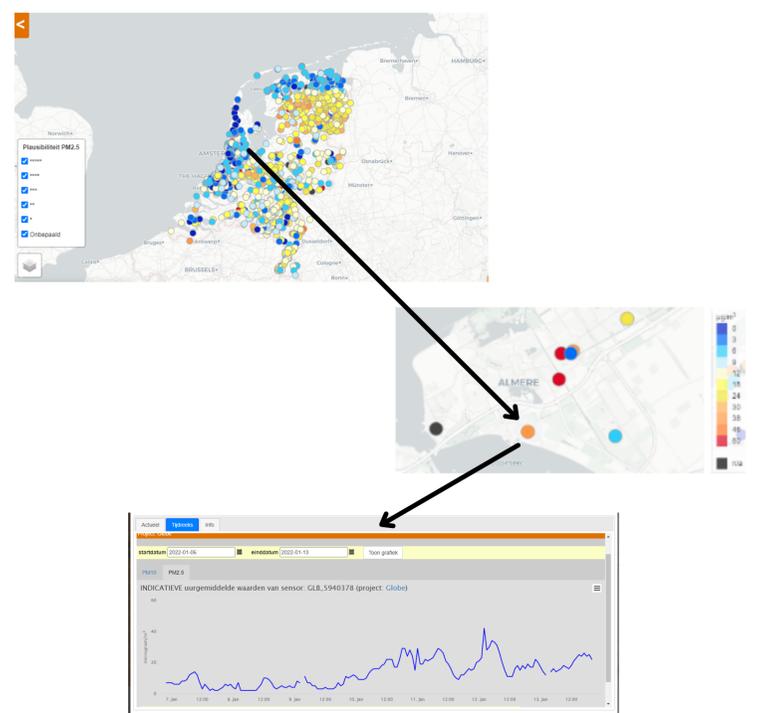
Based on the results, they work as a team to decide how they can contribute to reduce the amount of particulate matter and improve air quality. For instance, they can approach the school, their parents, the (sub)municipality, the local government and discuss their data and conclusions, with the aim of reducing the amount of particulate matter.



## Results

The RIVM (National Institute for Public Health and the Environment) in the Netherlands has been measuring the particulate matter concentration in the atmosphere since 1992 at a number of official measuring points. European sister organizations of the RIVM make comparable measurements. This makes them an important institute in research into particulate matter. They collect all kinds of data about our living environment. They do this to monitor the quality of our living environment. The data collected by students in the Netherlands, with their sensor kit, ends up in their database.

<https://samenmeten.rivm.nl/dataportaal/>



## Conclusion

The Netherlands has since 2020 an agreement of clean air between the central government and the local government. Those participants has the ambition to reduce the particulate matter of 50% in 2030. The particulate matter project is now running by several schools in the Netherlands.

