

## Lesson Plan Overview

Grade Level	4-6 (Adaptable)
Time Required	2-3 class periods (45-60 minutes each)
Subject	STEM, Environmental Science, Coding

### → Learning Objectives

1. Design and build an environmental noise detection device using a micro:bit and noise sensor.
2. Program the device to measure and display noise levels in decibels on an OLED screen.
3. Explain the effects of environmental noise and its impact on health and ecosystems.
4. Connect the project to real-world applications of noise monitoring in urban planning and health systems.

### → Materials

<ul style="list-style-type: none"> <li>• Smart Science IoT: Kit</li> </ul>	Includes components for the environmental noise detection device.
<ul style="list-style-type: none"> <li>• Computer with internet access and MakeCode</li> </ul>	For programming and code execution.
<ul style="list-style-type: none"> <li>• Noise sensor</li> </ul>	Detects noise levels and outputs data.
<ul style="list-style-type: none"> <li>• OLED screen</li> </ul>	Displays noise levels in real-time.

## 5E Model Lesson Plan

### Engage

Activity	Key Focus
Discuss the concept of environmental noise and its sources, such as transport, industrial, and recreational activities.	Building awareness about environmental noise and its causes.
Explore the effects of noise pollution on human health, wildlife, and ecosystems.	Highlighting the real-world significance of monitoring noise levels.
Present the challenge: Design and build a device that monitors environmental noise and displays noise levels in decibels.	Inspiring engagement through a relevant and tangible project.

### Explore

Activity	Key Focus
Provide students with the IOT: kit, including the noise sensor and OLED screen.	Promoting teamwork and exploration of new components.
Guide students to explore the connection points and understand the functionality of the noise sensor and OLED screen.	Encouraging hands-on discovery of sensor and display integration.
Have students experiment with connecting the noise sensor and OLED screen to the micro:bit and testing basic functionality.	Building practical understanding of how the components interact.
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 group discussion where students share their observations and challenges.	Reflecting on hands-on exploration to solidify understanding.
Introduce/review key concepts: Noise pollution, sensors (noise sensor), outputs (OLED screen), microcontrollers (micro:bit), and programming logic.	Providing foundational knowledge to support the design and coding of the device.
Explain how the noise sensor detects sound levels and outputs them in decibels, and how the OLED screen displays this data.	Highlighting the roles and interactions of each component in the monitoring system.
Demonstrate how these components interact through coding and circuit integration to display noise levels.	Bridging theoretical knowledge with practical application.

## Elaborate

Activity	Key Focus
Guide students step-by-step in assembling their environmental noise detection devices, ensuring proper connections between the noise sensor, OLED screen, and micro:bit.	Applying theoretical knowledge to create a functional device.
Introduce students to the MakeCode programming environment, including extensions for initializing the OLED screen and configuring sensors.	Building coding skills and confidence in using programming tools.
<b><i>Help students write a program to:</i></b>	
- Initialize the OLED screen and display time.	Teaching how to prepare the display for real-time data visualization.
- Measure and display noise levels from the sensor every second.	Demonstrating how to collect and present sensor data effectively.
- Pause between measurements to allow for accurate updates.	Reinforcing the importance of timing in monitoring systems.
Encourage troubleshooting and teamwork as students refine their devices for accurate noise detection.	Developing critical thinking and resilience through collaborative problem-solving.

## Evaluate

Activity	Key Focus
Have groups test their devices in different environments, such as classrooms, hallways, or outdoor areas, and record noise levels.	Assessing functionality and real-world application of the devices.
<b><i>Encourage students to reflect on their learning experience by discussing:</i></b>	
- 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 monitoring environmental noise.	Reinforcing the relevance 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 noise detection device.
Programming skills	Accurate and effective use of MakeCode to program the micro:bit.
Concept understanding	Comprehension of noise pollution, sensors, outputs, and microcontrollers.
Creativity and problem-solving	Innovative approaches to building and testing the system.

## 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 real-world applications of noise monitoring in urban planning and health systems.
Device enhancements	Add features such as a data logging system or a noise threshold alarm.
Advanced programming	Explore additional features and programming concepts using the micro:bit.
Awareness campaign	Create a presentation or video showcasing the importance of noise monitoring and their device.

## Teacher Notes

Note	Details
<b>Safety</b>	Ensure students handle tools and materials safely.
<b>Instructions</b>	Provide clear steps for assembly and programming.
<b>Support</b>	Offer guidance during hands-on activities.
<b>Collaboration</b>	Encourage teamwork and collective problem-solving.
<b>Real-world connection</b>	Emphasize the relevance of the project to real-life challenges of noise pollution.