MONITORING

THE

CONCENTRATION

OF

CARBON DIOXIDE

In a New York City Classroom

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Contents

Introduction

Carbon dioxide also known as CO2 is produced during cellular respiration (Olsen, 2011). Humans that are exposed to high levels of CO2 can experience health problems for example brain damage and breathing problems (W.D.H.S, 2011). Human activity is rapidly changing the composition of the Earth's atmosphere, contributing to warming from excess carbon dioxide (Feely, Sabine, Takahashi & Wannikhof, 2001). This project will determine how much CO2 a person is taking in everyday, and how much is surrounding them in the classroom. The CO2 sensor will detect how high the levels of Carbon Dioxide are in the Classroom. If the doors and windows are closed the CO2 levels will increase to levels above 1000pm because all of the air is locked in or the ventilation system is not an effective system and also there are no open spaces to let external air in.

Background Information

Concentration Levels	Symptoms
250-350 ppm	The normal outdoor air level
350-1000 ppm	The typical level found in occupied spaces with good air exchange
1000-2000 ppm	Levels with drowsiness and poor air
2000-5000 ppm	Experience signs of headaches, sleepiness, bad concentration, increase

	in heart rate, and slight nausea.
5000 and up	Can lead to loss of oxygen which can damage the brain permanently

Source: (W.D.H.S, 2011)

As modern technology advances rapidly, the environmental pollution has been also progressing very fast (Kang & Kim, 2012). The exchange of O2 and CO2 in the external environment and the cells of the body are efficient because alveoli and capillaries have very thin walls and it is very abundant to our lungs (Bio 301, 2011).

Project design Chart

Scientific Problem
What are the effects of opening and closing the windows and doors on the levels of carbon dioxide in a New York City Classroom?
Hypothesis
If the doors and windows are closed then that CO2 levels will increase to levels above 1000 ppm and there are no open spaces to let external air in.
Objectives
Determine the levels of carbon dioxide when there are students in the classroom and when there are no students in the classroom, in different sets of opening and closing the doors and windows.

Compare the data of students in the classroom to students not in the classroom.
Determine why the data are different(different trends)
Independent Variables
The presence and absence of students
Opening and closing of windows and doors.
Dependent Variables
The carbon dioxide levels
Proposed Controls
The windows and doors
Students in the classroom
Constants
The amount of students in the classroom
Assumptions
Opening windows will allow air exchange and lower CO2
The ventilation system is not functioning properly
Limitations
Not a lot of sensors to collect data in other classrooms.

Locality

Figure 1-New York Harbor School, located on Governors Island.

Materials

Materials	Quality	description
CO2 sensor (Li-820)	1	To detect the carbon dioxide in the classroom
Microsoft Excel	1	To make graphs
Bluetooth antenna	1	Collects data from sensor and send to computer.
HyperTerminal(program)	1	used to display the data of CO2
Sp4h (program)	1	Program downloaded to store data

Procedures

The students will be in the classroom with windows and doors open, while the Carbon Dioxide sensor is detecting and collecting data. Next set up would be students in the classroom while the windows and doors are closed. Next the windows and doors will be closed with the students in the classroom for 1 hour precisely on Tuesday's and Thursdays at 2:00pm to 3:00pm. Next the windows and doors will be closed with no students in the classroom. The data will be collected and saved onto a computer that the sensor is hooked up to; later the data is collected and put on a flash drive, then it's off to finalizing the data and doing the math, Finding out the standard deviation. This project will test the CO2 levels in a classroom, the CO2 sensor will detect how much CO2 is flowing in the classroom with students in the classroom with closed windows and doors, and students with open windows and doors, next would be when the students are not in the classroom continuing with the same process as the students were in the classroom. So as the CO2 sensor is detecting data it the job that is need to be done is collecting the information that is being stored onto SPIP4H which is a program that is downloaded to store all data that is being detected.

Results

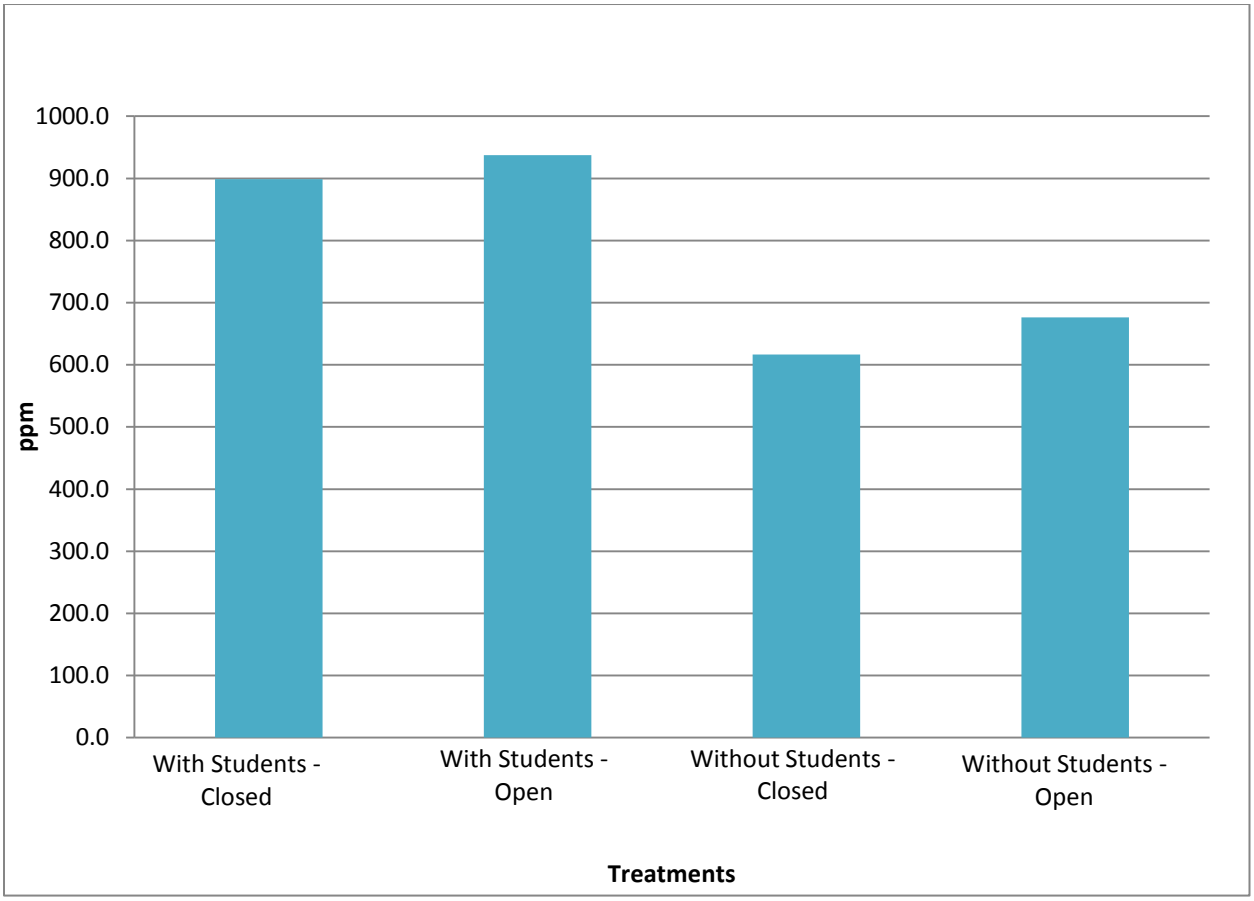

Figure 2- **Average CO2 levels in a New York City Classroom**

Windows closed with students opened is greater on the graph, than windows closed with students, without students opened is a bit higher than without students closed, the students contribute to the CO2 that is coming into the classroom when windows and doors are opened. With student's windows and doors opened is about 920 ppm, students with windows and doors opened, without student's windows and doors closed, and without student's windows and doors opened are found in the typical level found in occupied spaces with good air exchange.

Analysis of Results

Carbon Dioxide is a colorless, odorless, harmful gas. Depending on the temperature and pressure of the room CO2 can exist as a liquid or a solid (W.D.H.S, 2011). There were large differences in CO2 in the classroom with students and without students. There was a slight increase in CO2 concentrations when the windows and doors were opened. There were no real differences in opening and closing the windows and doors. The CO2 sensor could've read differently, because the CO2 sensor has a set cell temperature. When the CO2 sensor is hot it reads less CO2 data, when the CO2 sensor is cold it reads more data. The hypothesis was incorrect as shown in the results where there are students in the classroom and students not in the classroom. In an article only students were measured without ventilation and that lead to 750 ppm (H. Allan, A.D. Teet, and M. Alo). The levels of carbon dioxide when the students are in the classroom with opened doors and windows were different from when there were students in the classroom with the windows and doors closed. When the doors and windows are opened the concentration of Carbon Dioxide shows a great effect of when the windows and doors are closed with students in the classroom. Some observations that were made were in the results, closed with students and closed without students were very close.

Conclusion

Concentration of carbon dioxide in the classroom with student – closed shows the greatest amount of CO2 10ppm away from 1000ppm which is found in occupied places with good air exchange, so the ventilation system in the room when the windows and doors are closed worked well in regulating the air in the classroom. The data wasn't as good as hoped because of the change within the CO2 sensor, when the room temperature is cool the sensor reads a bit more and when it's warm the CO2 sensor reads less.

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