Teacher: Fatma Gündoğan
Subject: Reducing the harm of microplastics in our lives

Title	Reducing the Harm of Microplastics Using Computational Thinking	**Time**	2 hours
Subject:		**Chemistry, Biology, Science,**	
Aims		Students will learn about the impact of microplastics on the environment and health and use computational thinking to devise strategies to reduce the harm of microplastics in daily life.	
Key CS elements:		Decomposition; Pattern recognition; Abstraction; Algorithm design.	
Age group :		**12-14 years old**	
Learning situations:	They will learn what microplastics are and see their impact on the environment and human health. In this way, they will be able to minimize the use of microplastics that threaten our world and our health.	**Activity type:**	**in-class activity for Chemistry and biology**
Resources: Materials: Whiteboard and markers Projector for visual presentations Internet access for research (optional) Paper and pens for group work Recycled plastic items for demonstration (optional)		1-Online Research Sources: Scientific Databases and Journals: Google Scholar – Search for academic articles and studies on microplastic pollution. PubMed – Focus on health-related impacts of microplastics. 2-Environmental Organizations and NGOs: Plastic Pollution Coalition – Provides detailed reports and campaigns on microplastic pollution. Greenpeace – Offers articles and studies about the environmental harm caused by plastics. The Ocean Cleanup – A project aimed at cleaning plastic waste from oceans, often has reports on microplastic impacts	

	3- Government and International Agencies

Learning development:

Introduction

Discuss Microplastics:

Ask students if they've heard of microplastics and their potential harm.

Define microplastics: tiny plastic particles (less than 5mm) found in water, food, and even the air.

Show a short video or presentation on the harmful effects of microplastics on marine life and human health.

Encourage students to share where they think microplastics come from and how they might affect their lives**.**

What are microplastics?

Microplastics are tiny plastic particles, generally less than 5 millimeters in size. They come from the breakdown of larger plastic items or are intentionally created (e.g., microbeads in cosmetics).

Sources of Microplastics:

Primary Microplastics: These are manufactured to be small, such as microbeads in personal care products (toothpaste, face scrubs) and plastic pellets used in industrial processes.

Secondary Microplastics: These come from the breakdown of larger plastic objects, like plastic bags, bottles, or fishing nets, due to environmental factors like sunlight and ocean currents.

Microfibers: Released from synthetic clothing during washing, these are a significant contributor to microplastic pollution in water.

Why Are Microplastics a Problem?

Environmental Impact:

Microplastics are ingested by marine animals, often causing harm to their health.

They can accumulate in ecosystems, leading to contamination of water sources and soil.

Human Health Concerns:

Humans consume microplastics through seafood, water, and even the air. Although the long-term effects are not fully understood, there are concerns about toxicity and chemicals absorbed by plastics.

Global Scale of the Issue:

Provide a few statistics to highlight the scale of microplastic pollution. For example:

An estimated 14 million tons of plastic enter the ocean every year.

A typical person could be ingesting over 5 grams of plastic weekly — the equivalent of a credit card.

Relevance to Students' Lives:

Help students understand how microplastics are present in everyday items they use (e.g., plastic packaging, synthetic clothing) and how their habits contribute to microplastic pollution.

1. **Decomposition**

   Goal: Break down the problem of microplastic harm into smaller, manageable parts.

   Activity:

   Divide students into small groups.

   Ask each group to list the different ways microplastics are produced and enter our daily lives (e.g., through plastic packaging, clothing, cosmetics, etc.).

   Encourage them to think about which items they use that contribute to microplastic pollution.

2. **Pattern Recognition**

   Goal: Identify patterns in microplastic usage and disposal.

   Activity:

   Have each group look at the sources of microplastics they listed and identify common patterns (e.g., frequent use of plastic bottles, improper recycling habits, etc.).

   Discuss the broader patterns they see in society regarding single-use plastics and recycling efforts.

3. **Abstraction**

   Goal: Focus on the most critical factors that contribute to microplastic pollution.

   Activity:

Students will decide which sources of microplastic pollution have the greatest impact and focus on ways to reduce them. For example, they might prioritize reducing plastic waste from packaging or microfibers from clothing.

Create a simplified model to illustrate the key sources of microplastic harm that need addressing.

4. **Algorithm Design**

Goal: Develop a step-by-step plan (algorithm) to reduce microplastic pollution.

Activity:

Each group will create a plan outlining specific actions individuals, households, or communities can take to reduce microplastics (e.g., using reusable containers, avoiding synthetic clothing, improving recycling habits).

They should also create a flowchart or diagram to represent their strategy visually.

Step 1: Reduce Plastic Use:

Avoid Single-Use Plastics: Choose reusable items like water bottles, shopping bags, straws, and utensils instead of disposable plastic versions.

Opt for Plastic-Free Packaging: Select products with minimal or no plastic packaging. Choose alternatives like glass, metal, or cardboard.

Step2: Recycle Properly:

Sort and Recycle Plastics: Ensure that plastic waste is properly sorted and sent for recycling. Follow local recycling guidelines to avoid contamination.

Support Companies Using Recycled Plastic: Purchase products made from recycled plastics to support the recycling industry and reduce the need for virgin plastic production.

Step 3: Avoid Products with Microbeads:

Check Labels: Avoid personal care products containing microbeads (like exfoliating scrubs, toothpaste, etc.). Look for terms like "polyethylene" or "polypropylene" on ingredient lists.

Use Natural Alternatives: Choose products with natural exfoliants, such as sugar, salt, or oats.

Step4: Choose Natural Fabrics:

Avoid Synthetic Fabrics: Opt for clothing made from natural fibers like cotton, wool, or bamboo rather than synthetic fabrics like polyester, nylon, or acrylic, which shed microfibers when washed.

Wash Synthetic Clothes Less Frequently: When possible, reduce the frequency of washing synthetic clothes, and wash them in cold water to reduce microfiber shedding.

Step 5: Install Filters:

Use a Microfiber Filter in Washing Machines: Install a microfiber filter or use laundry bags designed to capture microplastics, preventing them from entering water systems through your washing machine.

Use Water Filters at Home: Consider installing a water filter to reduce microplastics in your tap water.

Step 6: Support Regulations and Policies:

Advocate for Legislation: Support local and global initiatives that aim to ban or reduce single-use plastics and regulate the use of microplastics in products.

Encourage Companies to Adopt Sustainable Practices: Support businesses that are reducing their plastic use and pressure others to follow suit.

Step 7: Clean Up Plastic Waste:

Participate in Cleanups: Join community efforts to clean up plastic waste in local parks, rivers, beaches, and other areas to reduce the amount of plastic that eventually breaks down into microplastics.

Organize Plastic-Free Days: Encourage your school or community to organize events that focus on reducing plastic use for a day or week.

Step 8: Educate and Raise Awareness:

Spread the Word: Teach others about the dangers of microplastics and how they can help reduce their use of plastic.

Start a Campaign: Create awareness campaigns at school or on social media about the importance of reducing microplastic pollution.

Step 9: Choose Biodegradable Products:

Use Biodegradable Alternatives: Choose biodegradable plastics or products made from renewable materials, such as plant-based plastics or compostable materials, to reduce long-term plastic waste.

Activity

- Students can research microplastic pollution in their local environment (e.g., local beaches, water sources) and present their findings in the next lesson.
- They can also design a campaign or social media post to raise awareness about reducing microplastic waste.

5. Reflection

- Reflect on how computational thinking helped break down a complex problem into manageable steps.
- Encourage students to think about how they can implement some of these strategies in their own lives and homes.

6. Conclusion (5 minutes):

1. Increased Awareness of Microplastic Pollution:

Students will develop a deeper understanding of what microplastics are, how they are formed, and the various sources that contribute to their presence in the environment.

They will become aware of the significant impact microplastics have on ecosystems, marine life, and human health.

2. Critical Thinking and Problem-Solving Skills:

By applying computational thinking (decomposition, pattern recognition, abstraction, and algorithm design), students will improve their problem-solving abilities.

They will learn to break down complex environmental problems, identify patterns in plastic consumption, and design feasible, step-by-step solutions to reduce microplastic pollution.

3. Personal and Behavioral Change:

Students may become more conscious of their own plastic consumption and take steps to reduce their use of single-use plastics in daily life.

They might also adopt sustainable practices such as recycling properly, choosing natural fabrics, and avoiding products with microbeads.

4. Practical Solutions for Reducing Microplastics:

Students will leave the lesson with concrete ideas and actions they can implement at home or in their communities, such as using reusable items, installing microfiber filters, or participating in cleanup efforts.

They will also learn how to educate others on reducing microplastic pollution, potentially leading to wider community action.

5. Collaboration and Communication Skills:

Through group activities and discussions, students will enhance their ability to collaborate, share ideas, and present solutions. This will help develop their teamwork and communication skills.

6. Environmental Responsibility and Advocacy:

Students may become environmental advocates, encouraging their peers, families, and communities to take action in reducing plastic use and supporting policies that limit microplastics.

They might also initiate or participate in local campaigns or school projects aimed at reducing plastic waste.

7. Long-Term Thinking and Sustainability:

Homework:

School-based Research:

- Organize a school project where students collect samples from tap water, bottled water, or synthetic fabrics (e.g., clothing), and use microscopes to look for microplastics.

Assessment:	• Participation in group activities and discussions. • Quality and creativity of the solutions presented. • Ability to apply the steps of computational thinking to a real-world problem.

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Expected results:	By the end of the lesson, students will understand what microplastics are, their environmental and health impacts, and how to reduce their usage. Using computational thinking principles—**decomposition, pattern recognition, abstraction, and algorithmic thinking**—students will break down the problem, identify harmful patterns, and create practical, step-by-step solutions. They will work in groups to design campaigns promoting microplastic reduction, improving their collaboration and communication skills. Ultimately, students will be motivated to adopt environmentally friendly habits, raise awareness in their communities, and apply critical thinking to real-world problems.
Notes:	