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Full Length Research Article

ANALYSIS OF THE INFLUENCE OF ENVIRONMENTAL FACTORS: TEMPERATURE, HUMIDITY, AND NOISE LEVELS ON STUDENTS' COMFORT AND LEARNING EFFICIENCY WITHIN ACADEMIC SETTINGS

*[1]Joseph A. Akinyemi, [2]Adesanya O. Atilade and [3]Sakiru A. Okedeyi

[1]Department of Mathematical Sciences, Lagos State University of Science and Technology, Ikorodu, Nigeria
[2]Department of Physical Science, Lagos State University of Science and Technology, Ikorodu, Nigeria
[3]Department of Physics, Lagos State University of Education, Oto-Ijanikin, Lagos, Nigeria

*Corresponding Author Email Address: akinyemi.ja@lasustech.edu.ng

ABSTRACT
This study aimed to examine the influence of environmental factors: temperature, humidity, and noise levels on students' comfort and learning efficiency within academic settings at LASUSTECH and Caleb University. Data collected revealed that average temperatures increased from 28.99 °C in the morning to 31.75 °C in the afternoon, while humidity declined from 78.02% to 62.77%, and noise levels (LAeq) fluctuated between 63.05 dB in the morning, 66.75 dB at midday, and 59.92 dB in the evening. Correlation analysis showed a moderate negative relationship between temperature and humidity ($r = –0.60$), a weak positive relationship between temperature and noise ($r = 0.32$), and a weak negative correlation between humidity and noise ($r = –0.25$). The regression model for LASUSTECH yielded an $R^2 = 0.268$ ($F = 1.907$, $p = 0.127$), while Caleb University's model produced a higher $R^2 = 0.294$ ($F = 2.834$, $p = 0.0304$), indicating a stronger, statistically significant influence of environmental factors on noise levels. Overall, the findings suggested that variations in temperature and humidity significantly affect acoustic conditions and student comfort, emphasizing the need for effective environmental control and sound management strategies to enhance learning efficiency across university environments.

Keywords: Environmental conditions, Multiple regression model, Noise level, Academic setting.

INTRODUCTION
The academic environment significantly impacts student performance and well-being. Various environmental factors, such as temperature, humidity, and noise levels, influence the comfort and concentration of students and staff within educational settings. Understanding the interplay between these factors is crucial for designing and maintaining optimal learning environments. Numerous studies have documented the effects of temperature on cognitive function and academic performance. Wargocki and Wyon (2007) found that classroom temperatures above 25 °C can impair students' performance in tasks requiring concentration and memory. Similarly, Haverinen-Shaughnessy *et al.* (2011) reported that optimal learning occurs in classrooms maintained at moderate temperatures, ideally between 20^oC and 23^oC. Atilade *et al.* (2024) investigated noise pollution, a prevalent issue in schools, by assessing noise levels in twelve secondary schools within a specific area. The study found that noise levels in this location were significantly higher than the World Health Organization (WHO,1999) recommended limits for classrooms and outdoor environments. The research confirmed that the primary effects of the noise on respondents were headaches and stress, posing serious concerns for their health and well-being. Continuing the focus on noise pollution in schools, Sakiru *et al.* (2023) conducted a study in twelve primary schools within a selected area of Ikorodu, Lagos State, to assess noise levels. The findings highlighted the urgent need to establish and enforce regulations aimed at protecting primary school pupils from the harmful effects of noise pollution. Implementing such laws would significantly enhance the well-being of these vulnerable students.

Humidity levels also play a critical role in the comfort and health of students. Low humidity can lead to dry skin and respiratory discomfort, while high humidity levels can contribute to the growth of mold and other allergens, impacting students' health and attendance (Mendell & Heath, 2005). Studies by Fisk *et al.* (2010) suggest that maintaining indoor relative humidity between 40% and 60% can minimize health risks and enhance comfort. Noise pollution is another significant factor affecting academic performance. Shield and Dockrell (2003) demonstrated that high noise levels can interfere with speech perception, reading comprehension, and overall learning outcomes. A study by Stansfeld and Matheson (2003) found that chronic exposure to high noise levels in schools is associated with increased stress levels and reduced cognitive function among students.

Research into the combined effects of temperature, humidity, and noise is limited, though emerging studies suggest that these factors can interact in complex ways to influence the learning environment. For instance, Bak-Bir *et al.* (2012) found that high temperatures and poor ventilation, combined with high noise levels, can significantly degrade indoor air quality and student performance. Furthermore, Piccolo *et al.* (2015) highlighted that maintaining optimal levels of these environmental factors requires a holistic approach to indoor environmental quality management. Atilade *et al.* (2021) conducted noise level measurements at randomly selected locations near the students' union building during both peak and off-peak academic hours. The study highlighted that the noise levels observed were significant and underscored the need for immediate corrective action.

Although previous studies have explored the individual effects of temperature, humidity, and noise on students' academic performance, few have examined how these factors interact to influence learning outcomes. This research aims to bridge that gap by analyzing the combined influence of these environmental variables across different educational environments. Specifically, the study seeks to explore the relationships among temperature, humidity, and noise levels in various school settings; evaluate their collective impact on student comfort and academic achievement; and propose data-driven recommendations for improving classroom environmental quality to support better learning performance.

MATERIAL AND METHODS

The data was collected from multiple locations within two university campuses (Lagos State University of Science and Technology & Caleb University), both at Ikorodu, Lagos State, over different times (ranging from 7:00 am to 8:00 pm) of the day to capture the variations in environmental conditions. The study focuses on understanding how these factors interact and their potential impact on student comfort and academic performance.

Data Collection

Measurements were taken at each location at the specified times over a period of one week to ensure consistency and account for any day-to-day variations. All instruments were calibrated before use to ensure accuracy. The recorded data was entered into a spreadsheet and checked for any anomalies or missing values. The recorded data was now analysed with the aid of Python software for accurate computation and visualization.

Sampling Locations for Caleb University:

Data was collected from ten different locations on the Caleb **University campus**:

1. Joseph Hall
2. Cafeteria
3. College of Art and Social Management Sciences (CASMAS)
4. College of Education (COLED)
5. Joshua Hall
6. College of Pure and Applied Sciences (COPAS 1)
7. College of Environmental Sciences and Management (COLENSMA)
8. Library
9. College of Postgraduate Studies (COPS)
10. College of Pure and Applied Sciences (COPAS 2)

Sample locations for Lasustech University:

1. College of Agriculture
2. College of Engineering
3. College of Environmental Design Tech.
4. College of Applied Social Sciences
5. College of Basic Sciences
6. Library Complex
7. Students' Activities Centre
8. SUG Building

Time Intervals: Environmental data were recorded at four different times of the day to account for diurnal variations:

1. 7 AM - 8 AM
2. 11 AM - 12 NOON
3. 3 PM - 4 PM
4. 7 PM - 8 PM

Parameters Measured:

1. Temperature (^{o}C)
2. Humidity (%)
3. Noise Level (LAeq, dB)

Instruments

Temperature and Humidity Sensor: A digital thermohygrometer was used to measure temperature and humidity levels at each location.

Sound Level Meter: A calibrated sound level meter was employed to measure the equivalent continuous sound level (LAeq) in decibels.

Data Analysis

Descriptive Statistics:

The mean and range for each environmental factor were calculated for each location and time interval. The overall average and range across all locations and times were also determined; these are used to plot line graph and scatter plots to show the relationship between the environmental factors.

Graphical Representation:

Line graphs and scatter plots were used to visually represent the variations and correlations between the environmental factors.

Correlation Analysis:

For the inference, Pearson correlation coefficients were calculated for both universities to assess the relationships between temperature and humidity, temperature and noise level, and humidity and noise level.

Statistical model

The statistical model to explain the relationship between Temperature, Humidity, and Sound Level was fitted as

$$soundlevel(LAeq) = \beta_0 + \beta_1(temperature) + \beta_2(humidity) + ei \quad (1)$$

using Ordinary Least Squares (OLS) regression. The significance of the model was tested using two-way Analysis of Variance (ANOVA). We also employed correlational analysis to measure and explain the strength of the relationship that existed based on the data collected.

RESULTS AND DISCUSSION

The results from the statistical analysis and graphical representations were interpreted to understand the interplay between temperature, humidity, and noise levels in the academic settings.

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Summary Statistics
Summary Statistics of temperature, humidity, and Noise levels for Lasustech and Caleb Universities

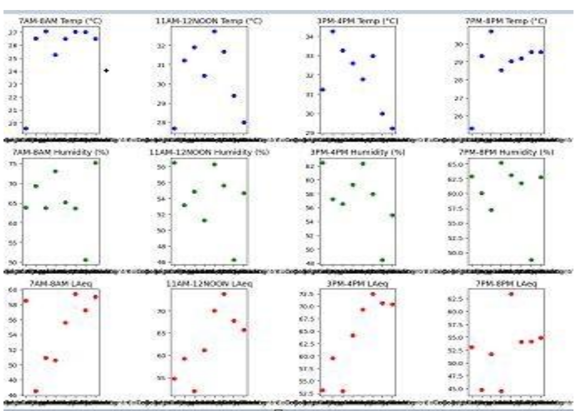
Table 1a: Summary Statistics for Caleb Table 1b: Summary Statistics for Lasustech

	Temperature	Humidity	LAeq
count	40.000000	40.000000	40.000000
mean	30.606900	69.348710	63.565848
std	1.893562	8.343961	6.051933
min	27.213110	53.409800	51.865570
25%	29.452865	62.365572	58.581560
50%	30.427050	70.248500	63.029505
75%	31.614753	75.334425	67.984425
max	36.196720	84.131150	73.827870

	Temperature	Humidity	LAeq
count	32.000000	32.000000	32.000000
mean	29.213500	59.318953	58.598231
std	2.990347	6.738289	8.178925
min	19.568852	46.250000	44.522500
25%	27.045833	54.883333	53.027657
50%	29.350000	58.922418	57.864331
75%	31.338798	63.273581	64.516667
max	34.250000	75.200000	73.785000

The dataset includes 40 observations for Caleb University and 32 observations for LASUSTECH. Table 1a shows a mean temperature of $32.61^{o}C$, while Table 1b records $29.21^{o}C$, indicating a slight difference. Higher humidity levels are observed in Table 1a, whereas Table 1b shows lower humidity. Both universities exhibited low variability in sound levels, although LASUSTECH demonstrated higher variability compared to Caleb University.

Graphs and Visualizations



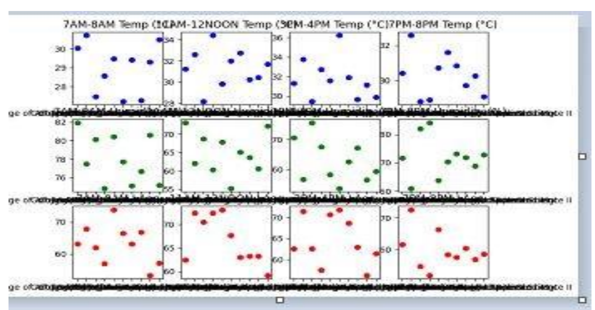


Figure 1a: Scatter plots for Caleb University Fig 1b: Scatter plots for Lasustech University

The scatter plots represent measurements of temperature, humidity, and equivalent continuous sound level (LAeq) at different times throughout the day.
Temperature:

1. 7 AM-8 AM: Temperatures are relatively low and tightly grouped, indicating consistent cooler morning conditions.
2. 11 AM-12NOON: There's a noticeable increase in temperature, with values clustering around the higher range, suggesting typical midday warming.
3. 3 PM-4 PM: This time shows the highest temperatures, with most data points located at the upper end of the scale, which is expected during the peak afternoon hours.
4. 7 PM-8 PM: Temperatures decline but remain moderately high, reflective of early evening conditions where the day's heat is still dissipating.

Humidity:

1. 7 AM-8 AM: Humidity levels are high in the morning, with data points generally above 60%, typical of morning atmospheric conditions.
2. 11 AM-12NOON: A significant drop in humidity is observed as temperatures rise, with points lowering but still showing moderate variability.

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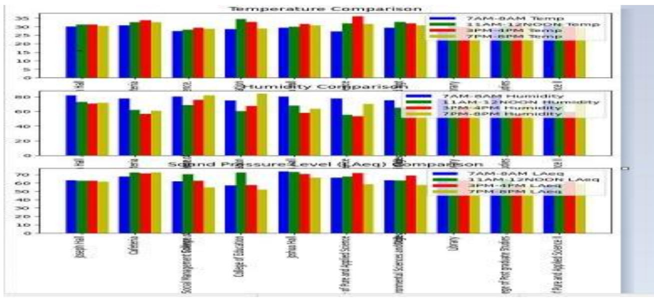
3. 3 PM-4 PM: Humidity continues to decrease slightly or remains stable, likely due to ongoing evaporation and warming.
4. 7 PM-8 PM: There is a slight increase in humidity as the temperature starts to fall, which is common in the evening.

Figure 2a: Line graph for Caleb University Fig 2b: Line graph for Lasustech University



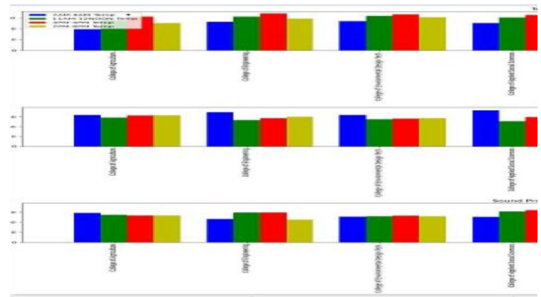
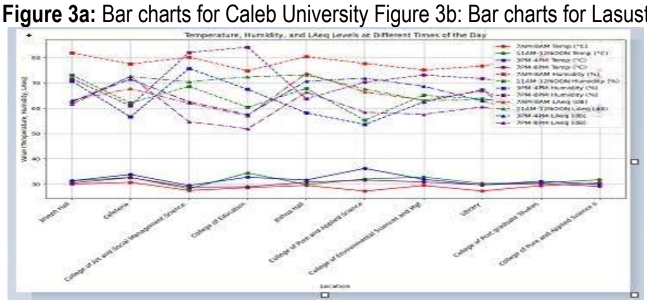
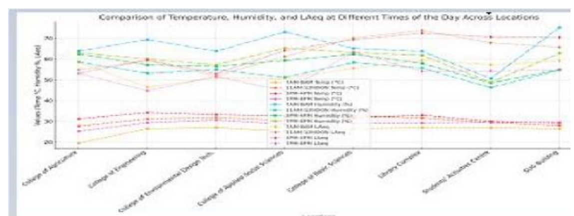


Figure 3a: Bar charts for Caleb University Figure 3b: Bar charts for Lasustech University





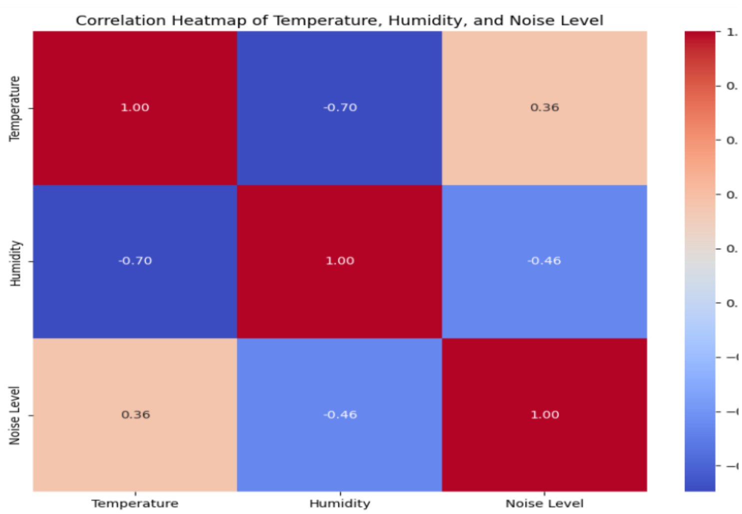


Figure 4: Heatmap of Temperature, Humidity, and sound for Caleb University

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Sound levels:

The relationship between the environmental factors at different locations in both universities is displayed in the bar charts. A similar relationship was recorded in the schools at different time frames

Correlational Analysis

1. 7 AM-8 AM: Sound levels are relatively low, suggesting quieter morning hours.
2. 11 AM-12NOON: There is an increase in noise levels, possibly due to more human activity and traffic during these hours.
3. 3 PM-4 PM: This period exhibits the highest sound levels, potentially reflecting peak activity in the area, such as traffic, construction, or commercial activity.
4. 7 PM-8 PM: Sound levels reduce slightly but are still elevated, aligning with typical early evening urban activity.

Line graphs

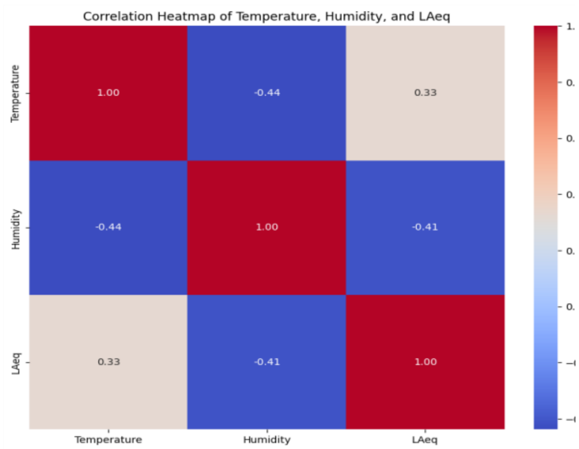

Figure 5: Heatmap of Temperature, Humidity, and sound for Lasustech University

The heat maps showed that the correlation between the following in the two schools is as follows: First, at Caleb University

Temperature and Humidity: The Pearson correlation coefficient indicates a moderate negative correlation (r = -0.79), suggesting that as temperature increases, humidity tends to decrease.

Temperature and Noise Level: The Pearson correlation coefficient shows a weak positive correlation (r = 0.36), indicating that higher temperatures are slightly associated with higher noise levels.

Humidity and Noise Level: The Pearson correlation coefficient demonstrates a weak negative correlation (r = -0.46), indicating that higher humidity is slightly associated with lower noise levels.

Second for Lasustech

Temperature and Humidity: The correlation coefficient is -0.44, indicating a moderate negative relationship. This suggests that as temperature increases, humidity tends to decrease.

Temperature and Noise Level: The correlation coefficient is 0.33, indicating a weak positive relationship. Higher temperatures are slightly associated with higher noise levels.

Humidity and Noise Level: The correlation coefficient is -0.41, indicating a weak negative relationship. Higher humidity is slightly associated with lower noise levels. These results provide a clear picture of the interplay between temperature, humidity, and noise levels in these academic settings.

Distribution of sound levels

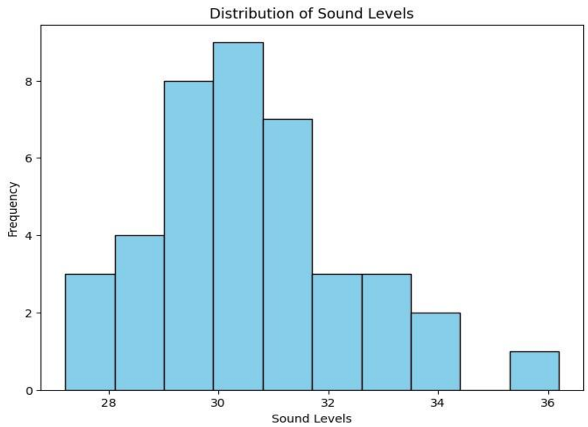

Figure 6: Distribution of sound levels for Caleb University

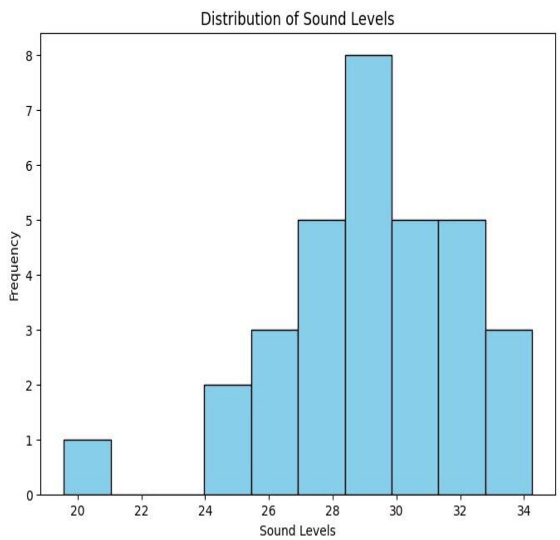

Figure 7: Distribution of sound levels for Lasustech University

Model Summary:
Since the variables of the statistical model in equation 1 are not linear, further analysis was conducted to find the statistical model of the two universities. The variables are presented in tables 2a & 2b where the dependent variable is taken to be Avg_{LAeq} (Average Sound Level), and Avg_{Temp} (Average Temperature), and $Avg_{Humidity}$ (Average Humidity) are independent variables
We noted that due to the large value of standard error (4.35e+03), the correlations are weak.

Model summary for Lasustech and Caleb Universities
The statistical model is given below:

$$Slevel = \beta_0 + \beta_1[Temp] + \beta_2[Humdty] + \beta_3[Temp]^2 + \beta_4[Humdty]^2 + \beta_5[Temp][Humdty] + e_i \quad (2)$$

The estimate for Caleb University is presented in equation (3) (Table 2a)

$$Slevel = -108.28+0.188[Temp]+5.27[Humdty]+0.109[Temp]^2-0.018[Humdty]^2-0.102[Temp][Humdty] \quad (3)$$

Similarly, estimate for Lasustech is also presented in equation (4) (Table 2b)

$$Slevel = 591.9-18.67[Temp]-9.09[Humdty]+0.195[Temp]^2+0.040[Humdty]^2+0.14[Temp][Humdty] \quad (4)$$

Key Findings:
1. Coefficients: Avg_{Temp}: The coefficient for average temperature is 0.7035, indicating a positive relationship between temperature and sound level. However, the p-value (0.712) is not statistically significant, suggesting that this relationship may not be meaningful. $Avg_{Humidity}$: The coefficient for average humidity is -0.3676, indicating a negative relationship between humidity and sound level. Similarly, the p-value (0.505) is not statistically significant.

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2. R-squared: The R-squared value is 0.209, indicating that approximately 20.9% of the variability in the average sound level can be explained by the average temperature and humidity.
3. F-statistic: The F-statistic is 0.9243 with a p-value of 0.440, indicating that the model is not statistically significant overall.

The findings suggest the following conclusions:

1. Average Temperature (*Avg _Temp*): Although the coefficient of 0.7035 indicates a positive relationship between temperature and sound levels, the high p-value (0.712) shows that this relationship is not statistically significant. This means we cannot confidently claim that temperature has a meaningful impact on sound levels based on this data.
2. Average Humidity (*Avg _Humidity*): The negative coefficient (-0.3676) suggests an inverse relationship between humidity and sound levels, but with a p-value of 0.505, this result is also not statistically significant. Therefore, there is no strong evidence to conclude that humidity significantly affects sound levels.
3. Model Fit (R-squared): The R-squared value of 0.209 indicates that only 20.9% of the variability in sound levels is explained by the temperature and humidity in this model. This suggests the model does not adequately capture the factors influencing sound levels, implying that other variables might be more influential.
4. Model Significance (F-statistic): With an F-statistic of 0.9243 and a p-value of 0.440,the overall model is not statistically significant. This means that temperature and humidity, together, do not have a significant combined effect on sound levels.
5. In conclusion, the model does not provide strong evidence of a meaningful relationship between temperature, humidity, and sound levels. This suggests that other factors beyond temperature and humidity may play a more significant role in determining sound levels in the environment studied.

Descriptive Statistics
The readings were taken as follows:
Morning (7 am-8 am)
Midday (11 am-12noon)
Afternoon (3 pm-4 pm)
Evening (7 pm-8 pm)

Table 2a: Averages

	Morning	Midday	Afternoon	Evening
Ave. T°C	28.99	31.34	31.75	30.29
Ave.Humidity	78.2%	64.90%	62.77%	71.9%
Ave.LAeq	63.05dB	66.75dB	64.55dB	59.92dB

Table 2b: Ranges

	Morning	Midday	Afternoon	Evening
Temperature(°C)	27.21-30.61	28.77-34.40	29.43-36.20	28.51-32.56
Humidity(%)	74.81-95.00	55.25-73.10	53.54-75.74	63.77-84.13
LAeq(dB)	53.3-73.83	59.18-73.16	56.21-71.91	51.87-72.63

Correlation Analysis
Temperature and Humidity: The correlation coefficient is -0.60, indicating a moderate negative relationship. This suggests that as temperature increases, humidity tends to decrease. Temperature and Noise Level: The correlation coefficient is 0.32, indicating a weak positive relationship. Higher temperatures are slightly associated with higher noise levels. Humidity and Noise Level: The correlation coefficient is -0.25, indicating a weak negative relationship. Higher humidity is slightly associated with lower noise levels.
These results provide a clear picture of the interplay between temperature, humidity, and noise levels in an academic setting.

Key Findings: In summary, Table 2a has higher and more stable temperatures, higher humidity, and less variation in sound levels, while Table 2b shows more variability in temperature and sound, but lower humidity levels overall.

Temperature and Humidity: There is a moderate negative correlation between temperature and humidity (-0.60). This indicates that as temperature increases, humidity tends to decrease. Such a relationship is typical in environmental studies and can impact comfort levels and the perceived atmosphere in academic settings.

Temperature and Noise Level: The correlation between temperature and noise level is weakly positive (0.32). This suggests that higher temperatures are slightly associated with

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higher noise levels. This could be due to increased activity levels or changes in building ventilation and acoustics as temperatures rise.

Humidity and Noise Level: A weak negative correlation (-0.25) exists between humidity and noise level, indicating that higher humidity levels are slightly associated with lower noise levels. This might be due to the dampening effect of higher humidity on sound propagation.

Implications:

Comfort and Learning: The interplay between temperature, humidity, and noise levels can significantly impact student comfort and learning. High temperatures and noise levels can be distracting and may reduce the effectiveness of teaching and learning.

Environmental Management: Schools should consider environmental management strategies that regulate temperature and humidity to maintain optimal conditions for learning. This might include using air conditioning, dehumidifiers, or soundproofing measures in noisy areas.

Model Fit Summary for LASUSTECH and Caleb University
Tables 3a & 3b Model summary for Lasustech and Caleb Universities

OLS Regression Results

Dep. Variable:	LAeq	R-squared:	0.268
Model:	OLS	Adj. R-squared:	0.128
Method:	Least Squares	F-statistic:	1.907
Date:	Fri, 06 Sep 2024	Prob (F-statistic):	0.127
Time:	11:45:48	Log-Likelihood:	-107.15
No. Observations:	32	AIC:	226.3
Df Residuals:	26	BIC:	235.1
Df Model:	5		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	591.9046	493.759	1.199	0.241	-423.032	1606.841
Temperature	-18.6746	17.233	-1.084	0.288	-54.098	16.749
Humidity	-9.0905	8.762	-1.037	0.309	-27.101	8.920
Temperature^2	0.1949	0.133	1.464	0.155	-0.079	0.469
Humidity^2	0.0398	0.035	1.143	0.264	-0.032	0.111
Temp_Humidity	0.1402	0.188	0.747	0.462	-0.246	0.526

Omnibus:	2.575	Durbin-Watson:	1.366
Prob(Omnibus):	0.276	Jarque-Bera (JB):	1.345
Skew:	0.112	Prob(JB):	0.510
Kurtosis:	2.021	Cond. No.	1.51e+06

OLS Regression Results

Dep. Variable:	LAeq	R-squared:	0.294
Model:	OLS	Adj. R-squared:	0.190
Method:	Least Squares	F-statistic:	2.834
Date:	Sun, 22 Sep 2024	Prob (F-statistic):	0.0304
Time:	11:16:05	Log-Likelihood:	-121.30
No. Observations:	40	AIC:	254.6
Df Residuals:	34	BIC:	264.7
Df Model:	5		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
const	-108.2877	1044.133	-0.104	0.918	-2230.221	2013.645
Temperature	0.1883	47.325	0.004	0.997	-95.988	96.365
Humidity	5.2719	9.817	0.537	0.595	-14.679	25.223
Temperature^2	0.1094	0.531	0.206	0.838	-0.970	1.189
Humidity^2	-0.0178	0.025	-0.724	0.474	-0.068	0.032
Temp_Humidity	-0.1020	0.225	-0.454	0.653	-0.558	0.354

Omnibus:	3.637	Durbin-Watson:	1.683
Prob(Omnibus):	0.162	Jarque-Bera (JB):	2.727
Skew:	0.632	Prob(JB):	0.256
Kurtosis:	3.200	Cond. No.	6.68e+06

Model summary for Lasustech and Caleb Universities
In the LASUSTECH model, the R-squared value of 0.268 indicates that about 26.8% of the variability in sound levels (LAeq) is explained by the independent variables, with an adjusted R-squared of 0.128 suggesting limited explanatory power. The F-statistic (1.907, p = 0.127) indicates that the overall model is not statistically significant, meaning the independent variables do not strongly explain the variation in sound levels. In contrast, the Caleb University model shows a higher R-squared of 0.294, indicating 29.4% of variability explained, and a statistically significant F-statistic (2.834, p = 0.0304), suggesting at least one independent variable significantly influences sound levels. Both models exhibit multicollinearity concerns, as indicated by high condition numbers, suggesting potential instability in coefficient estimates due to high correlations between independent variables.

Conclusion
This study examined the relationships between temperature, humidity, and noise levels in various academic settings withing two universities in the same geographical locations in Ikorodu, Lagos State. The data was collected across four different time periods throughout the day at multiple locations within the schools. Our analysis provides valuable insights into how these environmental factors interact and potentially influence the academic environment.
The highest temperatures and sound levels occur in the mid-afternoon, likely coinciding with peak sunlight and human activity, while humidity follows a typical diurnal pattern higher in the morning, decreasing throughout the day, and slightly rising in the evening reflecting typical urban environmental dynamics where temperature and human activities correlate with environmental parameters, which can be leveraged to assess environmental comfort or inform urban planning and daily activity scheduling.
The findings from the two regression models indicate that environmental factors, specifically temperature and humidity, have limited predictive power in explaining variations in the noise levels (LAeq) across the locations under study. In the first model, with an R-squared value of 0.268, the results suggest that only about 26.8% of the variation in noise levels can be explained by the environmental factors considered. Similarly, the second model shows a slightly higher but still modest R-squared value of 0.294, suggesting that 29.4% of the variation in noise levels can be attributed to temperature and humidity.

In both models, the predictors (temperature, humidity, and their interaction terms) were found to be statistically insignificant, with p-values well above the 0.05 threshold. This indicates that temperature and humidity do not have a strong or consistent impact on noise levels in this particular dataset. While the second model has a statistically significant F-statistic ($p = 0.0304$), suggesting that the model as a whole provides a better fit than expected by chance, the individual predictors still do not offer significant contributions.

The lack of statistical significance and low explanatory power may be attributed to several factors. First, the environmental conditions may not directly affect noise levels in a linear fashion. Other unmeasured variables, such as human activity, traffic patterns, or building acoustics, could play a more significant role in influencing noise levels. Second, the time periods used for data collection might not capture the full variation in environmental conditions, and thus, longer-term data collection or different time intervals could yield different results.

In conclusion, while this study provides valuable insights into the relationship between environmental factors and noise levels, the results indicate that temperature and humidity are not significant predictors in this context. Future studies should incorporate a wider range of variables and consider more sophisticated modelling techniques to better understand the determinants of noise pollution. These findings serve as a starting point for further exploration into how various factors, both environmental and anthropogenic, contribute to noise levels in urban and educational environments.

Recommendation

Efforts to reduce noise pollution should prioritize controlling human-made noise sources, such as traffic and industrial noise, as temperature and humidity had no significant impact on noise levels, with authorities focusing on traffic management, industrial noise control, and urban planning; educational institutions should implement noise regulation policies, such as soundproofing, particularly in high-traffic areas, and public education campaigns should raise awareness about the harmful effects of noise pollution and encourage residents and students to adopt measures to reduce their contributions to noise levels.

Data Availability Measurements of environmental factors of the two universities are available.

Ethical Considerations The study was conducted in compliance with ethical standards for research. No personal or sensitive data was collected, ensuring the privacy and confidentiality of individuals within the study locations.

Declaration of Conflict of Interest

All authors have agreed and approved the manuscript and have contributed significantly towards the article. There is no conflict of interest among the authors

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