



Lesson insert 3 : Health impacts of air pollution Presenters' guide

Aim

The aim of this lesson insert is to introduce students to links between sources of air pollutions and possible affects to human health. Students play a game where they support a group of scientists guessing health impacts based on exposure to different air pollutants and are invited to explore air quality varies across the world.

Equipment

- One deck of cards (Guess the Health Impacts- The game) per student or correspondent prints
- Lesson insert 3 PowerPoint slides

Preparation

Playing the game requires some preparation time. You will need to print one set of cards per student. A potential way to save time is to print 4 health cards on the same A4 sheet and ask students to cross out cards as they ask their questions. In this case students should use the chance cards. You will also need time to print evaluation materials. More information regarding evaluation materials can be found at the end of this document.

Curriculum links across all the MANAPRE educational resources

Our lesson inserts have been designed with links to the national curriculum. The list is not extensive and we are keen to work with teachers and presenters to make these links clearer and more comprehensive.

Subject	Level	Link
Geografía	Secundaria 1	Medioambiente y sustentabilidad Analiza la relación entre el deterioro del medioambiente y la calidad de vida de la población en diferentes países.
Química	Secundaria 3	Propiedades Caracteriza propiedades físicas y químicas para identificar materiales y sustancias, explicar su uso y aplicaciones.
Química	Secundaria 3	Ecosistemas Argumenta acerca de las implicaciones del uso de productos y procesos químicos en la calidad de vida y el medioambiente.
Matemática	Secundaria 1	Estadística



		Recolecta, registra y lee datos en tablas; usa y interpreta moda, media aritmética y mediana.
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Introduction [5 minutes]

NOTE: Please give your student the pre evaluation questionnaire ahead of this lesson. Mode retails regard evaluation can be found at the end of this document.

Keeping healthy

Begin by splitting the room into pairs of students. Give students 1 minute to discuss how they think they can keep healthy. Shows them the slide with the different ways of keeping healthy until you reach cleaner air. Often students don't associate air quality as a factor which impacts health so this is good way to introduce them to the topic.

Tip: Ask them to leave their hands up whilst going through the slide and to lower their hands if they have discussed any of the topics on the list. This way you can also understand how many of your students is aware of air pollution as a barrier to health and wellbeing.

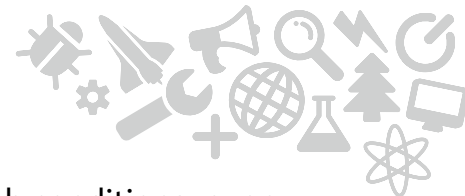
Air pollution is everywhere

Start by expanding to students that air pollution is everywhere (urban and rural areas) even in at home. The way we heat our homes and the way we cook can raise the levels of indoors air pollutants. Dust is an example of an indoor air pollutant. Because our planet has a rich and dynamic atmosphere, air pollutants travel across the world by weather patterns and ocean currents. The video [A Year in the Life of Earth's](#), created by NASA, shows how Carbon Dioxide (CO₂) sources are dispersed by the dynamics of the atmosphere. This is one of the reasons why air pollution is a global problem and every country must work together to lessen air pollution sources. The idea of air pollution being a global problem which can be tackle by individual citizens is further developed at the end of this lesson insert.

Where do air pollutants come from?

Both natural processes (such as volcanic eruptions) or human activity (burning of fossil fuels) can generate air pollution. For instance, pollen released by trees is an example of a natural air pollutant. Nitrogen Dioxide (NO₂) is a by-product of burning petrol and therefore is increased by human activity. There are other air pollutants and different ways of classifying them which is the focus of lesson Insert 1 Things in Air.

Air pollution impacts our health



Both natural and human-activity air pollutants can affect health conditions, even if we are exposed to an excess of air pollutants during a short period of time. Examples of links between air pollution and ill-health are heart disease, chronic obstructive pulmonary disease, lung cancer and acute respiratory infections.

Tip: It is worth reinforcing a key message to students regarding the fact that people's health is influenced by many factors. Being exposure to poor air quality is just one of these factors. Others like age, overall general health (e.g- body mass index) and lifestyle choices (e.g- smoking) will affect people's health. What we do know is that exposure to poor air quality can both initiate and enhance disease in humans. Cardiovascular disease accounts for the majority of deaths from air pollution with additional impacts from lung cancer, chronic obstructive pulmonary disease (COPD) and respiratory infections. Research shows that many of these health impacts rely on long-term (so called 'chronic') exposure to air pollution. This means we can all reduce our long-term exposure by acting now to improve our air quality; every little helps and every positive action adds up to reduce our overall lifetime exposure to pollutants in air.

Who studies air quality? – STEM person of the week

Juan Carlos is one of the scientists featured in our *STEM Person Of The Week – Who studies air pollution* resource, which is a 5 week intervention in schools designed to broaden students perceptions of people working in STEM and their attributes. If you are running this intervention in parallel we recommend to align the STEM person of the week with the one featured in this resource. For more information please refer to our presenter's guide 4.

There are several people studying air quality such as Juan Carlos who is a paediatrician interested in understanding how air quality affects conditions such as asthma and leukaemia.

Activity [20 minutes]

The game [5 minutes preparation + 10 minutes to play]

1 - Context

Your students are invited to work alongside a group of scientists interested in understanding how air pollutants affect the health of humans. Their goal is to find the links between different air pollutants and health, so they can all take action to minimise air pollution and improve health.

Each set of cards comes with instructions which should be read by the students. Here is the information needed to play the game:

NOTE: playing the game requires some preparation time. You will need to print one set of cards per student. A potential way to save time is to print 4 health



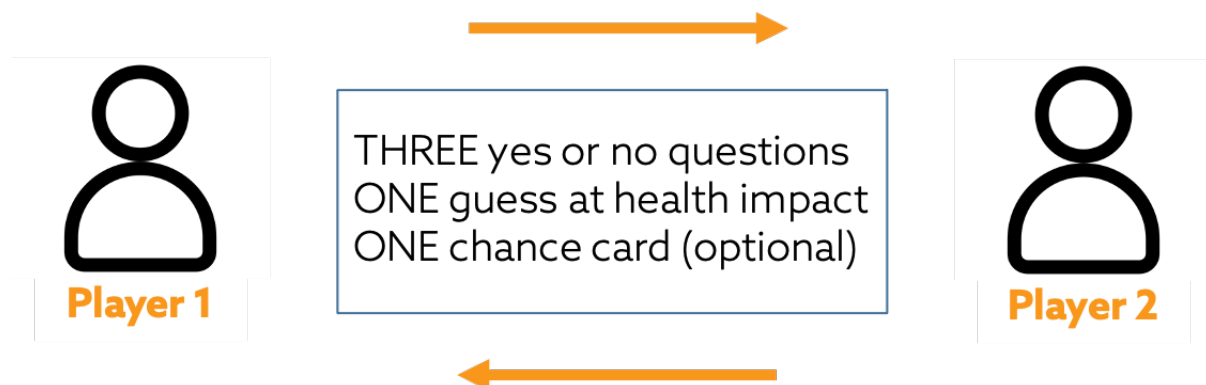
cards on the same A4 sheet and ask students to cross out cards as they ask their questions. In this case don't allow students to use the chance cards.

2 - Aims

- Guess the health impact on your opponent's card, by asking them three yes or no questions.
- Ask questions based on the information given on your cards.
- If you guess correctly you earn the points on the top of the card.
- After three rounds, the player with the most points, wins.

3 - How to play

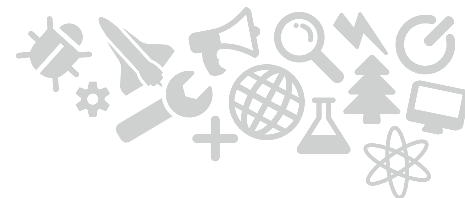
- Play in pairs.
- Each player gets their own deck of cards.
- Shuffle the chance cards and lay them face down.
- The game ends after three rounds.
- Each round entails:



- Remove the "guessed cards" from play after each round.

4 - Asking questions

- 4.1- Lay your deck of cards on the table face up.
- 4.2- On the cards, read the information about the air pollutants, their sources, and the body parts affected.
- 4.3- Use this information to ask three questions that require a YES or NO answer. See what questions you can ask next.
- 4.4- You then have one chance to guess the health impact. Get it right and win the points.
- 4.5- Feeling lucky? Pick one chance card from deck. Some will add points others subtract to your score This is optional.



5 - Answering questions

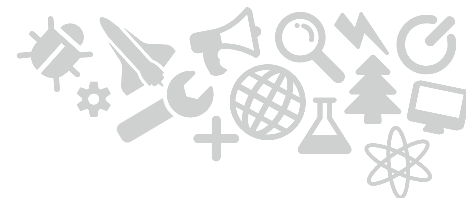
- 5.1- Read the information about the air pollutants, their sources, and the body parts affected on the cards.
- 5.2- Pick one card and keep it hidden. Lay the other cards on the table face down.
- 5.3- Answer the three yes or no questions. See what questions you can ask next.
- 5.4- Your opponent now has one chance to guess your health impact.
- 5.5- They can also pick a chance card from deck which will add or subtract points. This is optional.

6 - Questions allowed

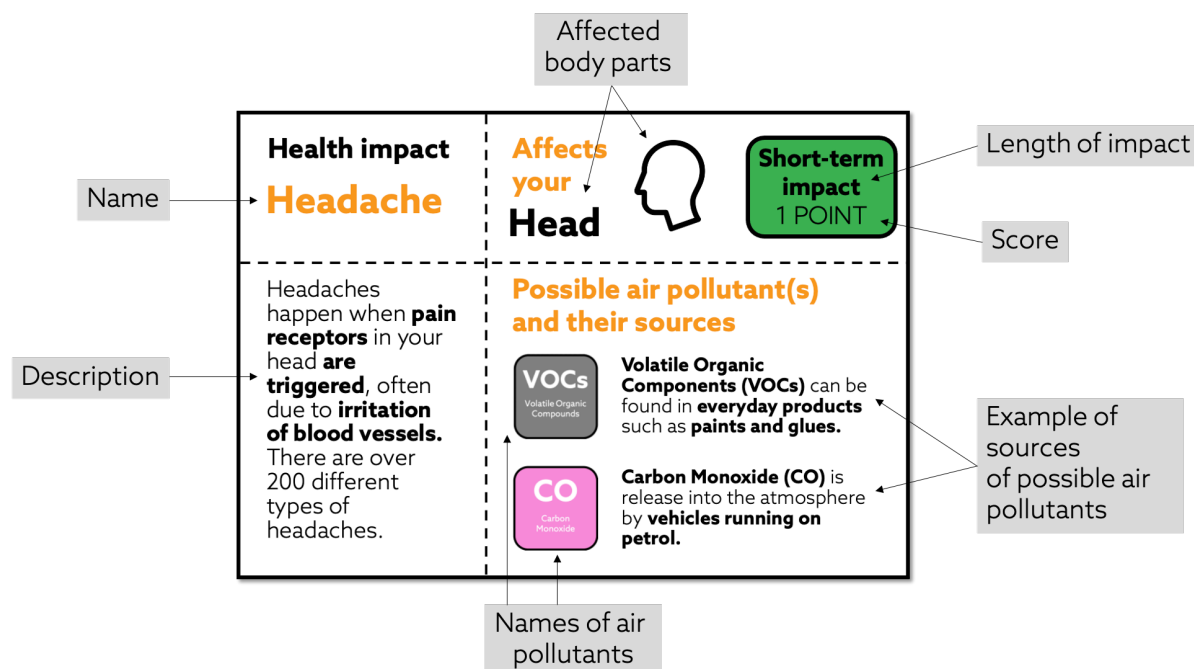
Types of questions	Example
Description of health impact	Is it related with pain receptors? Does it affect your memory?
Name of air pollutants	Is it linked with sulphur dioxide (SO ₂)?
Sources of air pollutants	Is the source of pollution road traffic?
Body parts	Does it affect your brain? Does it affect your airways?
Others questions	Is it short-term? Is the air pollutant in a pink box?

7 - Questions NOT allowed

Types	Example
Name of health impact	Is it COPD? Does it start with the letter H?
Questions with no yes or no answers	What are the air pollutants in your card? What are the sources of air pollution?



8 - Structure of the cards



NOTE: Wording the cards with POSSIBLE air pollutants was a deliberate choice whilst creating this resource.

Wrap up activity [5 minutes]

Health impacts of air pollution

Give students 1 minute to explore the cards and select one example they were unfamiliar with regarding:

- What body parts are affected by air pollution?

But don't forget to mention that, our overall health reflects many aspects of our local environment, not just the quality of the air, but also our lifestyle choices (the things we eat, the things we do) and our personal characteristics (our age, our genetic make-up). All of this complex range of factors influence our health – our air quality is just another one of these many factors.



- POSSIBLE sources of air pollution?

The final question, 'Who can be affected?' is a good prompt for wrapping up this lesson insert

Lesson insert wrap up [5 minutes]

Air pollution is a global problem

According to the World Health Organisation (WHO) 9 out of 10 people breathe air containing high levels of pollutants which unfortunately resulted in the premature deaths of 7 million people (in 2016). These death are associate with both indoors and outdoors air pollutants.

In Mexico

Mexico, like many other countries adds to these global statistics as shown in some of the media headlines.

Tip: A report published by the Secretaria del Medio Ambiente (SEDEMA) suggests that in 2015 there were 29 000 deaths related with one particular air pollutant, particulate matter 2.5 (PM_{2.5}). The report also highlights the efforts which Mexico City undergone over the past 25 years in order to reduce air pollution. Our Lesson insert 2 – Monitoring air quality in CDMX will enable yours students to access some of this data and verify the declining trend of this type of air pollutant.

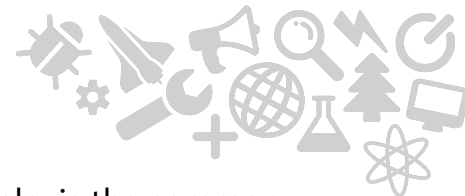
Air pollution and Sustainable Development Goals (SDGs)

As air pollution is a global problem, countries need to work together on solutions for reduce the sources of air pollution, especially those linked with human activity. Examples of these global solutions are:

- addressing sustainable transport
- more efficient and renewable energy production
- better use and waste management.

Addressing air pollution is part of the Sustainable Development Goals number 11, which is one of 17 goals aimed at making the world a better place by 2030.

The goals have been agreed by members of the United Nations (UN). The SDGs should enable young learners to see themselves as global citizens and engage with opportunities to take action for sustainable development at schools, local communities and beyond.



CLEAR AIR FOR ALL! Everyone is responsible, everyone can help, is the common message across all of the MANAPRE educational resources and good call for action for you and your students to think about what can they do to tackle air pollution.

Extension

Air quality across the globe

Thanks to the development of technology there are many air quality monitor stations across the world which measure levels of pollutants in the air, in real time. The data generated by this global network allows scientists not only monitor but also to model and understand local and global trends related with air quality.

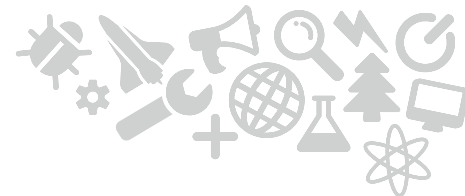
This data is also converted into different bands also known as Air Quality Index (AQI) which help inform citizens about their local air quality, just like a weather forecast. AQIs tend to be represented on an interval notation showing a value falling between two endpoints (e.g – 51-100) and their scales are often coloured coded. They also contain information regarding health implication for citizens.

[The World Air Quality Index website](#) contains information about air quality indexes across the globe. Clicking on the arrows will give you detailed information about local levels of up to six air pollutants: PM_{2.5}, PM₁₀, O₃, NO₂, SO₂ and CO. Its AQI scale is as follows:

AQI	Air Pollution Level	Health effects
0-50	Good	No health risks
51-100	Moderate	Moderate health concern for people who are sensitive to air pollution.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects.
151- 200	Unhealthy	Everyone may begin to experience health effects.
201-300	Very Unhealthy	The entire population is more likely to be affected.
300+	Hazardous	Health alert: everyone may experience more serious health effects.

A potential activity for your students is to look at local stations and have a discussion regarding how the local air quality links with characteristics of the area you are monitoring. A few suggestions below:

- Residential areas
- Industrial areas
- Small villages



- Coastal areas
- High altitudes

Another potential extension would be to ask for suggestions of places where students think air is **less polluted** or **more polluted than** their city or area. Ask students to justify their choices.

Further reading:

List of recommended sources of information for teachers and presenters keen to learn more about air quality and used across all the MANAPRE educational resources

Sustainable Development goals for teachers

<https://oxfamlibrary.openrepository.com/bitstream/handle/10546/620842/edu-sustainable-development-guide-15072019-en.pdf?sequence=4#:~:text=The%20SDGs%20are%20a%20set,the%20world%20a%20better%20place.&text=The%20SDGs%2C%20also%20known%20as,protect%20the%20climate%20and%20environment.>

WHO health impacts of air pollution overview

<https://www.who.int/news/item/02-05-2018-9-out-of-10-people-worldwide-breathe-polluted-air-but-more-countries-are-taking-action#:~:text=Air%20pollution%20levels%20remain%20dangerously,outdoor%20and%20household%20air%20pollution>

SEDEMA health benefits of reducing air pollution in CDMX

<http://www.data.sedema.cdmx.gob.mx/beneficios-en-salud-por-la-mejora-de-la-calidad-del-aire/descargas/analisis-espanol.pdf>

Mitigating Exposure to Traffic Pollution in and around schools

http://epubs.surrey.ac.uk/857127/1/4564_Brochure%20%28FINAL_All%29.pdf

Sustainable Development goals for teachers

<https://oxfamlibrary.openrepository.com/bitstream/handle/10546/620842/edu-sustainable-development-guide-15072019-en.pdf?sequence=4#:~:text=The%20SDGs%20are%20a%20set,the%20world%20a%20better%20place.&text=The%20SDGs%2C%20also%20known%20as,protect%20the%20climate%20and%20environment>

Evaluation toolkit



The MANAPRE educational resources were created under an evaluation framework which help presenters to quantify changes in students' knowledge and appreciation of air quality. The evaluation is easy to implement and explained below. All the forms are available online and any evaluation collected should be sent electronically to nustem@northumbria.ac.uk.

Student pre and post questionnaires:

These we design to collect a baseline information of knowledge and appreciation of the subject. The pre questionnaire should be given to students ahead of any delivery and *is independent of the number of activities you choose to deliver to your students*. In a similar way the post questionnaire should be given to your students after all the MANAPRE activities you choose to deliver.

Before we start...

How much do you agree with the following statements?

(please circle one face on each row only)

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
1 I know what air pollution is	☹	☹	☺	☺	☺
2 I understand how air pollution can impact our health	☹	☹	☺	☺	☺
3 I know how I can help tackle air pollution	☹	☹	☺	☺	☺
4 I know how to measure air quality	☹	☹	☺	☺	☺
5 I think environmental science is interesting	☹	☹	☺	☺	☺
6 I know some different jobs in environmental science	☹	☹	☺	☺	☺
7 People who work in environmental science have exciting jobs	☹	☹	☺	☺	☺
8 I am interested in protecting the environment	☹	☹	☺	☺	☺
9 I would like to find out more about air pollution	☹	☹	☺	☺	☺

First letter of your first name: Favourite food: Favourite animal: Favourite colour: Boy or Girl?

nustem

And finally...

How much do you agree with the following statements?

(please circle one face on each row only)

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
1 I know what air pollution is	☹	☹	☺	☺	☺
2 I understand how air pollution can impact our health	☹	☹	☺	☺	☺
3 I know how I can help tackle air pollution	☹	☹	☺	☺	☺
4 I know how to measure air quality	☹	☹	☺	☺	☺
5 I think environmental science is interesting	☹	☹	☺	☺	☺
6 I know some different jobs in environmental science	☹	☹	☺	☺	☺
7 People who work in environmental science have exciting jobs	☹	☹	☺	☺	☺
8 I am interested in protecting the environment	☹	☹	☺	☺	☺
9 I would like to find out more about air pollution	☹	☹	☺	☺	☺

First letter of your first name: Favourite food: Favourite animal: Favourite colour: Boy or Girl?

nustem

Lesson insert learning feedback

These are quick evaluation postcards to give to your students at the end of the each lesson insert (except lesson insert 4). They were designed to gather information regarding enjoyability of the activities and any to identify any immediate subject knowledge enhancement but also to recognise any misconceptions.



Workshop Review

What can be found in air pollution besides gases?

How many stars would you give this workshop?

nustem

Workshop Review

Has air quality improved in CDMX over the past 20 years?

How many stars would you give this workshop?

nustem

Workshop Review

How can air pollution affect health?

How many stars would you give this workshop?

What new thing did you learn in today's workshop?

nustem

Northumbria University
NEWCASTLE

Teachers and presenters feedback

This form was design to collect the feedback of teachers and presenters regarding the content and delivery experience of any of the MANAPRE educational resources.

MANAPRE Teacher Feedback Survey

Which of the following MANAPRE activities did you do with your class?

	Yes	No	Not sure	How many pupils did the activity?
1 Things in Air				
2 Monitoring air pollution				
3 Health impacts of air pollution				
4 Who studies air pollution - STEM Person of The Week				

What do you think children in your class have learnt as a result of taking part in this project?
Please write below

What have you learnt as a result of taking part in this project?
Please write below

Has taking part in this project made you think about or do anything differently?
Please write below

nustem



Lesson insert 4 - Who studies air quality ? STEM person the week

For this particular intervention we kindly ask presenters to use the pre and post evaluation tool linked to lesson 4. This is easy to implement as we ask students to use 6 words to describe people working in STEM, before and after the 5 week intervention.

What six words would you use to describe someone who works in STEM?

1. _____	4. _____
2. _____	5. _____
3. _____	6. _____

* To be completed **before** the STEM Person of the Week activity takes place.