Air Quality Monitoring

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 air quality monitoring device using a micro:bit and a dust sensor.
2. Program the micro:bit to measure and display dust particle levels.
3. Explain how a dust sensor works and its importance in monitoring air quality.
4. Connect the project to real-world applications of air quality monitoring and its impact on health and the environment.

→ Materials

• Smart Science IoT: Kit	For building and programming the air quality device.
• Computer with internet access and MakeCode	For programming and code execution.
• Dust sensor	Measures dust particle levels in the air.
• OLED screen	Displays the dust level readings.

5E Model Lesson Plan

Engage

Activity	Key Focus
Show images or videos of air pollution and discuss its causes and effects on health and the environment.	Building awareness about air pollution and its impact.
Discuss the importance of monitoring air quality and identifying potential sources of pollution.	Highlighting the need for air quality monitoring in real-world contexts.
Introduce the challenge: Design and build an air quality monitoring device that can measure and display dust particle levels.	Engaging students with a hands-on, real-world problem-solving task.

Explore

Activity	Key Focus
Divide students into groups and provide materials, IOT: kit, dust sensor, and OLED screen.	Promoting teamwork and exploration of new technologies.
Guide students to explore the kit's components, focusing on the dust sensor and OLED screen.	Encouraging hands-on discovery to understand sensor and display functionality.
Have students experiment with connecting the dust sensor and OLED screen to the micro:bit and observing their behavior.	Building practical knowledge of hardware integration.
Allow groups to share their discoveries and troubleshoot their setups collaboratively.	Enhancing problem-solving skills and peer-to-peer learning.

Explain

Activity	Key Focus
Facilitate a discussion where groups share their initial experiences and challenges faced.	Reflecting on hands-on exploration to reinforce understanding.
Introduce/review key concepts: Sensors (dust sensor), outputs (OLED screen), microcontrollers (micro:bit), programming logic, and basic electronics.	Providing foundational knowledge to support device assembly and coding.
Explain how the dust sensor measures dust particle levels and how the OLED screen displays the data.	Highlighting the science and technology behind air quality monitoring.
Demonstrate how these components interact through the micro:bit to collect and visualize air quality data.	Connecting theoretical concepts with practical applications.

Elaborate

Activity	Key Focus
Guide students to assemble their air quality monitoring devices, ensuring correct connections between the dust sensor, OLED screen, and micro:bit.	Applying learned concepts to build a functional device.
Introduce students to the MakeCode programming environment.	Building confidence in coding and problem-solving.
Help students write a program to:	
- Initialize the OLED screen.	Teaching how to prepare the display for data visualization.
- Read dust particle levels from the sensor.	Demonstrating how to extract and process sensor data.
- Display the dust level readings on the OLED screen.	Showing how to present sensor data in a user-friendly format.
Encourage troubleshooting and teamwork as students refine their air quality monitoring devices.	Enhancing critical thinking and collaboration skills.

Evaluate

Activity	Key Focus
Have groups test their air quality monitoring devices in different environments (e.g., classroom, outdoors) and record their observations.	Assessing functionality and real-world application of the devices.
Encourage students to reflect on their learning experience by discussing:	
- Challenges they faced and how they overcame them.	Promoting resilience and self-assessment in problem-solving.
- Improvements they could make to their devices.	Inspiring creativity and iterative design.
- Insights gained about the importance of air quality 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 air quality monitoring device.
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., demonstration, video).

Extension Activities

Activity	Details
Real-world research	Investigate air quality monitoring applications in industries and public health.
Device enhancements	Add features such as alarms for critical dust levels.
Advanced programming	Explore additional micro:bit features and programming concepts.
Awareness campaign	Create a presentation or video highlighting the importance of air quality monitoring and showcasing their devices.

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.