MATHEMATICS - LESSON PLAN

Grade:	11-12 years old
Subject:	United in Biodiversity- Pollution
Lesson n°:	**1**
Topic:	**What's in the air? - An analysis of the impact of air pollution on the environment using clever counting.**
Lessons focus and goals:	**Subject of the lesson:** **How much does smog cost? - clever calculations using air pollution statistics.** **Aims of the lesson:** The aim of the lesson is to teach students about air pollution through the concept of smog and show them some examples. Students will be able to analyze the impact of air pollution using quick calculations with natural numbers and decimal fractions. During the lesson, students learn methods of dealing with the problem of air pollution. Additionally, during the lesson, students will use mathematical skills to calculate and compare the costs related to air pollution.
Learning objectives:	**Goals:** <u>You will be able to :</u> - analyze the results , - use calculations that will get the results, - create conclusions from the implementation, - reading the text with understanding, - tell what is a micrometer, - change the unit of length (micrometers to meters or millimeters) - calculate the costs related to air pollution, You will consolidate your skills: - performing mathematical calculations on natural numbers and decimal fractions, Expand your skills in areas such as nature. You will learn: - what is smog, - what does smog consist of, - how to protect yourself against air pollution,

	- what are the costs associated with polluted air, - what is the micrometer unit in the SI system. The student will also improve skills such as: - communication, - organization, - motivation, - data analysis Thanks to this education, students will learn about our role in environmental protection and how we could benefit from environmental protection.

Materials	- table for data analysis - Internet connection - computer -projector or multimedia board to display data, - word cloud creation program.
Structure and activities	**1. Introduction to the topic** (20 minutes) The teacher asks the students what the word air means to them. The teacher writes down the entries in a digital creator that creates a graphic cloud of words organizing the hierarchy of word importance. ● Teacher showing the film Air Pollution (National Geographic). https://www.youtube.com/watch?v=e6rglsLy1Ys ● The teacher explained the origin and meaning of the word SMOG. **SMOKE + FOG = SMOG** Additionally, the teacher explains to students that there are two sources of smog. 1) London smog, the cause of which is the so-called low emission, a side effect of burning poor quality fuel (waste, garbage) in low-quality furnaces and car exhaust fumes. 2) Los Angeles-type smog, called photochemical smog, which occurs in strongly sunny areas closer to the equator, especially on windless days in cities with heavy car traffic. The reason is primarily car exhaust fumes. Smog is created by dust, which is a very fine but very dangerous type of particulate matter (PM). According to the classification of pollutants, there are two basic fractions: PM 2.5 (finer)

and PM 10 (coarser).

Teacher shows students the page Lightpollution map. (Light pollution map)
Students analyze the areas with the most pollution on the basis of a map.

2. **Exercises** (30 minutes)

Essential Information:

The teacher should hand out or project this essential information to the students throughout the activity:
PM 2.5 – particles that have a diameter of no more than 2.5 µm
PM 10 – particles that have a diameter of no more than 10 µm

µm - unit of length in the SI system (International System of Units) - MICROMETER

1 m = 1000,000 µm, i.e. 1 µm = 0.000,001 m
1m=1000mm

Implementation:

1. The teacher asks the question 1 mm=……..µm
   1 µm=……..mm

2. The teacher gives students conversion tables to complete.

A grain of sand is 0.1 mm.
Drops of drizzle are 0.1-0.5 mm.
Flour particles are approximately 250 µm.
Human hair is approximately 50-60 µm.

3. The teacher asks students to convert the value of a flour particle and a human hair into mm.

4. The teacher divides the students into groups.

Students are asked to calculate how many times the diameter of poisonous particles is smaller than the information on the cards:

	PM 2,5	PM 10
A grain of sand		
A drop of drizzle		
A particle of flour		

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	Human hair | |

All students and teachers check the correctness of the answers.

3. Lesson summary (15 minutes)

1. The teacher asks the children how can we protect ourselves against air pollution?" and conducts a brainstorming session in the class.
2. The teacher presents students with information about the costs incurred by society due to air pollution. According to Greenpeace and Deloitte, our country may lose over EURO 22 billion annually.
The teacher gives the children worksheets to solve.

Calculate the costs of the consequences of smog on human health per person. There are 38 million of us.

22 000 000 000 zlotych: 38 000 000 = _____ euro/person per year
Check how much this amount is per month:
_____ euro/person per year : 12 = over _____ euro per month

Inclusion

Explanation of Lesson Aim and Structure:
This lesson is designed to actively engage students in understanding and combating the concept of smog, air pollution and show them some examples. Students will be able to analyze the impact of air pollution using quick calculations with natural numbers and decimal fractions.

Clear Instructions, Adapted for All Students:

	Instructions will be communicated clearly and tailored to meet the needs of all students, ensuring comprehension and engagement. Visual aids, such as videos and images, will support understanding, particularly for visual learners. Instructions will be repeated as necessary, and individualized support will be provided to students who require additional assistance or clarification. **Formation of Inclusive Groups:** To promote collaboration and peer learning, inclusive groups will be formed with consideration for diverse abilities and backgrounds. Mixed-ability groups will encourage cooperation and shared learning experiences, allowing students to support one another. Teachers will ensure that group dynamics are inclusive, fostering an environment where every student feels valued and empowered to contribute. **Monitoring Engagement and Supportive Interventions:** Teachers will monitor student engagement throughout the lesson, ensuring that all students have the opportunity to participate actively. Supportive interventions will be employed if any student appears disengaged or encounters challenges. These interventions may include providing additional guidance, modifying tasks, or encouraging peer collaboration. Teachers will also address any instances of discomfort or exclusion promptly and sensitively, maintaining a supportive and inclusive learning environment.

Assessments:

#1 -

	Initiating	Developing	Excelling
Description of performance	Low knowledge about the impact of substances harmful to the environment.	Explain how pollution is one of the biggest problems of biodiversity loss in the world. Explaining the link between mathematics as a tool in combating air pollution.	Great understanding of Pollution as a biodiversity loss issue and Mathematics as a tool to protect wild fauna and flora from it.
Sample student response	“Air pollution is the presence of harmful substances in the Earth's atmosphere, which may have a negative impact on	"People have to protect the environment from emitting harmful substances, including: by installing filters,	“The result of human activity is air, soil and water pollution. Smog and acid rain damage plants, resulting in loss of

	the health of humans and other living organisms, as well as on the entire natural environment.”	implementing renewable energy sources, introducing ecological means of transport, etc.	biodiversity, e.g. climate change.”

#2 -

	Initiating	Developing	Excelling
Description of performance	Little or no knowledge on the connection between Pollution, Mathematics and Biodiversity.	The ability to explain what damage pollution does to biodiversity and what are the costs to be incurred by the impact of air pollution on biodiversity, and the role of mathematics in this procedure.	Developed sense of citizen agency to stop Pollution and advocate against it.
Sample student response	"Pollution and the development of industry, agriculture, municipal economy and transport have led to the degradation of the natural environment and the disruption of biodiversity."	"Pollution of water and soil with industrial and municipal sewage threatens many species, and in the case of rivers and lakes it leads to the almost complete extinction of organisms living in them, air pollution causes of smog and acid rain, which damages plants."	„Methods of protection against the emission of harmful substances, including: by installing filters, implementing renewable energy sources, introducing ecological means of transport, etc.

Supporting Documentation/Resources:

Videos:

a. National Geographic Kids: National Geographic Kids produces videos about air pollution. https://www.youtube.com/watch?v=e6rglsLy1Ys

Quantitative Assessment Rubric:

Criteria	Initiating	Developing	Excelling
Description of Performance			
Immersive Learning Reflection			
- Emotions and challenges expressed	1-3 points	4-6 points	7-10 points
- Connection to ethical considerations	1-3 points	4-6 points	7-10 points
Creative Expression and Advocacy			
- Project plan depth and creativity	1-3 points	4-6 points	7-10 points
- Strategy for impact outlined	1-3 points	4-6 points	7-10 points
- Consideration of broader community impact	1-3 points	4-6 points	7-10 points

Total Points Calculation:

- Total points for each criterion can be calculated by summing up the points awarded in each category.

Sample Student Response:

- Qualitative descriptors alongside quantitative assessments provide additional context and insight into the student's performance.
- For example, a response in the "Developing" category may be accompanied by qualitative feedback like "Demonstrates improvement in expressing emotions and challenges experienced during the simulation. However, further development is needed to deeply connect these experiences to ethical considerations."

Assessment Table: Inclusion and Diversity - Pollution

Criteria	Check
Information offered in multiple formats	
- Variety of learning materials provided	
- Text, visual, auditory resources	
Inclusive methodologies like peer-to-peer learning	
- Opportunities for collaborative activities	
- Group discussions, peer teaching	
Use of ICT tools	
- Integration of technology in learning activities	
- Use of online platforms, interactive tools	
Overall Inclusion and Diversity	
- Integration of diverse perspectives	

- Opportunities for student engagement	
- Promotion of equitable participation	

Explanation of Criteria:

- **Information offered in multiple formats:**
  - Assess whether the lesson plan provides learning materials in various formats such as text, visuals, and auditory resources to cater to diverse learning styles.

- **Inclusive methodologies like peer-to-peer learning:**
  - Evaluate if the lesson plan incorporates inclusive methodologies like peer-to-peer learning, group discussions, and collaborative activities to encourage interaction and engagement among students.

- **Use of ICT tools:**
  - Determine if the lesson plan utilises ICT tools such as online platforms and interactive resources to enhance learning experiences and accessibility.

- **Overall Inclusion and Diversity:**
  - Summarise the overall assessment of inclusion and diversity in the lesson plan, considering the integration of diverse perspectives, opportunities for student engagement, and promotion of equitable participation.