

BioSTEM Project 2: Predicting Air Quality Patterns: A Visual Investigation-Project Packet

Name(s) _____

Project Overview

Students will analyze real air quality data from Memphis, TN using simple visual tools and basic math to identify patterns and make predictions about future air quality conditions.

Time Required: 4 class periods **Subject Integration:** Social Studies, Environmental Science, Math

Learning Objectives

Students will:

- Understand how air quality affects community health and daily life
- Analyze real environmental data to identify patterns
- Make predictions based on historical data
- Connect environmental issues to social and economic factors
- Practice data visualization and basic statistical thinking

Materials Needed

- Computers or tablets with internet access
- EPA Air Quality Index Daily Values Report website
- **Calculator** (or phone calculator)
- **Printed data recording sheets** (provided below)
- Colored pencils or markers

Background Information for Students

What is Air Quality?

Air quality measures how clean or polluted the air is. The **Air Quality Index (AQI)** uses a scale from 0-500:

- **0-50 (Green):** Good - Air quality is satisfactory
- **51-100 (Yellow):** Moderate - Acceptable for most people
- **101-150 (Orange):** Unhealthy for sensitive groups
- **151-200 (Red):** Unhealthy for everyone
- **201-300 (Purple):** Very unhealthy
- **301-500 (Maroon):** Hazardous

Why Does This Matter?

Poor air quality affects:

- **Health:** Asthma, heart disease, lung problems
- **Economy:** Medical costs, missed work/school days
- **Social Justice:** Low-income communities often face worse air quality
- **Daily Life:** Outdoor activities, sports, commuting

Step-by-Step Project Instructions

Phase 1: Data Collection (Day 1) [Homework= 10 pts, if any step is incomplete in Phase 1, 10 points will be deducted, Data Recording Sheet will need to be submitted with completed project packet for Phase 1]

Step 1: Access EPA Data

1. Go to the **EPA Air Quality Index Daily Values Report:**
<https://www.epa.gov/outdoor-air-quality-data/air-quality-index-daily-values-report>
2. Select settings:
 - **Pollutant:** All AQI Pollutants
 - **Year:** Start with 2024
 - **County:** Shelby County (Memphis area)
3. Click "Generate Report"
4. **Don't download** - just look at the data on screen

Step 2: Record Key Data Points

Using the **Data Recording Sheet** (see below), manually record:

- **12 data points** - one from the middle of each month (around the 15th)
- **Focus on these columns:** Date, Overall AQI Value, Main Pollutant
- **Repeat for 2023 and 2022** (change year and record 12 more points each year)

Data Recording Sheet Template (you will receive a physical copy of a Data Recording Sheet Template in class, use it to complete this part):

MEMPHIS AIR QUALITY DATA COLLECTION

2024 Data:

January 15: AQI = _____, Main Pollutant = _____

February 15: AQI = _____, Main Pollutant = _____

March 15: AQI = _____, Main Pollutant = _____

[Continue for all 12 months]

2023 Data:

[Same format]

2022 Data:

[Same format]

Phase 2: Manual Data Analysis (Day 2-3) [Classwork= 10 pts, if any step is incomplete in Phase 2, 10 points will be deducted, 3 Year Monthly Average Chart will need to be submitted with completed project packet for Phase 2]

Step 3: Calculate Monthly Averages by Hand

For each month, calculate the 3-year average using a calculator:

Example for January:

- January 2022: AQI = 45
- January 2023: AQI = 52
- January 2024: AQI = 48
- **January 3-Year Average:** $(45 + 52 + 48) \div 3 = 48.3$

Fill in Your 3 Year Monthly Average AQI Chart (you will receive a physical copy of a 3 Year Monthly Average AQI Chart in class, use it to complete this part):

Month	3-Year Average AQI
January	48.3
February	___
March	___
[etc.]	

Step 4: Identify Patterns by Visual Inspection

Look at your averages and answer:

- **Which months have the highest AQI?** (Circle them in red, **on your 3 Year Monthly Average Chart**)
- **Which months have the lowest AQI?** (Circle them in green, **on your 3 Year Monthly Average Chart**)

- **Are there seasonal patterns (write your averages HERE on your packet)?**

- Winter (Dec-Feb = add avg. for Dec, Jan, Feb and $\div$ by 3): Average =

- _____

- Spring (Mar-May = add avg. for Mar, Apr, May and $\div$ by 3): Average =

- _____

- Summer (Jun-Aug = add avg. for Jun, Jul, Aug and $\div$ by 3): Average =

- _____

- Fall (Sep-Nov = add avg. for Sep, Oct, Nov and $\div$ by 3): Average =

- _____

Step 5: Count "Unhealthy" Days

Go to the EPA Air Quality Index Daily Values Report and count, **input your data from your count here on your packet:**

- **2022:** How many days had AQI over 100? _____

- **2023:** How many days had AQI over 100? _____

- **2024:** How many days had AQI over 100? _____

- **Consider, is this getting better or worse?**

Phase 3: Make Predictions (Day 4) [Assessment= 10 pts, if any step is incomplete in Phase 3, 10 points will be deducted, predictions should be written here in project packet for Phase 3]

Step 6: Simple Prediction Methods (Complete ALL three Methods, write your results on your HERE on your packet below)

Method 1: Pattern-Based Days over 100 2025 prediction

- Examine your data from step 5
- Make a prediction how many days in 2025 will have a AQI over 100 based on your data

Method 2: Pattern-Based Seasonal 2025 Prediction Predict which seasons will have the highest AQI based on your data from step 4.:

- Examine your data from step 5
- Make a prediction on what season(s) in 2025 will have the worst AQI based on your data.

Method 3: Pattern-Based Month 2025 Prediction

- Examine your data from step 5, with your "worst" and "best" months
- Predict which months in 2025 will be the worst/best for AQI

Prediction 1: Pattern-Based Days over 100 2025 prediction

Prediction 2: Pattern-Based Seasonal 2025 Prediction

Prediction 3: Pattern-Based Month 2025 Prediction

