MODULE VII

Lesson Plan 3

Summary

Title

Building a homemade air purifier

Duration	45 minutes
Student age range	10-14

Summary of the topic

Breathing is one of the most essential actions for human beings. With a frequency of 12 to 20 breaths per minute, clean air is necessary to maintain health. In the air, we can find many foreign elements that can harm our health, from suspended particles to viruses and bacteria. Allergens can also be present, which trigger allergy symptoms. Air purifiers eliminate or reduce the presence of these elements as much as possible, filtering the air and creating an environment free of allergens and foreign particles. In this session, we will create a homemade air purifier to clean the air in any indoor environment, such as our house, workshop, classroom, etc. This purifier can be more or less restrictive, depending on our materials.

Learning outcomes

Purpose/Learning Objectives

- Introduce the importance of clean air for health and the dangers of breathing polluted air.
- Introduce the concept of air purification and filtration.

Transversal objectives

- Promote and protect your health and that of those around you.

Connection with Sustainable Development Goals

This theme is aligned with SDG 4, "Quality education", specifically Target 4.7 " By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and culture's contribution to sustainable development ". Building a purifier is also related to SDG 3 "Ensure healthy lives and promote well-being for all at all ages", specifically Target 3.3 “By

2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases" and Target 3.9 "By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination".

Implementation

Facilitation

- Make sure all resources and materials are ready before starting class.
- Read all precautions for using the fan and filters carefully.
- You will need to handle dangerous materials, such as scissors and fans, which could cause harm. You will also need to handle delicate materials, such as filters. Constant adult supervision of the entire activity is required.
- Keep in mind that students and the classroom may get a little dirty.
- Make sure to use recyclable or recycled materials whenever possible.

Resources / Materials needed

- 4 20” x 20” x 1” air filters. MERV 13 is recommended for maximum filtration. Lower-rated filters, such as MERV 11 can be used.
- One 20” x 20” box fan
- Scissors
- Duct tape or electrical tape
- Cardboard

Ideas to continue

To test the performance of your home air purifier, you can try several activities that take advantage of its benefits. Possible options include placing sheets of paper near the filters and checking how the paper sticks to the filters due to the fan's suction. You can also use smaller particles, such as sawdust, and check how the air from the fan does not carry the particles that remain on the filter. If you have an air quality meter, you could also use it to check the purifier's effectiveness.

Outline of the topic

Although the air we breathe may appear clean and free of impurities or odours, this is not the case. Air contains fine particles and pollutants that could negatively impact our health.

According to the World Health Organization (WHO), 99% of the world's population breathes air that exceeds the quality limits recommended by the WHO and endangers their health by breathing unhealthy levels of fine particulate matter and nitrogen dioxide. This effect is even more serious and noticeable in people living in low—and middle-income countries. This information can be verified and expanded at the following link: https://www.who.int/news/item/04-04-2022-billions-of-people-still-breathe-unhealthy-air-new-who-data.

One way to improve the quality of the air you breathe in a room is by installing an air purifier. An air purifier is a device that helps clean the air in a room, removing contaminants and cleaning and purifying the air. At https://www.deltrian.com/news/article/air-purifier, you can check the advantages and operations of an air purifier.

1. **Air suction**: Air suction: The purifier sucks in dirty and contaminated air from the room in which it is placed.
2. **Filtering**: This aspirated air passes through different filters:
    - **Prefilter**: Responsible for trapping large particles, such as dust and hair
    - **HEPA filter**: Capable of capturing small particles such as pollen, mites, and some bacteria
    - **Activated carbon filter**: Eliminates odours and toxic gases
3. **Release of clean air**: After passing through the filters, the clean air is released back into the room.

Air purifiers are essential for several reasons:

1. **Air quality**: Due to pollution, the air quality in many cities and industrial areas can be very poor. This includes dust particles, pollen, smoke, and other pollutants.
2. **Health**: Breathing polluted air can affect our health. It can cause respiratory problems such as asthma, allergies, and other diseases. Air purifiers help reduce these risks by removing pollutants from the air.
3. **Well-being**: Cleaner air can improve our overall well-being, helping us sleep better and feel more comfortable in our surroundings. For example, reducing dust and hair in the air can improve allergy symptoms by not being in contact with allergens.

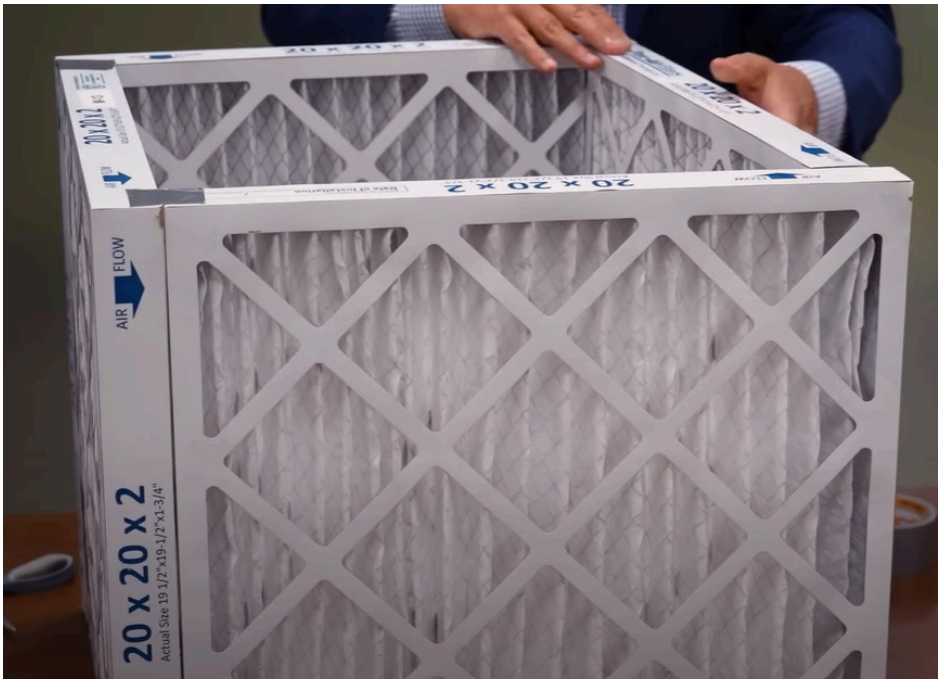
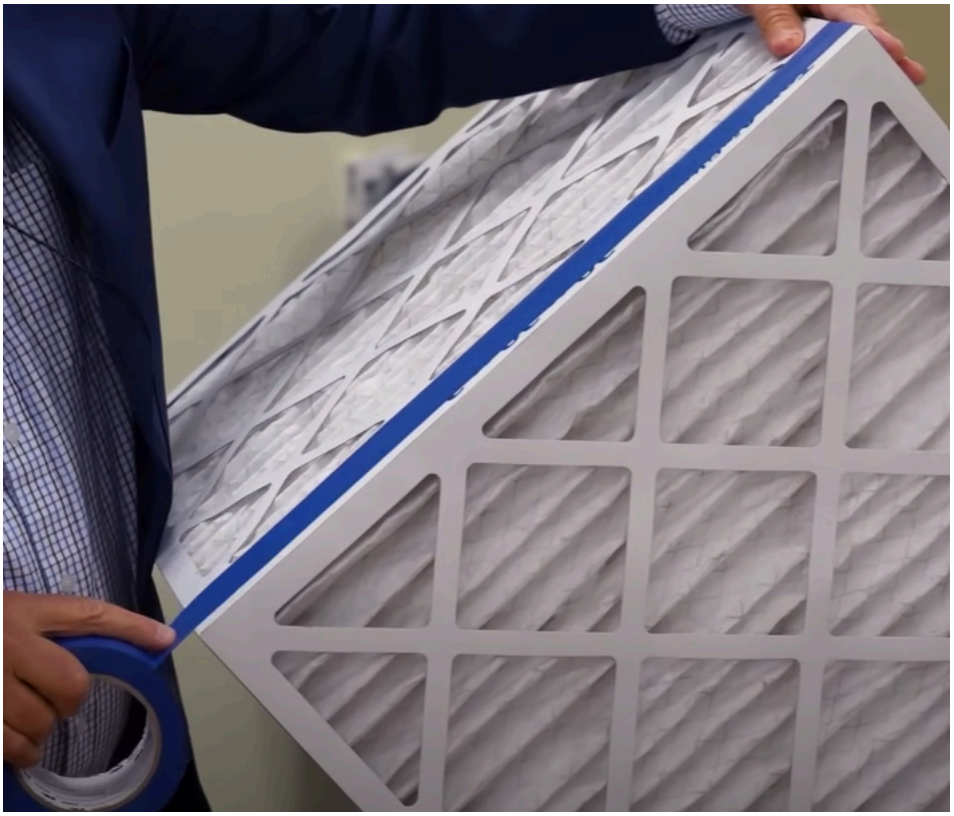
For these reasons, homemade air purifiers have long been a cheap solution to improve room air quality, although less effective than commercial ones. For example, it is trendy among people who work with wood, who generate a lot of chips and sawdust, exposing themselves to many external agents. In turn, with the COVID-19 pandemic, the popularity of the air purifier increased a lot when the Corsi-Rosenthal box, a homemade air purifier, was created. At https://engineering.ucdavis.edu/news/science-action-how-build-corsi-rosenthal-box, a guide to building it is shown as the basis of this activity. In addition, there is a video showing this procedure: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s. Following the step-by-step instructions in this session, you should have a functional homemade air purifier, as shown in Figure 7.3.1.



Figure 7.3.1 – Homemade air purifier. Source: Youtube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s

A step-by-step guide to building a homemade air purifier is also available on the website: https://encycla.com/Corsi-Rosenthal_Cube. It also includes variations on the original design, information on the possible consumption and noise of the purifier, and advice on its positioning in the room.

Time	Step-by-step instructions
5 min	Carefully unpack both the fan and filters from their packaging.
10 min	Use the adhesive tape to stick the filters together and create an incomplete cube where the base and lid are missing. Pay special attention to the following points: - The direction of the airflow must point towards the inside of the bucket. An arrow drawn on the filter itself can determine this direction. - They should be placed so that the filter folds are vertical. This prevents the accumulation of dust and other particles. - Filters should not overlap each other.

	The final result of this activity is shown in Figure 7.3.2.  *Figure 7.3.2 – Basic structure of the air purifier. Source: Youtube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s*
10 min	Use adhesive tape to seal the joint between the filters, thus forcing air through the filter. Figure 7.3.3 shows an example of this step.  *Figure 7.3.3 – Hermetic sealing of air filters. Source: Youtube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s*
5 min	Use cardboard to create a base that will fully support the four filters. You can use the cardboard box from the fan or the cardboard box from the filters to make the base.

5 min	Use adhesive tape to seal the joint between the cardboard base and the filters to prevent air from entering through the joint. Figure 7.3.4 shows how this joint can be hermetically sealed.  *Figure 7.3.4 – Hermetic closure of the cardboard base. Source: YouTube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s* An item such as four bottle caps or carafes can be placed to act as legs for the structure and slightly raise the filters off the ground. This will protect the purifier from moisture or possible water or other liquid spills. An example is shown in Figure 7.3.5.  *Figure 7.3.5 – Elevation of the air purifier. Source: Encycla. Link: https://encycla.com/Corsi-Rosenthal_Cube*
5 min	Place the fan on top, opposite the cardboard base. Pay special attention to the direction of the airflow. The air should go upwards so that the air sucked by the fan passes through the filters.
5 min	Use cardboard scraps and tape to cover any holes between the filters and the fan. The result of this step is shown in Figure 7.3.6.



Figure 7.3.6 – Closing the fan with the purifier structure. Source: YouTube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s

Properly seal the fan to the filters with duct tape in the same manner as in previous steps. The tight seal between the fan and the filters can be verified in Figure 7.3.7.



Figure 7.3.7 – Hermetic sealing of the fan. Source: YouTube. Link: https://www.youtube.com/watch?v=hIuH-2naozI&t=1s

Formative assessment

Formative assessment will be carried out through classroom observations. Teachers observe students carrying out the activity, paying particular attention to their application of the acquired knowledge. Oral questions may also be asked of each work group to determine their theoretical knowledge of the subject, each student's ability to work in a team, and their degree of participation in the activity.

Feedback

Net Promoter Score (NPS) is a widely used tool to measure customer or student loyalty and satisfaction in an educational context. It measures the likelihood that students will recommend the subject or course to others.
Here's how to analyse and apply NPS:

NPS Question Development:

- Main question: "On a scale of 0 to 10, how likely are you to recommend this topic to other students?".
- Follow-up questions: "Why did you select that score?" and "How can we improve this topic?".

Collecting responses:

- Digital Surveys: Use online tools like Google Forms, SurveyMonkey, or Typeform to collect student responses.

- Aper surveys: At the end of the lesson, paper questionnaires are distributed for students to fill out. The Appendix shows a template for collecting responses using paper surveys.
- Interactive Applications: Interactive applications such as Quizziz, Mentimeter, or Kahoot! Collect responses in real time.

Classification of responses:

- Promoters (Score 9-10): Students who are very satisfied and likely to recommend the topic.
- Passives (score 7-8): Students are satisfied but not enthusiastic; they could easily change their minds.
- Detractors (Score 0-6): Students who are dissatisfied and unlikely to recommend the topic may offer constructive criticism.

NPS Calculation:

- Formula: NPS = % of promoters - % of detractors.
- Interpreting the score: NPS ranges from -100 to +100. A positive score (above 0) is generally good, and a score above 50 is excellent.

Analyse and use feedback:

- Review the comments to understand the reasons behind the scores.
- Identify patterns and specific areas of improvement among detractors and passives.
- Use positive feedback from promoters to reinforce the positive aspects of the topic.

Annexes

QUESTIONNAIRE TO COLLECT FEEDBACK ON THE TOPIC

On a scale of 0 to 10, how likely would you recommend this topic to another student?

0	1	2	3	4	5	6	7	8	9	10

Not likely at all — Extremely likely

Why did you choose that score?

How could this topic be improved?