

Content package for interactive whiteboards: “Air, wind, and weather”

This guideline provides an overview of the content and didactic context of the media in the content package for interactive whiteboards entitled “Air, wind, and weather.”

General information on the use and teaching concept of the content package for interactive whiteboards is provided in the teaching method “Working with a content package for interactive whiteboards,” which is also included in the media package.

1 Introduction to teaching this topic

1.1 Motivation for the topic

In many countries, the curricula for personal, social, and health education (PSHE) provide for coverage of the topic of air at all different grade levels. There are two more comprehensive subjects, “Environment and nature” and “My body.” These include content such as “Weather,” “Experiences with air,” “Properties of air,” “Air and life,” “Weather,” “Environmental pollution,” “Protection of nature,” and “Energy-saving measures,” “Animals in different habitats,” “Respiration,” or “People at work.”

The topic also plays a role in environmental education, which is an interdisciplinary educational objective at elementary school.

Note: The topics of weather and wind are covered in this content package for interactive whiteboards only as partial aspects of the main topic of air.

1.2 Media selection

The content package for interactive whiteboards entitled “Air, wind, and weather” contains 25 individual media.

- 1 graphic evoking associations with the topic of air (cover image)
- 1 photo of a historic airplane
- 1 photo collage on the topic of air pollution
- 2 interactive graphics that can be used to work through the parts of an airplane and the human respiratory organs
- 4 interactive exercises (matching exercises): “What can fly and what cannot fly?”, “How do plant seeds fly?”, “Cyclones and winds,” and one related to the Beaufort scale
- 2 films on the topics of how wind is produced and wind energy
- 4 information sheets on the topics of cyclones, wind forces (with answer sheet), history of aviation, and air and weather
- 1 worksheet in which students deal with objects, plants, and animals that can fly
- 1 link list

1.3 Background information for teachers

In this content package for interactive whiteboards, students will not only learn about the composition, volume, and weight of air, but will also become acquainted with the physical properties resistance, buoyancy (lift), and sound transmission as well as the significance of air for objects, animals, and plants. In addition, the relevance of air for nature, human beings, and the environment will also be conveyed by covering topics such as weather including wind and cyclones, respiration, and air pollution.

The media can be used individually and completely independently from each other. However, the lesson will certainly be livelier when the media are used in context. This provides the chance to spark interest in the subject details, based on the meaning for the students' lives. To that end, we recommend working through the topic in the following steps:

- Introduction to the topic
- What can air do? (physical properties)
- What can fly? (flying objects, plants, and animals)
- History of aviation
- Air and life (respiration, air pollution)
- Air and weather (weather station, wind, cyclones)

2 Introduction to the topic

Air influences the life of human beings from birth, and not only in the sense that independent respiration starts at birth. The physical properties of air such as propulsion, buoyancy, and resistance and their significance for living organisms and inanimate objects are things that we encounter from an early age and that accompany us over our whole life – during recreational activities, our school career, or our professional life. The topic of weather is also closely related to air, since it is crucial for air pressure and hence for weather phenomena such as temperature, air humidity, precipitation, and wind. These topics will be addressed below and their significance explained in more detail in due course.

The cover image for this content package illustrates many different things that are associated with air. It will serve as a tool to help the students recall previous experience. Its purpose is to give children an opportunity to communicate what they know about air and how it relates to wind, respiration, and so forth, and so understand that the main focus will initially be on the topic of air:

Medium



“Air”

3 What can air do?

Air is a mixture of different gases, but consists predominantly of two gases: nitrogen (78 percent) and oxygen (21 percent). Other constituents of air are argon (0.9 percent), carbon dioxide (0.04 percent), hydrogen, and other noble gases that are present in very small amounts.

In its natural state, air is colorless, odorless, and tasteless. We can therefore neither see it, taste it, hear it, smell it, nor touch it. Nevertheless, it is present and of great significance for human beings. Children gain new experiences with air and its properties almost every day from an early age, for example, when flying a kite, or when they discover a parachute or hot air balloon in the sky when out on a walk or picnic. They might pass by numerous wind turbines while driving on vacation, or see objects flying through the air in windy or stormy weather, or observe butterflies or birds in the garden. These are all things that would be impossible without air.

Five experiments illustrate the physical properties of air and awaken or develop students' awareness of the significance of air:

- Air acts as a brake: We make a parachute
- Air carries: We make a kite
- Air propels: We make and test a pinwheel
- Air takes up space: We pump up a bicycle tire
- Air transmits sound: Jumping grains of rice

The experimentation instructions include information for teachers providing technical explanations as well as notes on conducting the experiments.

Media



“What can air do?”



“What can air do?” (teacher information)”

4 What can fly?

Birds, insects, bats, and flying foxes can fly because they have wings, and apart from their muscle power, they also make use of the buoyancy and the resistance of air. There are also a large number of plants that use air to reproduce. Their seeds are carried by the wind in different directions over short or long distances depending on the wind force and the “design” of the flying seeds. Objects can also fly. They are carried by the wind in exactly the same way as animals or parts of plants, or else have their own propulsion systems and can be controlled in terms of their direction, altitude, and speed, as is the case with airplanes and helicopters. With certain objects such as kites or parachutes, the direction can be influenced but not the speed, which depends on the wind force. Other objects such as paper or plastic garbage fly around wherever the wind blows them. On a worksheet, students will first go outside to identify and write down the names of animals, plants, and objects that can fly so that they can discover the diversity of objects that can fly. They should then answer the question of what flies with and without its own means of control and determine similarities and differences with respect to flight direction, altitude, and speed. This will demonstrate to children how human beings have made use of the flight mechanisms of certain plants or animals for constructing flying objects:

Medium



“What flies?”

In an interactive graphic, students can then categorize picture cards of objects, animals, and plants that fly or cannot fly in order to recognize why certain animals, plants, and objects can fly and why others cannot:

Medium



“What can fly and what cannot fly?”

The students match plant names to pictures of seeds that come from the plants in an interactive exercise. Another objective is recognizing the principle these seeds use to “fly”:

Medium



“How do plant seeds fly?”

Information and ideas: Following this assignment, the students will make comparisons between the different “types of flight” of various seeds and suggest ideas as to which man-made flying objects were modeled on them. The seeds of the maple tree, for example, rotate like a helicopter propeller in flight, while the fruit of the linden tree resembles a “frisbee.”

The design of our modern-day airliners also originates from an idea found in nature. An interactive exercise is provided in which the parts of an airplane can be labeled interactively in order to work out what is important for a flying object of this size so that it can fly at all.

Medium



“The parts of an airplane”

Information and ideas: After this exercise, students will compare the wings of the airplane with the wings of birds.

5 History of aviation

Today's students take for granted the idea of covering long distances in an airplane at high speed. However, flying was not always as easy as it now appears to us as passengers. It took a great many years - with innumerable failures along the way - to arrive where we are today. A brief foray into the history of aviation is intended to illustrate this for students.

Some of the important inventions that humans have made and further developed over the course of time before aircraft of the kind we know today evolved are shown along a time line represented by a snake. The story of Daedalus and Icarus is recounted briefly, and short descriptions are given of Leonardo da Vinci's airscrew, the Montgolfier brothers' balloon, Otto Lilienthal's glider, the Wright brothers' powered airplane, and the jet airplane:

Medium



“The history of aviation”

Information and ideas: This document is suitable as an introduction for further research into the topic of the “history of aviation”.

A photo shows a historic airplane of the type known as a biplane.

Medium



“Biplane”

Information and ideas: This photo is a perfect example for illustrating the topic “history of aviation,” since the Wright brothers' first airplane to enter series production (Wright Standard type A, 1909) was a biplane.

6 Air and life

Air is vital for humans, plants, and animals. We breathe it in and out naturally, without being aware of the complexity of the underlying process. Precisely because air is so important for us and all other living organisms on earth, we should actively make an effort to keep it clean.

6.1 Respiration

Generally speaking, respiration is used to mean the lung activity and all processes associated with it. Put simply, during inhalation air flows into the body through the mouth or nose and passes via the larynx into the windpipe (trachea). There it is cleaned by tiny hairs called cilia. When the inhaled air reaches the lungs, the oxygen is “filtered” out of it in air sacs (alveoli). As a result, the alveoli fill up and expand. The thorax rises in order to make room for the lungs. The oxygen is now transported to tissues and cells through blood vessels. The carbon dioxide produced in the tissues and cells is then returned to the lungs via the blood and finally exhaled. The lungs contract again and the thorax falls.

The students will learn all about respiration in the following six experiments. The objective is to make them consciously aware of the respiration process and learn to understand it better:

1. Wind slalom course
2. Straw suction exercise
3. Measuring your chest
4. Measuring exhaled air
5. Different ways of breathing (yawning, hiccups, coughing, sneezing, laughing)
6. We build a model of the lungs

In addition to the experimentation instructions, there is information for teachers providing notes on conducting the experiments as well as expert explanations on respiration.

Media



“How does respiration work?”



“How does respiration work? (teacher information)”

Students can work through the parts of the human respiratory system that are necessary for breathing with an interactive graphic, which also serves to highlight the complexity of the respiration process:

Medium



“What do we breathe with?”

6.2 Clean air to breathe

Air pollution means a change in the natural composition of air in a way that is harmful for people and the environment, for example, through exhaust gases from traffic and industries. In industrialized countries, attempts are being made to counter air pollution, for example, through legislation and technical measures. The large-scale logging and clear-cutting of rainforests is also problematic, because this destroys a natural air filter in the earth's ecosystem.

Students will have already discovered in the previous chapters of this content package that air is necessary for all living organisms. At this point, children's attention should be drawn to the dangers of air pollution in order to create awareness of the need to protect the environment.

Two photos serve as graphics for discussion: A factory chimney from which smoke is rising, and a group of trees.

Medium



“Clean air to breathe?”

Information and ideas: Students in the role of “environment detectives” ask themselves questions about the causes and consequences of air pollution, find possible solutions, and record them in a table.

7 Air and weather

Since this content package is concerned primarily with the topic of air, it does not cover the complete range of possibilities for teaching children about the weather.

This content package for interactive whiteboards deals only with a partial aspect, namely the critical importance of air for weather phenomena such as clouds, rain, or snow due to its equalizing function between cold and hot, and the meaning of the term wind.

7.1 Weather phenomena

Weather is a natural phenomenon that small children already experience firsthand more or less every day without consciously perceiving the negative effects or impact, let alone understanding

them. The cognitive confrontation with the topic of weather, e.g., when looking at weather maps and weather reports in newspapers and on TV, frequently raises questions for children. How hail, snow, or wind are produced, how the weather impacts the organization of our daily lives and our psyche, are things that children first have to learn. They have to gradually understand why, for example, they are sent to school in the morning with a rain jacket although the sun is shining, why many people are depressive in bad weather, why and when we need sun protection, why plans for outdoor activities are frequently upset by rain, and many other things.

There is an information sheet that provides a basic introduction to the topic. Apart from explanations of the terms high/low pressure, wind, temperature, air humidity, clouds, and precipitation, this information sheet also contains a graphic with a weather map and various weather symbols that students have to match with keywords:

Medium



“Air and weather”

This can be followed up by an experiment involving building a weather station. Detailed building instructions and an observation sheet to be filled in by the students are provided. The weather station includes a barometer for measuring air pressure, a wind sock for observing wind force and wind direction, a thermometer for measuring air temperature, and a rain gauge for measuring the amount of precipitation.

There is also teacher information that provides further expert explanations as well as notes on conducting the experiments:

Media



“Can I measure the weather?”



“Can I measure the weather? (teacher information)”

Information and ideas: Once students have become aware of the weather and its elements through this experiment and by observation of the weather over a certain period of time and are familiar with the symbols, they will be able to understand weather forecasts in newspapers or on television. The children can, for example, give their own forecasts by playing the role of a “newscaster.” In addition, they could organize a fashion show in which they “model” various clothes suitable for different weather conditions, and demonstrate which recreational activities are appropriate and which are less so in different weather.

Another learning objective in connection with the topic of weather could be to acquaint students with the significance of the weather (wind, light, heat, water) for animals and plants, e.g., for propagation, foraging for food, habitats, and so on.

7.2 Wind

The next media are concerned with the topic of wind as air in motion. The students will again be made aware that air is not “nothing” and that they can feel it directly and perceive it in different ways. We can see, feel, and hear it in the form of wind.

A film shows how wind is produced by the movement of air masses in the atmosphere. The buoyancy (lift) provided by warm air is explained using the example of a hot air balloon:

Medium



“How wind is produced”

Students will become acquainted with the Beaufort scale of wind forces by means of an information sheet. This information sheet also contains an assignment section for which an answer sheet is provided. There is an interactive exercise for further study in which students are required to match picture cards and word cards with descriptions to the corresponding values on the Beaufort scale.

Media



“How strong is the wind?” (with answer sheet)



“How strong is the wind?”

An information text about tropical cyclones provides a short explanation about how these storms are formed. An experiment illustrates the force of a tornado in a jar filled with water.

Medium



“How do cyclones form?”

For further study on the topic, students can work through an interactive graphic to match the cyclones with the regions where they occur:

Medium



“Cyclones and winds”

Wind has enormous force. A video shows how human beings can harness this force in order to generate energy:

Medium



“Wind energy”

8 Links for further study

A link list includes links for websites that students can use on their own to read up on certain topics again and to deepen or extend their knowledge of them:

Medium



“Link list for the “Air, wind, and weather” interactive whiteboard content