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Discussion on changes in concentration of suspended particulates on campus

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Summary

To observe the phenomenon where students want to know more about the conditions in school but don't know how to obtain the information.

As a result, we collected data using instruments provided by Zhongshan University and instruments placed by the Environmental Protection Agency at Herbin Elementary School.

Ultimately, we created the video for students to help them realize more information about the environment

Research Motivation and Purpose

As members of the Kaohsiung Municipal Girls' Senior High School Atmospheric Society, we serve as observers at school and participate in the GLOBE Program (The Global Learning and Observations to Benefit the Environment) which is an international collaboration between the United States and Taiwan. This program provides instruments to participating GLOBE schools as students' observation tools for teachers to integrate into their curriculum, encouraging students to actively engage in scientific research during their academic journey.

Recently, our school received instruments for monitoring suspended particulate matter from Zhongshan University. We used this equipment to analyze the fluctuation characteristics of suspended particulate matter concentration on the campus of Kaohsiung Municipal Girls' Senior High School. We specifically focused on the peak PM2.5 concentration time each day in October and November. Our aim is to further explore the trends in suspended particulate matter concentration in the campus environment and identify potential influencing factors.

Revised sentence: Additionally, we found that air quality prevention measures on campus are typically conveyed through materials produced by the Environmental Protection Agency, which are displayed directly on the TV wall. However, this method fails to effectively capture students' attention, and the small font size of the materials prevents them from reading all the information before the next message appears. We aim to assess students' understanding of air quality pollution and prevention methods. We have created a short video to attract students' attention, and we will use the results to develop videos and promotional materials that specifically target students on campus. This approach aims to replace the previously uniform messages

issued by government agencies. It also aims to stimulate interest among students in understanding air quality control measures and encourage them to dedicate time to implementing various prevention strategies.

Research Methods and Procedures

1. We compare and statistically analyze the variation in suspended particulate matter (PM2.5) concentrations in Kaohsiung Municipal Girls' Senior High School and the EPA's Qianjin monitoring station during August and September, using instruments provided by Zhongshan University for Kaohsiung Municipal Girls' Senior High School and instruments placed by the Environmental Protection Agency at the Herbin Elementary School.
2. Analyze the trend of concentration variations and explore potential anthropogenic factors. For example, investigate whether the concentrations are lower during holidays due to the absence of people on campus, if they are influenced by traffic flow, and whether human activities during summer vacation affect the concentrations.
3. The focus should be on analyzing the peak PM2.5 concentration time each day in October and November, and using AQI level indicators to understand the air quality over the two-month period.
4. Research will be conducted on preventive measures against air pollution that students may have less understanding of or are generally unaware of. The analysis will focus on the pros and cons of various behaviors for students, as well as the difficulty of implementation. Key points will be simplified for use as the main segments in promotional videos and materials. The aim is to attract students' interest and encourage their active participation in prevention efforts.
5. We will produce a video to present our research findings, primarily targeting students from Kaohsiung Municipal Girls' Senior High School for the purpose of raising awareness. The promotional material will be specifically designed for prevention and control efforts.

Introduction and Review of Literature

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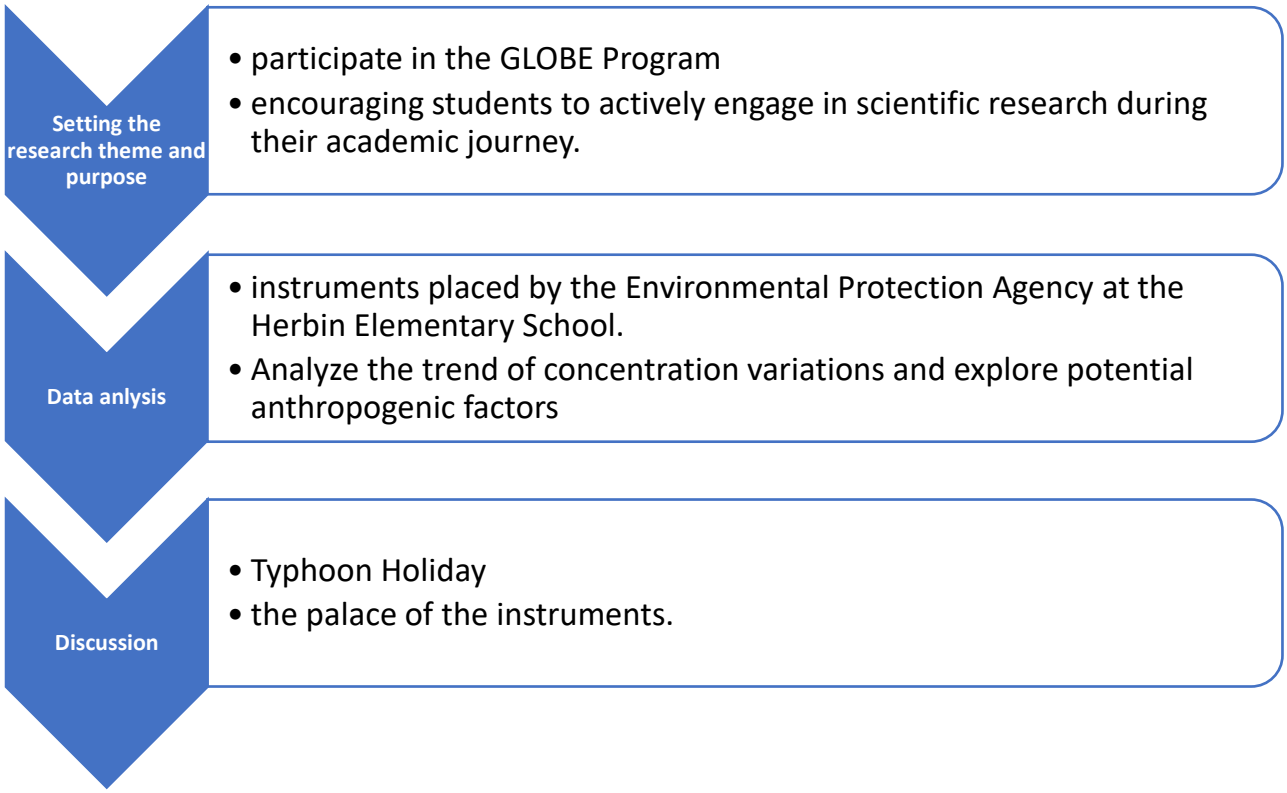
6. Department of Health, Ministry of Health and Welfare (n.d.). Reference Information on Fine Particulate Matter (PM2.5).https://www.nmmst.gov.tw/other/B7050-wc.pdf

7. Ministry of Health and Welfare (2018, March 3). Protect Health, Love the Earth: Six Tips to Reduce PM2.5 - Starting with Food, Clothing, Housing, Transportation, Education, and Entertainment.https://www.mohw.gov.tw/fp-3792-40064-1.html

8. Kaohsiung City Government (December 30, 2021). Kaohsiung City Air Pollution Prevention Plan (Years 2020-2023). https://reurl.cc/1GnOGX

research Methods and Materials



Results and Conclusions

1.Data analysis

Based on the results from the Kaohsiung Municipal Girls' Senior High School station during two separate weeks in August and September, we selected the periods from August 21st (Monday) to August 27th (Sunday) and from September 4th (Monday) to September 10th (Sunday). It is important to note that some of these days included school activities or experienced significant weather changes.

(1) Freshman Orientation: August 23rd-24th

(2) Health Checkup: August 25th

(3) Typhoon Holiday: September 4th-5th

We observed in the August chart that the variation in suspended particulate matter concentration in the air did not align with our initial assumptions. Initially, we expected higher concentrations of suspended particulate matter on days with school activities during the summer vacation period. However, only the concentrations on August 24th and 25th were higher compared to the preceding days. Surprisingly, the concentration on August 23rd remained relatively low, and the concentrations on August 24th and 25th were not significantly elevated, falling within the margin of error of the instruments. Consequently, we speculate that the location of the observation site at the rear entrance of the school, where only teachers' vehicles typically enter and exit during regular weekdays, may not readily reflect the impact of summer activities, predominantly attended by students, entering the campus through the front entrance in the data collected by the instruments.

The variation in suspended particulate matter concentration influenced by the September typhoon aligns with our initial theoretical speculation. Before the intensification of the typhoon's wind and rain, the peripheral circulation of the typhoon causes a deterioration in air quality in the plains vicinity. As the wind and rain intensify, the air quality gradually improves. Although Kaohsiung declared a typhoon holiday on September 4th and 5th, the wind and rain were not particularly severe on the 4th. It was only in the evening of the 4th that the wind and rain gradually intensified. Consequently, this aligns with the data observed by the instruments. The data shows a significant increase in PM2.5 concentration on September 4th compared to normal levels, followed by a decrease starting from the evening of the 4th. In

the days following the typhoon, due to continuous rainfall, the PM2.5 concentration in the air remained below 4 ppm. There was a slight increase again on Sunday (September 10th).

Conclusion

In this study, we used the school's instruments to analyze the variations and trends in PM2.5 concentration within the campus environment. Despite our instruments being located at the rear entrance, which is less affected by student activities, the overall trends closely matched those of the Environmental Protection Agency's data, confirming the reliability of our instrument data. Additionally, we observed that during typhoons, air quality data was influenced by various weather factors, deviating from theoretical expectations.

Further analysis of the daily peak concentrations in October and November revealed that PM2.5 concentrations in the air of Kaohsiung tend to increase as winter approaches. This increase is likely influenced by wind direction and external pollution. After dividing each day into five time periods, we found that the air quality is generally better during the afternoon when students are in school. If this trend proves consistent in longer-term studies, we could recommend schools to schedule outdoor activities in the afternoon.

Kaohsiung Municipal Girls' Senior High School students demonstrated a good understanding of relevant air pollution information and expressed their willingness to wear masks for self-protection in the questionnaire survey. However, there were misconceptions regarding the effectiveness of masks against PM2.5, which prompted the need for further research and the creation of educational videos on this topic. While students expressed a desire for schools to provide air quality information, the effectiveness of routine awareness campaigns may be limited. Therefore, we hope that our educational videos can capture attention and encourage a greater emphasis on conveying relevant information.

Suggestions

1. To better understand the variations in PM2.5 concentration within the campus environment, it is important to analyze the concentrations during different time periods and assess their impacts. Feasible improvement measures can be proposed, such as enhancing student awareness, providing real-time air quality information, and suggesting scheduling outdoor activities in the afternoon whenever possible.
2. Assess the levels of students' awareness regarding air quality-related knowledge in their daily lives. Based on the results, create promotional videos that address areas where students may be less familiar or have misconceptions. The aim is to enhance students' attention and awareness of relevant knowledge by disseminating information.
3. Apply the data obtained from campus observations to real-life situations, giving more significance to the collection and trends of the data.