Name: Date: Class:

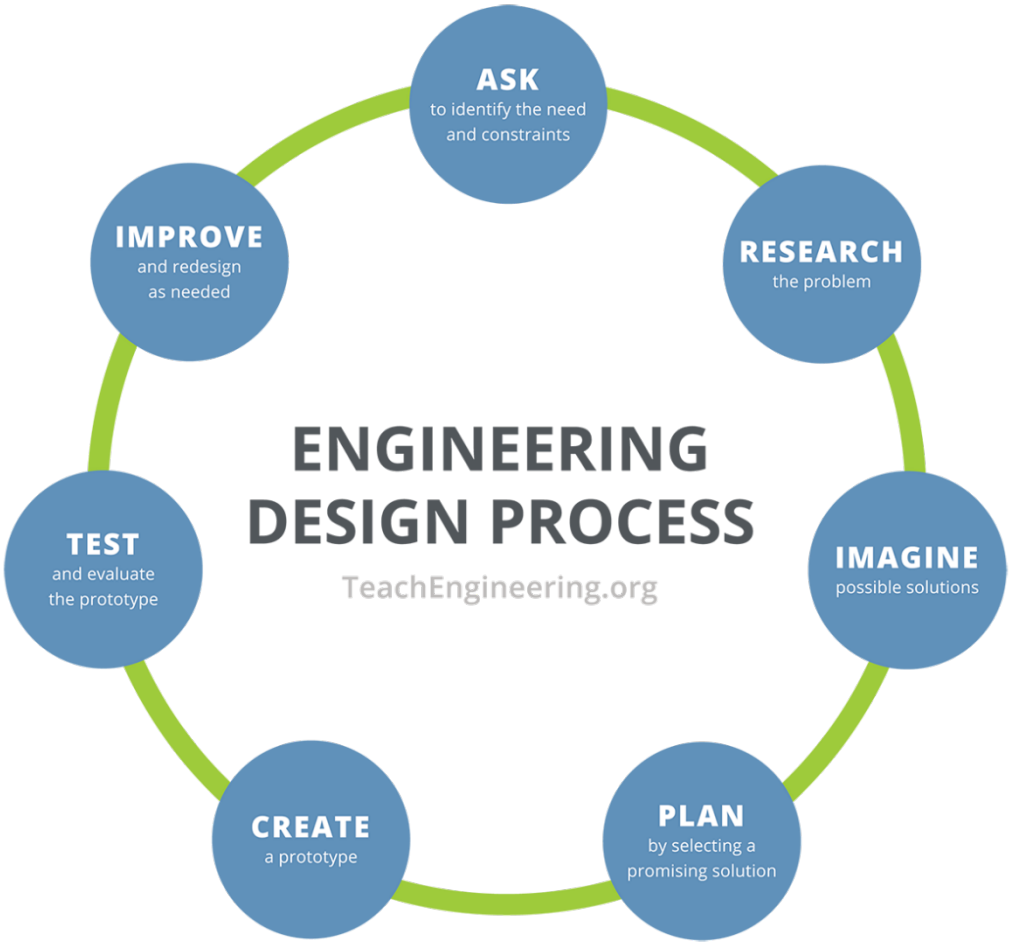
Student Activity Guide

How can we ensure optimal teaching and learning and fulfill United Nations sustainability goals by monitoring the air quality of classrooms?

ROLE: You are a team that works for the Environmental Protection Agency (EPA). Your team has been commissioned by the school district to assess the air quality in school classrooms.

PROBLEM: The school district is concerned about the well-being of its students in the school district. In addition, the superintendent wants to develop global citizenship by fulfilling United Nations sustainability goals. To ensure that students have optimal conditions for learning, your team is tasked with providing a report of the atmospheric conditions inside the classrooms.

PRODUCT: Your team needs to create a report outlining the atmospheric conditions of various classrooms and suggestions for improvement.



Name: **Date:** **Class:**

Reading Check: Putting the problem into context

How Air Quality Affects Your Performance in School

Studies have shown that poor indoor quality can have farther-reaching effects aside from respiratory ailments and allergies. Indoor air pollution in schools can have a negative impact on school attendance and academic performance.

For instance, a Chinese study showed that children in schools with higher levels of particulates in the air had higher cases of asthma and hospital admission. Meanwhile, a study from Oregon showed that students taking exams in 72°F (22°C) environments did better than those in 62°F (16°C) and 82°F (28°C) environments.

Various indoor air quality metrics can have a direct effect on academic performance. In a nutshell:

- Air pollution causes inferior memory performance. A study from Health Affairs shows that high levels of nitrogen dioxide (NO_2) results in a 7.37% decrease in memory function. Poor air quality can have a serious effect on student mental health and performance.

- Poor air results in poor concentration. Higher levels of carbon dioxide (CO_2) can cause students to easily lose focus during school. Excessive CO_2 in the air is known to cause headaches, drowsiness, and even confusion in people. Too much CO_2 makes it difficult to "think strategically" and "take initiative." Although it's not immediately dangerous to student health, it can reduce performance at school greatly.

- Classrooms with inferior ventilation end up with worse exam performance. A study from the University of Tulsa showed that students in classrooms with poor air quality and inadequate ventilation performed an average of 74 points lower on exams. It's unfortunate, but these poor air quality conditions can cause serious repercussions for any student; doing poorly in exams can limit their opportunities later in life.

- Poor air quality results in more absences. One of the biggest causes of absenteeism is asthma. In American schools, asthma results in 14 million days of absence for students nationwide every year. Both long-term and short-term exposure to bad air can trigger asthma, and once there it's a chronic condition that never really gets cured. And the more particles, smoke, and other irritants in the air, the worse the asthma gets. In severe circumstances, it can lead to an asthma attack, which can be life-threatening, and even if a student receives prompt medical care, it is a very harrowing and frightening experience that can affect a student physically, mentally, and emotionally for a long time.

Name: **Date:** **Class:**

Review Questions

1. List the factors in the atmosphere that can have a negative effect on learning.

2. At what temperature do students have the best exam results? Why do you think that is?

3. What are some negative effects of high CO_2 levels in a classroom?

4. What is one major cause of absenteeism in American schools?

Activity

1. Create an Arduino air quality monitor that measures two properties of the atmosphere.

2. Place your air quality monitor in a classroom and measure the air quality before, during, and after class (collect data at least 30 minutes at three-minute intervals).

3. Write an air quality report that includes the following sections:
    a. Background research (Use answers from reading check)
    b. Essential question
    c. Methods
    d. Graph
    e. Discussion of results that includes improvements and further research ideas