Environmental Monitoring Station

Lesson Plan Overview

Grade Level	**4-6 (Adaptable)**
Time Required	**1-2 class periods (45-60 minutes each)**
Subject	**STEM, Environmental Science, Coding**

→ Learning Objectives

1. Design and build an environmental monitoring station using a micro:bit, dust sensor, and sound sensor.
2. Program the micro:bit to measure and display both air quality (dust particle levels) and noise levels.
3. Explain how sensors work and their importance in monitoring environmental factors.
4. Connect the project to real-world applications of environmental monitoring and its impact on health and the environment.

→ Materials

• Smart Science IoT: Kit	For building and programming the environmental monitoring station.
• Computer with internet access and MakeCode	For programming and code execution.
• Dust sensor	Measures dust particle levels in the air.
• Sound sensor	Detects noise levels in the environment.
• OLED screen	Displays the data collected by the sensors.

5E Model Lesson Plan

Engage

Activity	Key Focus
Show images or videos of environmental issues like air pollution and noise pollution.	Building awareness of environmental challenges.
Discuss the importance of monitoring environmental factors such as air quality and noise, emphasizing their impact on health and ecosystems.	Connecting environmental monitoring to real-world health and environmental implications.
Encourage students to share their personal experiences with air and noise pollution.	Building curiosity and relevance through real-life connections.
Introduce the challenge: Design and build an environmental monitoring station that measures both air quality and noise levels.	Inspiring engagement by presenting a tangible, hands-on problem-solving challenge.

Explore

Activity	Key Focus
Divide students into small groups and provide materials, including the Smart IOT: Kit, dust sensor, sound sensor, and OLED screen.	Promoting collaboration and teamwork.
Guide students to explore the components of the kit, focusing on understanding the functionality of the sensors and OLED screen.	Encouraging hands-on exploration to build familiarity with components.
Have students experiment with connecting the sensors and OLED screen to the micro:bit to observe how the components work together.	Developing practical knowledge of how sensors and displays interact with a microcontroller.
Allow groups to share their discoveries and collaborate to troubleshoot or refine their understanding.	Fostering peer learning and problem-solving.

Explain

Activity	Key Focus
Facilitate a group discussion where students share their initial experiences and challenges.	Encouraging reflection on hands-on experiences to solidify learning.
Introduce/review key concepts: Sensors (dust and sound), outputs (OLED screen), microcontrollers (micro:bit), programming, and basic electronics.	Providing foundational knowledge to support device assembly and programming.
Demonstrate how the sensors interact with the micro:bit and OLED screen to collect and display environmental data.	Connecting theory to practical application for better understanding.
Explain how the dust sensor measures dust particle levels, and the sound sensor detects noise levels.	Highlighting the science and technology behind the sensors and their importance.

Elaborate

Activity	Key Focus
Guide students step-by-step to assemble their environmental monitoring stations, ensuring proper connections between the sensors, OLED screen, and micro:bit.	Applying learned concepts to create a functional monitoring station.
Introduce students to the MakeCode programming environment.	Familiarizing students with a coding platform to program their devices.
Help students write a program to:	
- Initialize the OLED screen.	Building foundational coding skills to enable functionality.
- Read data from the dust sensor to measure air quality.	Teaching how to extract and interpret data from sensors.
- Read data from the sound sensor to measure noise levels.	Expanding programming to include multi-sensor integration.
- Display both dust level and noise level readings on the OLED screen.	Visualizing data for easy interpretation and communication.
Encourage troubleshooting and teamwork as students refine their stations.	Developing critical thinking and collaboration skills.

Evaluate

Activity	Key Focus
Have groups test their environmental monitoring stations in different environments (e.g., classroom, hallway, outdoor areas) and record observations.	Assessing functionality and real-world application of the device.
Encourage students to reflect on their learning experience by discussing:	
- Challenges they faced and how they overcame them.	Promoting self-assessment and resilience in problem-solving.
- Improvements they could make to their device.	Inspiring innovation and iterative design.
- Insights gained about the importance of environmental monitoring.	Reinforcing the significance of their work in real-world contexts.
Use a rubric to assess participation, device functionality, programming skills, and understanding of key concepts.	Providing structured and meaningful feedback on student performance.

Assessment Criteria

Criteria	Details
Participation	Active involvement in group discussions and activities.
Device functionality	Proper assembly and working of the environmental monitoring station.
Programming skills	Accurate and effective use of MakeCode to program the micro:bit.
Concept understanding	Comprehension of sensors, outputs, microcontrollers, and data analysis.
Creativity and problem-solving	Innovative approaches to building and testing the device.

Differentiation Strategies

Strategy	Details
Scaffolding	Offer varying levels of support for coding and building tasks.
Alternative materials	Provide substitutes for components if necessary.
Task complexity	Adjust programming challenges based on student skill levels.
Flexible presentations	Allow students to showcase their work in multiple formats (e.g., presentation, video).

Extension Activities

Activity	Details
Real-world research	Investigate environmental monitoring applications in industries and public health.
Device enhancements	Add features such as alerts for critical air or noise levels.
Advanced programming	Explore additional micro:bit features and programming concepts.
Awareness campaign	Create a presentation or video to highlight the importance of monitoring air and noise pollution.

Teacher Notes

Note	Details
Safety	Ensure students handle tools and materials safely.
Instructions	Provide clear steps for assembly and programming.
Support	Offer guidance during hands-on activities.
Collaboration	Encourage teamwork and collective problem-solving.
Real-world connection	Emphasize how the project applies to real-life environmental challenges.