Evaluation of Noise Level in Selected Primary Schools in Ikorodu Division Area of Lagos State, South-Western, Nigeria

Okedeyi Abiodun Sakiru[1*], Atilade Adesanya Oluwafemi[2], Akinyemi Joseph[3] and Idowu Ibikunle Albert[3]

[1]Department of Physics Science Education, Lagos State University of Education, Oto-Ijanikin, Lagos State

[2]Department of Physical Sciences, Lagos State University of Science and Technology, Ikorodu, Lagos State

[3]Department of Mathematical Sciences, Lagos State University of Science and Technology, Ikorodu, Lagos State

***Corresponding Author**

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ABSTRACT

Noise pollution is a significant issue of concern other than air and water pollution since it harms physical, psychological and social wellbeing. This research work is to evaluate the noise (dB) levels in twelve primary schools selected using stratified random sampling from six Local Council Development Area (LCDA) within Ikorodu Division of Lagos State. Noise level, humidity and temperature measurements were carried out at three points within the school premises of selected schools at time intervals of 8 am to 9 am, 10 am to 11 am and 12 noon to 1 pm using a factory-calibrated Digital Sound Level Meter AS844+. The data collected were subjected to statistical analysis both descriptive and inferential. The results obtained revealed that the average noise levels are 71.54 dB between 8 am and 9 am, 73.65 dB between 10 am and 11 am and 71.75 dB between 12 noon and 1 pm. Average humidity ranges from 66.45% and 61.01% while average temperature ranges from 31.09 ^{0}C to 33.19 ^{0}C. These noise levels were significantly above the World Health Organization's recommended school noise levels of 35 dB for classrooms and 55 dB for playgrounds. This study creates awareness on the level of noise in primary schools and also promotes a simple method for regular assessment of the noise levels in these environments towards encouraging an action plan on the part of Government.

Keywords: Digital Sound Level Meter, Humidity, Mental Well-being, Noise Level, Statistical Analysis, World Health Organization

INTRODUCTION

Noise is any unwanted, unpleasant, unexpected, and louder sound than threshold limits that are adjudged to be annoying and distracting. (Ryherd, 2016; Farina, 2017; Farooqi *et al.,* 2020; Atilade *et al.,* 2022). Noise Pollution is recognized as a major problem for the quality of life in urban areas all over the world (Atilade *et al.,* 2019).

In schools, speech is rarely transmitted to children without interference from background noise. At the same time, the effective transmission of auditory information is essential for better academic performance (Crandell and Samaldino, 2000; Fidencio *et al.,* 2014). Noise is not only a nuisance in schools but also interferes with performance in educational activities as teachers feel uncomfortable while teaching in noisy classrooms thereby making students feel uncomfortable in receiving the information, as well as in dispersion

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of attention (Fidencio *et al.*, 2014).

To be able to hear and understand spoken messages in classrooms, the World Health Organization (WHO) recommends that in school classrooms and pre-schools, the background sound level should not exceed 35 dB(A) during teaching sessions. Also, school outdoor/playground noise level should not exceed 55 dB(A), the same value given for outdoor residential areas in the daytime (Berglund *et al.*, 1999; Ochiabuto *et al.*, 2021).

In Nigeria, the National Environmental Standards and Regulations Enforcement Agency's (NESREA) maximum permissible noise level specification for the general environment such as buildings used as hospitals, convalescence homes, homes for the aged, sanatorium, institutes of higher learning, conference rooms, public library, environmental or recreational sites is 45 dB(A) (NESREA, 2009; Ochiabuto *et al.*, 2021). Despite these specifications, many children in Nigeria do not have access to ideal or serene learning environments (Ana *et al.*, 2009; Ochiabuto *et al.*, 2021).

This study was conducted basically to determine the noise dB(A) levels in primary schools within Ikorodu division of Lagos State, Nigeria. Sound level intensity is measured in decibels (dB). 1 dB is the amplitude of sound that a human ear can hear. If the amplitude of pressure fluctuation is P, the sound level in decibels is given by equation (1) (Marathe, 2012; Atilade *et al.*, 2019).

$$L = 20 \log\left[\frac{P}{P_0}\right] dB \qquad (1)$$

Location of the Study Area

Ikorodu (Figure I) lies approximately 36 km north of Lagos. The Division consists of Ikorodu Local Government, and five Local Council Development Areas including Igbogbo-Baiyeku, Ikorodu North, Ikorodu West, Imota and Ijede. The Division serves as the entrance to the country's hinterland (Lagos State Government, 2021).

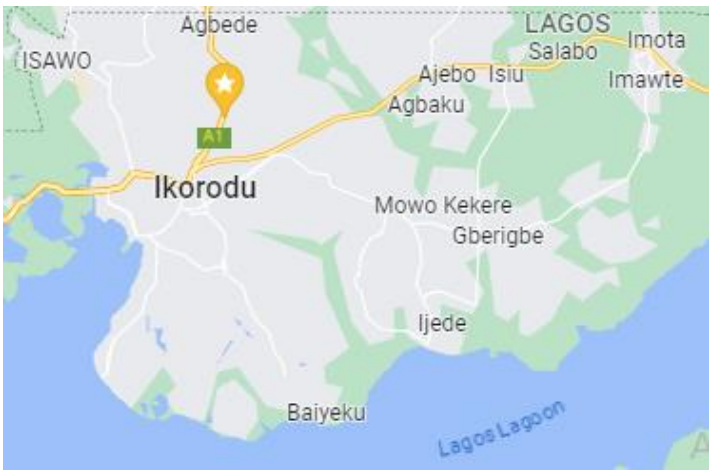

Figure I: Map of Ikorodu showing study environments (Source: Olaleye and Ogunbajo, 2015)

The area of investigation covers twelve selected primary schools within Ikorodu division of Lagos State.

MATERIALS AND METHODS

The equipment required for data acquisition includes the following: Digital Sound Level Meter AS844+ (Figure II) capable of measuring noise level, temperature and humidity of the selected locations, HTC -2 Clock, Temperature and humidity measuring device (Figure III) and 30m – tape rule (Figure IV).

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Figure II: Digital Sound Level Meter AS844+ (Source: Physics Laboratory, Lagos State University of Science and Technology).

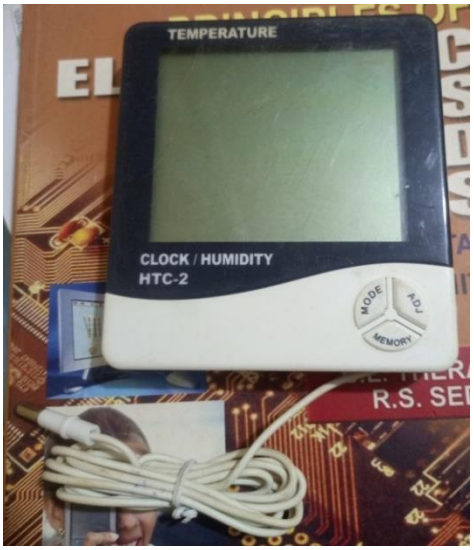

Figure III: Digital Clock/Humidity HTC-2 (Source: Physics Laboratory, Lagos State University of Education).

Figure IV: 30-Metre Tape Rule (Source: Physics Laboratory, Lagos State University of Science and Technology).

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Twelve (12) public primary schools were selected using stratified random sampling from six Local Council Development Area (LCDA): Igbogbo – Bayeku, Ikorodu Central, Ikorodu North, Ikorodu West, Ijede, and Imota making up Ikorodu Division of Lagos State resulting in two primary schools per LCDA selected using simple random sampling. The primary schools include Anglican Primary School Ijede, African Bethel Primary School Maya, Methodist Primary School Ikorodu, Methodist Primary School Igbogbo, Methodist Primary School Gberigbe, LA Primary School Imota, LGA Primary School Isiu, Ipakodo Primary School, Lagos State Model Primary School Igbokuta, C&S Primary School Majidun, Universal Primary School Ajaguro Ishawo and Igbogbo Bayeku Primary School.

Noise levels in the schools were measured using a factory-calibrated Digital Sound Level Meter AS844+ set at the slow response mode with A-weighted decibels [dB(A)]. Noise measurements were conducted from 8 am to 9 am, 10 am to 11 am and 12 noon to 1 pm respectively. Measurements were conducted at three points in both the classrooms and school playgrounds and data is presented as mean noise level [dB(A)]. Temperature and humidity measurements were conducted along with the noise level measurements. Data acquired were analysed with SPSS version 23 software and data were subjected to statistical analysis both descriptive and inferential.

RESULTS AND DISCUSSION

The average data for each location at different periods of measurement are presented in Table I.

Table I: Average measurements of Temperature, Humidity and Noise level at twelve selected locations

	8am - 9 am			**10am - 11am**			**12noon - 1pm**		
School	**Temperature/^{0}C**	**Humidity/%**	**Noise Level/dB**	**Temperature/^{0}C**	**Humidity/%**	**Noise Level/dB**	**Temperature/^{0}C**	**Humidity/%**	**Noise Level/dB**
Anglican Pry Schl Ijede	27.69	68.23	76.10	27.66	69.44	75.21	26.88	76.72	65.55
	29.75	71.23	68.96	28.54	79.74	67.37	27.52	84.77	62.94
	29.59	67.54	71.54	31.60	56.98	74.87	33.34	54.91	73.15
African Bethel Pry Sch Maya	29.77	70.04	68.46	29.90	69.14	76.10	31.74	63.54	74.47
	31.95	65.23	68.02	31.56	66.23	76.25	34.32	59.26	74.27
	29.74	70.97	62.78	32.26	60.41	65.84	34.16	47.21	65.11
Methodist Pry Sch Ikorodu	25.81	85.21	73.51	26.28	81.77	72.89	27.75	74.90	63.49
	27.15	83.48	80.31	27.52	78.92	71.40	28.93	75.92	78.66
	26.38	79.13	73.38	28.46	68.87	75.63	29.77	63.25	73.57
Methodist Pry Sch Igbogbo	29.74	70.97	62.78	32.26	60.41	65.84	34.16	47.21	65.11
	29.59	67.54	71.49	31.60	56.98	74.87	33.34	54.91	73.15
	32.63	57.90	66.59	33.49	53.15	75.42	35.01	47.07	70.51
Methodist Pry Sch Gberigbe	32.70	62.57	69.70	32.87	62.70	77.10	33.16	61.52	72.43
	34.16	60.06	69.48	34.46	60.21	78.04	36.64	54.91	73.15
	35.25	57.48	72.32	35.53	58.62	82.39	35.21	59.49	77.65

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LA Pry Sch Imota	30.02	74.74	47.52	29.76	74.93	75.71	32.63	59.84	64.44
	28.23	82.10	63.51	28.30	79.82	69.70	30.11	71.75	65.83
	29.42	81.69	71.90	29.34	80.23	74.60	30.89	73.26	71.14
LGA Pry Sch Isiu	32.05	69.83	71.90	33.59	64.78	69.67	36.17	57.20	70.78
	32.47	68.93	65.08	32.96	65.94	61.67	35.19	61.36	70.45
	30.16	74.39	62.11	31.59	70.34	70.44	33.49	66.39	68.24
Ipakodo Pry Sch	27.68	75.20	69.92	28.36	72.61	64.44	31.80	63.13	70.90
	28.33	71.87	80.41	31.36	63.31	72.04	27.73	74.06	71.96
	27.58	76.66	79.17	29.05	72.05	79.88	31.60	63.01	71.18
Lagos State Model Pry Sch Igbokuta	34.06	67.27	67.27	34.90	61.13	79.70	33.98	62.09	79.05
	32.49	61.52	74.79	31.80	62.92	70.83	32.78	57.74	66.01
	32.65	66.67	78.00	32.90	65.36	78.21	33.55	60.89	73.69
C&S Pry Sch Majidun	31.57	57.61	84.39	33.40	56.43	82.16	32.91	58.79	75.72
	31.52	36.80	72.81	38.71	29.69	72.56	40.49	54.33	63.72
	31.86	60.82	78.42	34.01	60.23	77.81	34.27	58.30	76.91
Universal Pry Sch Ajaguro, Ishawo	31.57	57.11	83.66	34.55	57.83	67.57	34.77	57.52	73.89
	31.27	54.36	76.54	35.59	55.68	71.93	34.71	57.08	76.53
	32.38	52.08	73.93	38.01	49.98	66.37	37.30	51.65	72.24
Igbogbo Bayeku	37.79	52.90	81.02	35.94	54.70	82.93	34.98	57.04	81.98
	38.92	50.61	66.04	36.77	51.98	73.39	36.81	51.12	80.85
	35.26	61.46	71.64	37.04	55.17	80.44	36.89	54.22	74.18
Average	**31.09**	**66.45**	**71.54**	**32.28**	**63.57**	**73.65**	**33.19**	**61.01**	**71.75**

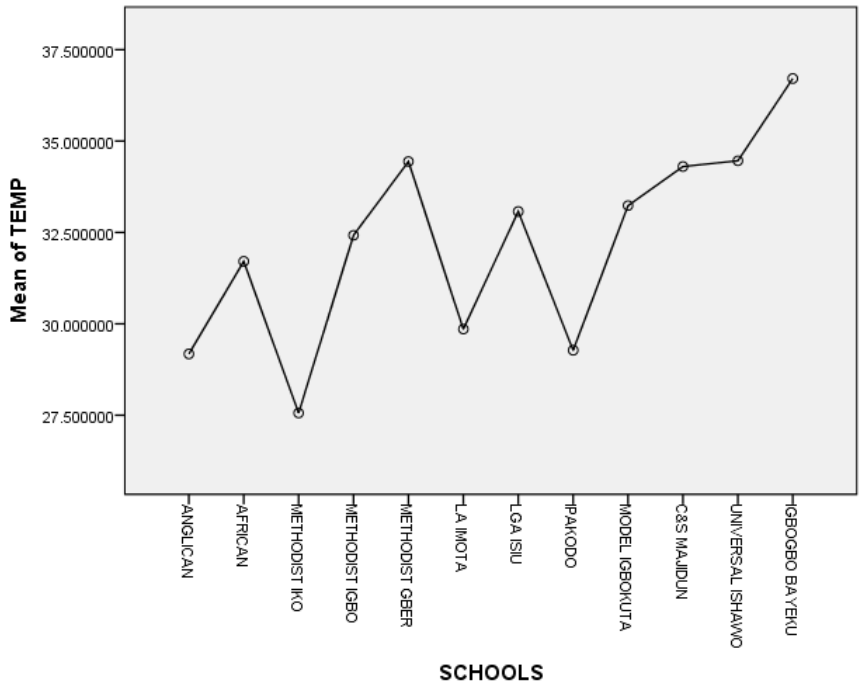

Figure V: Graph of mean temperature at the study locations

To compare the average temperature in the schools, Figure V revealed that Methodist Primary School,

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Ikorodu has the least mean temperature while Igbogbo Bayeku has the highest.

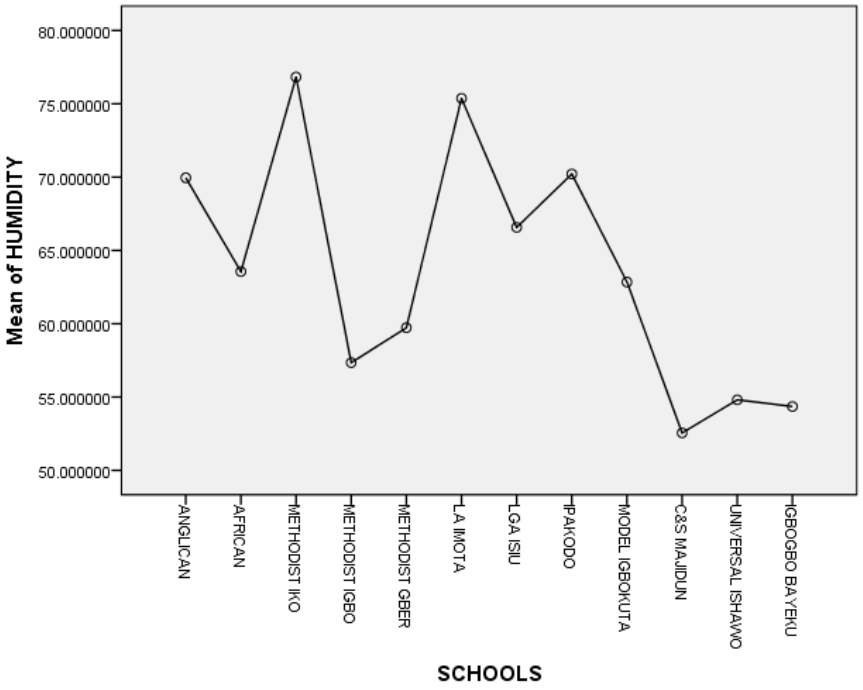

Figure VI: Graph of mean humidity at the study locations

Figure VI showed that Methodist primary school Ikorodu has the highest mean humidity while C & S primary school Majidun has the least.

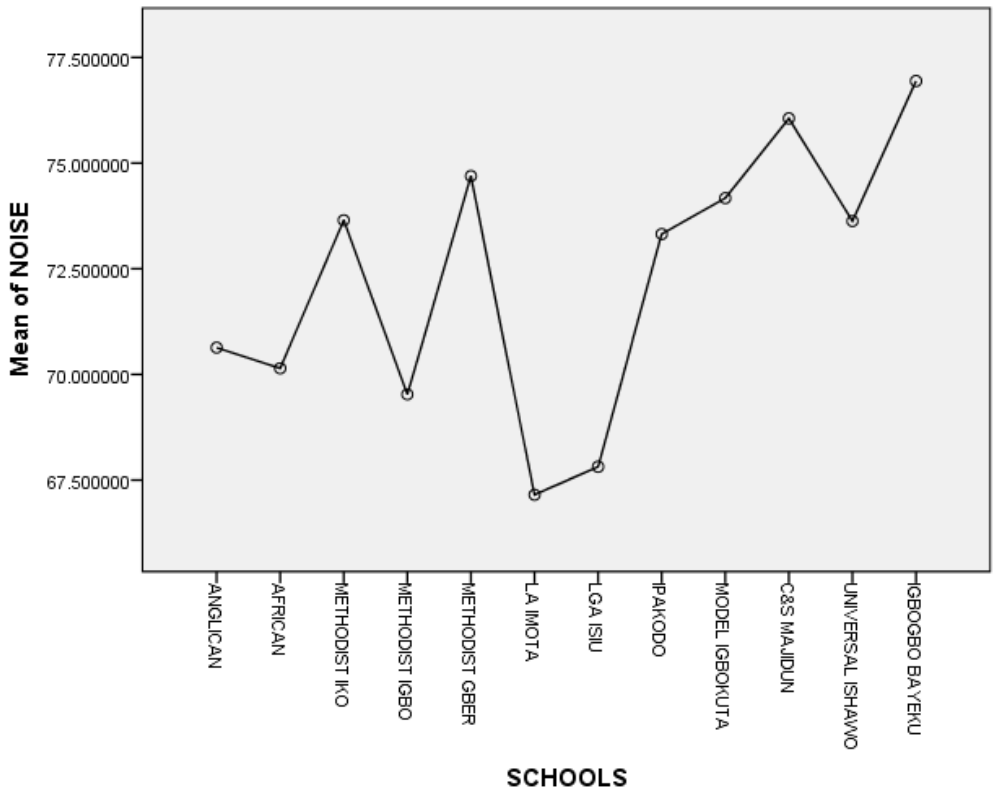

Figure VII: Graph of mean noise level at the study locations

Figure VII showed that the mean noise level hit the highest at Igbogbo-Bayeku Primary School while the least mean noise level was observed in LGA primary school Imota.

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Table II: Anova showing interaction between schools and noise level

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1267.833	101	12.553	3.930	.044
Within Groups	19.167	6	3.194		
Total	1287.000	107			

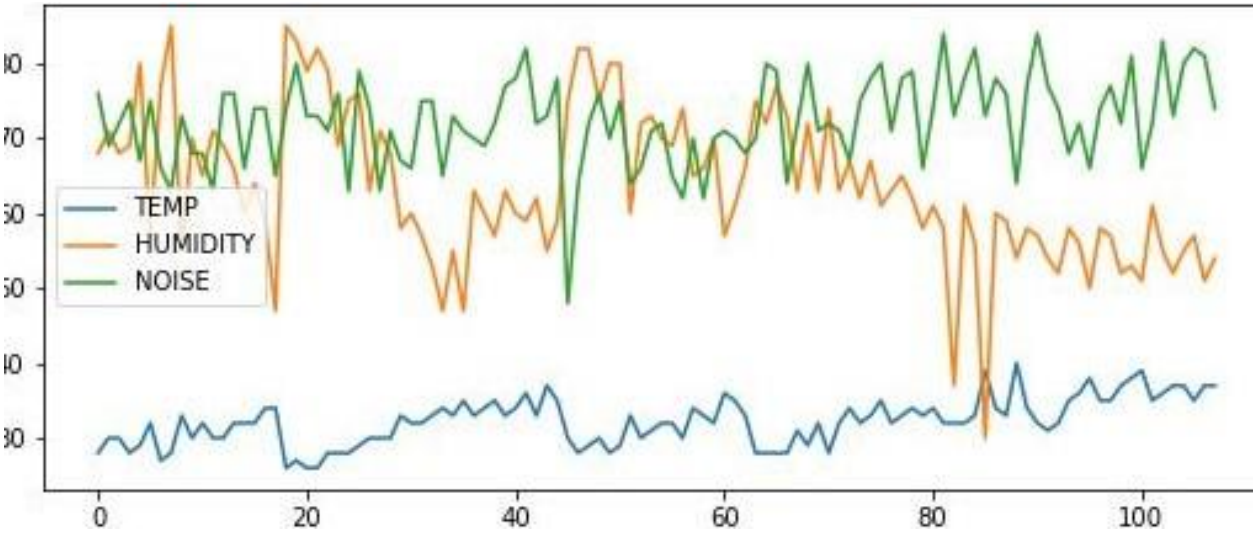

Figure VIII: Graph of temperature, humidity and noise level

In Figure VIII, there is a close relationship between humidity and noise while temperature and noise showed an in-direct relationship.

Table II: Anova showing interaction between schools and noise level

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1267.833	101	12.553	3.930	.044
Within Groups	19.167	6	3.194		
Total	1287.000	107			

Table III: Anova showing interaction between schools and humidity level

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1255.333	99	12.680	3.203	.040
Within Groups	31.667	8	3.958		
Total	1287.000	107			

Table IV: Anova showing interaction between schools and temperature

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1268.333	99	12.811	5.491	.007

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Within Groups	18.667	8	2.333		
Total	1287.000	107			

Table V: Correlations between temperature and humidity

Correlations			
		TEMP	HUMIDITY
TEMP	Pearson Correlation	1	-.814**
	Sig. (2-tailed)		.000
	N	108	108
HUMIDITY	Pearson Correlation	-.814**	1
	Sig. (2-tailed)	.000	
	N	108	108

Figure VI: Correlations between temperature and humidity

Correlations			
		NOISE	TIME SPACE
NOISE	Pearson Correlation	1	.014
	Sig. (2-tailed)		.885
	N	108	108
TIME SPACE	Pearson Correlation	.014	1
	Sig. (2-tailed)	.885	
	N	108	108

Table VII: Correlations between temperature and humidity

Correlations			
		NOISE	HUMIDITY
NOISE	Pearson Correlation	1	-.193*
	Sig. (2-tailed)		.045
	N	108	108
HUMIDITY	Pearson Correlation	-.193*	1
	Sig. (2-tailed)	.045	
	N	108	108

Table VIII: Correlations between temperature and noise

Correlations			
		TEMP	NOISE
TEMP	Pearson Correlation	1	.127
	Sig. (2-tailed)		.190
	N	108	108

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NOISE	Pearson Correlation	.127	1
	Sig. (2-tailed)	.190	
	N	108	108

Table IX: One sample test for noise level of the schools

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
NOISE	125.921	107	.000	72.311252457	71.17284962	73.44965530

One-way Analysis of variance was used to capture and to test whether the noise level in the area is significant. The analysis showed that there is significant difference in the noise level, humidity and Temperature of the schools (Table II – IV).

The correlation analysis showed that there is a strong inverse relationship between Temperature and Humidity (-0.814) of the schools which is significant (p= 0.000). The interaction between noise and time showed that a positive correlation exists between them and it is significant at 5% level of significance. To test the correlation between noise and humidity, correlation analysis was done and it showed that there is a negative correlation (r = -0.193) which is also significant (p = 0.045). A positive relationship exists between Temperature and noise (r = 0.127) which means as the temperature increases it brings about increase in the noise level of the schools (Table V – VIII).

Also in the analysis, there is significant difference (P = 0.000) in the noise level of the schools selected in Ikorodu Local Government using one sample t- test (Table IX).

CONCLUSION

This research work has created awareness of the implications of noise in primary schools and also promotes a simple method for regular assessments of the noise level, humidity and temperature variations in these environments. The results obtained after careful assessment of noise level revealed that the average noise levels are 71.54 dB between 8 am and 9 am, 73.65 dB between 10 am and 11 am and 71.75 dB between 12 noon and 1 pm with average humidity ranging from 66.45% and 61.01% while average temperature ranges from 31.09 ^{0}C to 33.19 ^{0}C. The correlation analysis also showed that there is a strong inverse relationship between Temperature and Humidity while temperature increases with increase in noise level of the schools. These noise levels were significantly above the NASREA and World Health Organization's recommended school noise levels of 35 dB for classrooms and 55 dB for playgrounds. The results also revealed that there is a close relationship between humidity and noise while temperature and noise showed an in-direct relationship.

RECOMMENDATIONS

The present study has indicated that there is a need to develop and enforce the laws that protect primary school pupils from noise pollution. Workshops/seminars on noise control in our schools will also assist in educating the school management towards an acceptable school environment. These will go a long way in improving the health and academic standards of the pupils.

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Compliance with ethical standards

Conflict of interest: The authors declare that they have no conflict of interest.

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