Noise Mapping of the University of Agriculture Makurdi Nigeria

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Abstract- University of Agriculture Makurdi, Benue State, Nigeria was mapped into eight noise zones using Google Earth zoomed to 50 meters above each of the locations and marked 001 - 008. At each of the locations, the noise level was recorded for 60 minutes at 5-6am, 1-2pm, and 7-8pm using a Calibrated B & K 2230 or Rion NL-11 Integrating Precision Sound Level Meters, and the experiment was repeated for fourteen days. The data generated was complied, the mean, mode, and standard deviation was calculated using SPSS version 17. Results showed that the University of Agriculture Makurdi has a mean of ±85 the noise level at convocation square and junior staff quarters was the highest at 90db, and the lowest of 52db at academic block B. Comparing with the standard noise level required for educational institution, University of Agriculture Makurdi requires immediate intervention to reduce the noise level to the acceptable limits for educational institutions.

Index Terms- Noise zones, noise level, acceptable limits.

I. Introduction

The learning environment provided by a school should be understood as resulting from a complex, dynamic relationship between the various physical elements and the attitudes and actions of the different users who constitute the school community. Therefore, although the identification of problems with the physical setting may be aided by a narrow focus, any attempts to improve the environment and facilitate better learning will require a wider perspective.

The word Noise is conveniently and concisely defined as unwanted sound that creates annoyance and interferes in conversation disturbs sleep and teaching-learning process; reduce work efficiency, causing stress and challenge to public health and it is silent killer problem growing day-by-day.

In 1910, a Nobel Prize winning German bacteriologist stated, “A day will come when man will have to fight merciless noise as the worst enemy of health”. According to Dr. Koch, “noise, like smog, is a slow agent of death” (Vijayalakshmi, 2003). Unfortunately, the forecast provided by Dr. Koch one hundred years ago has come true at the present time.

Noise is the most persistent physical contaminant in human. It can cause a series of detrimental health effects on human beings, such as Hearing Loss, Annoyance, Cardiovascular Disease, Sleep Disturbance, Immune Effects, Biochemical Effects, Reproductive Effects and Performance Effects, among which the best studied effect produced by the overexposure to noise is loss of hearing (Fernandez et al 2009).

The World Health Organization (WHO) and the U.S. Environmental Protection Agency (EPA) recognize the harmful health effects of noise pollution. According to the Centers for Disease Control and Prevention, noise pollution is “an increasing public health problem” that can lead to a variety of adverse health effects, including hearing loss, stress, high blood pressure, interference with speech, headaches, disturbance of rest and sleep, productivity and mental health effects, and a general reduction in one’s quality of life.

In the learning context, noise affects the behavior and understanding of students, and very noisy places are unfavorable for learning and make teaching exhaustive (Hagen et al, 2002). Poor acoustical condition and high noise levels can cause many problems for the instructors and students. Besides the risk of hearing damage, noise may cause on memory, performance, headache, increase blood pressure, and disturbance with activities (Berglund et al., 1990 and Fernandez et al., 2009). High sound levels not only affect the verbal quality of communication but also contribute to serious problems in the intellectual development of students, such as impaired learning, writing and speaking difficulties, limitations in reading comprehension and development of vocabulary (Berglund et al, 1990).

Much of the quite extensive research evidence relating to the issue of noise in education has been produced by studies focussed on relating noise levels to particular outcomes. Notably, the results, using both experimental and observational methodologies, are remarkably consistent. The findings show that noisy conditions have direct negative effects on learning, particularly language and reading development, as well as causing indirect problems to learners through distracting or annoying them. Laboratory based cognitive psychology experiments have shown that noise affects performance on memory tasks, an effect which is at least partly explained by noise interfering with language processing. This suggests that it might be problematic to live in a generally noisy place, and real world research into the effects of chronic noise, experienced by people living near airports or busy roads, confirms this extrapolation (Haines, et al., 2001). A review of this area concluded that, ‘The evidence for effects of environmental noise on health is strongest for annoyance, sleep and cognitive performance in adults and children.’ (Stansfeld and Matheson, 2003; Evans and Hygge, 2007). Of particular concern for education is the reliable finding, which fits with the laboratory results, that chronic noise exposure impairs cognitive functioning (Shield and Dockrell, 2003).

Koszarny showed that the noise level in study classrooms were in the range of an equivalent sound level of 60-95 dB(A) and the most frequent noise level was 80dB(A). Sound pressure level in corridors in break time in elementary schools was 85 dB(A) and for high schools was 77dB(A). Also studies have shown this index for classrooms with over 30 students was 3dB(A) higher than classrooms with 25 students or less (Koszarny, 1990 and 1992).

Noweir in a study of noise pollution in Jeddah schools found that the mean average Leq levels (60-89.2 dB(A)) highly exceeded the recommended levels (Noweir and Ikhwan, 1994). Zannin and Zwirtes in a study of public school classrooms found that the equivalent noise levels during class was 73.7-74.0 dB(A) (Zannin and Zwirtes, 2009). Daily measurements of equivalent sound levels in Clark study in the classes (Leq during school day) ranged from 59 to 87 dB(A) (Clark, 2006).

World Health Organization (WHO) in the guideline for community noise has specified an appropriate background noise level for classrooms as 35dB (LAeq) during teaching sessions (WHO, 1999).

The tables below show the standards for environmental noise, dangers and permissible hearing length.

Table 1.0: Noise Level Standards.

S/NO	POSSIBLE CAUSES	DECIBALS (db)
1	Jet aircraft, 50 m away	140
2	Threshold of pain	130
3	Threshold of discomfort	120
4	Chainsaw, 1 m distance	110
5	Disco, 1 m from speaker	100
6	Diesel truck, 10 m away	90
7	Curbside of busy road, 5 m away	80
8	Vacuum cleaner, 1 m distance	70
9	Conversational speech, 1 m distance	60
10	Average home	50
11	Quiet library	40
12	Quiet bedroom at night	30
13	Background in TV studio	20
14	Rustling leaves in the distance	10
15	Hearing threshold	0

Table 2.0: Environmental Noise Readings

DECIBALS (db)	READING
80	Busy Street, Alarm clock
70	Busy Traffic, Phone ringtone
60	Normal Conversation at 3ft
50	Quiet Office, Rainfall
40	Quiet Residential area, Park
30	Quiet whisper at 3ft

Table 3.0: Dangerous Levels of Sound and Effects.

S/NO	DECIBAL (db)	EFFECTS
1	190 dBA	Heavy weapons, 10 m behind the weapon (greatest level)
2	180 dBA	Toy pistol fired close to ear (greatest level)
3	170 dBA	Slap on the ear, fire cracker explosion on shoulder, small arms at a distance of 50 cm (greatest level)
4	160 dBA	Hammer stroke on brass tubing or steel plate at 1 m distance, airbag deployment very close at a distance of 30 cm (greatest level)
5	150 dBA	Hammer stroke in a smithy at 5 m distance (greatest level)
6	130 dBA	Loud hand clapping at 1 m distance (greatest level)
7	120 dBA	Whistle at 1 m distance, test run of a jet at 15 m distance
Threshold of pain, and fast-acting hearing damage in short action is possible		
8	115 dBA	Take-off sound of planes at 10 m distance
9	110 dBA	Siren at 10 m distance, frequent sound level in discotheques and close to loudspeakers at rock concerts, violin close to the ear of an orchestra musicians (greatest level)
10	105 dBA	Chain saw at 1 m distance, banging car door at 1 m distance (greatest level), racing car at 40 m distance, possible level with music head phones
11	100 dBA	Frequent level with music via head phones, jack hammer at 10 m distance
12	95 dBA	Loud crying, hand circular saw at 1 m distance
13	90 dBA	Angle grinder outside at 1 m distance
Over a duration of 40 hours a weak hearing damage is possible		
14	85 dBA	2-stroke chain-saw at 10 m distance, loud WC flush at 1 m distance
15	80 dBA	Very loud traffic noise of passing lorries at 7.5 m distance, high traffic on an expressway at 25 m distance
16	75 dBA	Passing car at 7.5 m distance, un-silenced wood shredder at 10 m distance
17	70 dBA	Level close to a main road by day,

		quiet hair dryer at 1 m distance to ear
Bad risk of heart circulation disease at constant impact is possible		
18	60 dBA	Noisy lawn mower at 10 m distance
19	55 dBA	Low volume of radio or TV at 1 m distance, noisy vacuum cleaner at 10 m distance
20	50 dBA	Refrigerator at 1 m distance, bird twitter outside at 15 m distance
21	45 dBA	Noise of normal living; talking, or radio in the background
Distraction when learning or concentration is possible		
22	35 dBA	Very quiet room fan at low speed at 1 m distance
23	25 dBA	Sound of breathing at 1 m distance
24	0 dB	Auditory threshold

Table 4: Permissible hearing time frame

S/No	Sound Pressure Level	Sound Pressure	Permissible Exposure Time
1	115 dB	11.2 Pa	0.46875 minutes (~30 sec)
2	112 dB	7.96 Pa	0.9375 minutes (~1 min)
3	109 dB	5.64 Pa	1.875 minutes (<2 min)
4	106 dB	3.99 Pa	3.75 minutes (<4 min)
5	103 dB	2.83 pa	7.5 minutes
6	100 dB	2.00 Pa	15 minutes
7	97 dB	1.42 Pa	30 minutes
8	94 dB	1.00 Pa	1 hour
9	91 dB	0.71 Pa	2 hours
10	88 dB	0.50 Pa	4 hours
11	85 dB	0.36 Pa	8 hours
12	82 dB	0.25 Pa	16 hours

The aim of this study was to examine the effect of noise in some mapped up areas of the University of Agriculture, Makurdi on the academic performance and students' health of the people in such areas.

II. MATERIALS AND METHOD

Human activity area in the University of Agriculture Makurdi, Benue State, Nigeria was mapped into eight noise zones, using Google Earth at fifty meter above the ground. These noise zones include North Core, College of Engineering, Akawe Torkula Hall, Food Science and technology (FST) and College of Management Sciences, Senior Staff Quarters, Junior Staff Quarters, South Core, and South Core Hostels. From the eight locations, twenty nine points were identified for measurement. At each location, the noise level was recorded for 30 seconds using a Calibrated B & K 2230 or Rion NL-11 Integrating Precision Sound Level Meters. Measurements were taken approximately one meter away, with the microphone approximately 1.2 meters above floor level and varying values displayed in form of graphs obtained. Measurement was taken by 5-6am, 1-2pm, and 7-8pm, for fourteen days and the peak values (Max), the Dwell, the mean, and standard deviation calculated using SPSS 17.

III. RESULTS AND DISCUSSIONS

The results presented in figures 1-6 showed that noise in educational institutions has a negative impact on learning and academic achievement of students (Karen et al. 2015) in the University of Agriculture, Makurdi.

From the measurement of noise level meter in different locations of the University, the results showed that noise pollution does exist in all the locations and it is found that Staff Quarters and South Core are highly noise polluted locations with an average maximum noise level of 89.5 dB and 84.2 dB respectively as shown in figures 1 and 2. This was followed by FST/ College of Management Sciences, and College of Engineering with average maximum noise level of 81 dB each as shown in figures 3 and 4 respectively. Hostels and North Core are least according to the study with average maximum noise level of 79.7dB and 77.3dB respectively as shown in figures C and A, although all locations exceeds the tolerance level of noise pollution which clearly indicated that the environment is not suitable for teaching-learning process.

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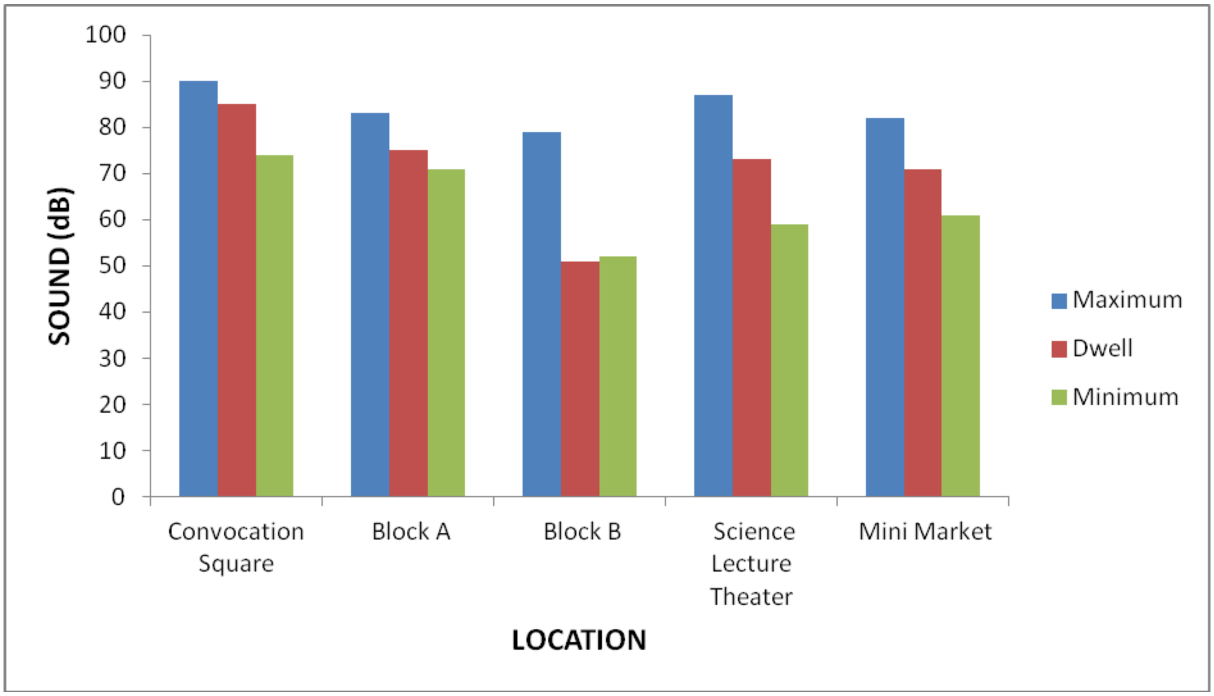

FIGURE 1: South Core

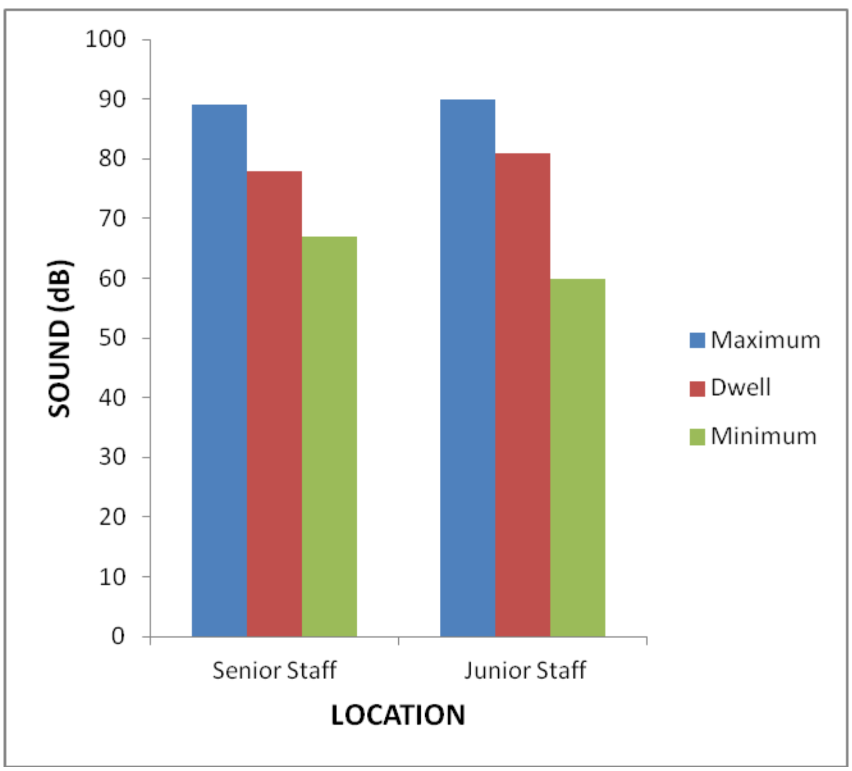

FIGURE 2: Staff Quarters

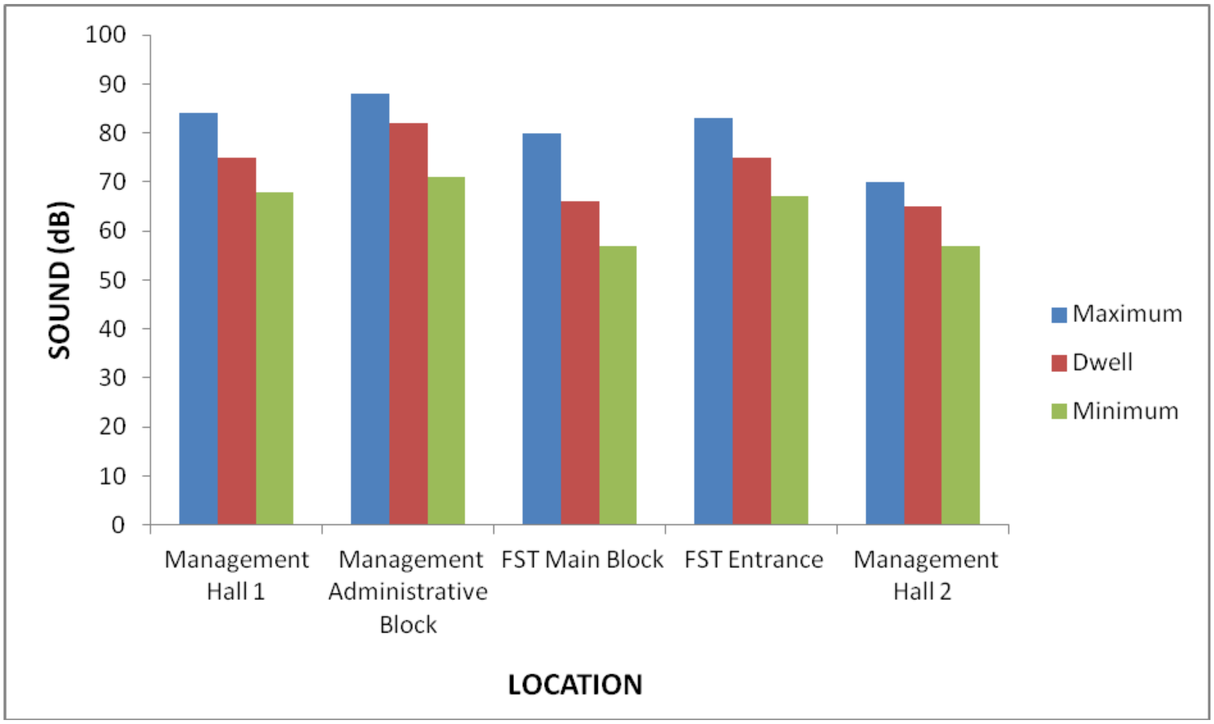

FIGURE 3: FST and College of Management Sciences

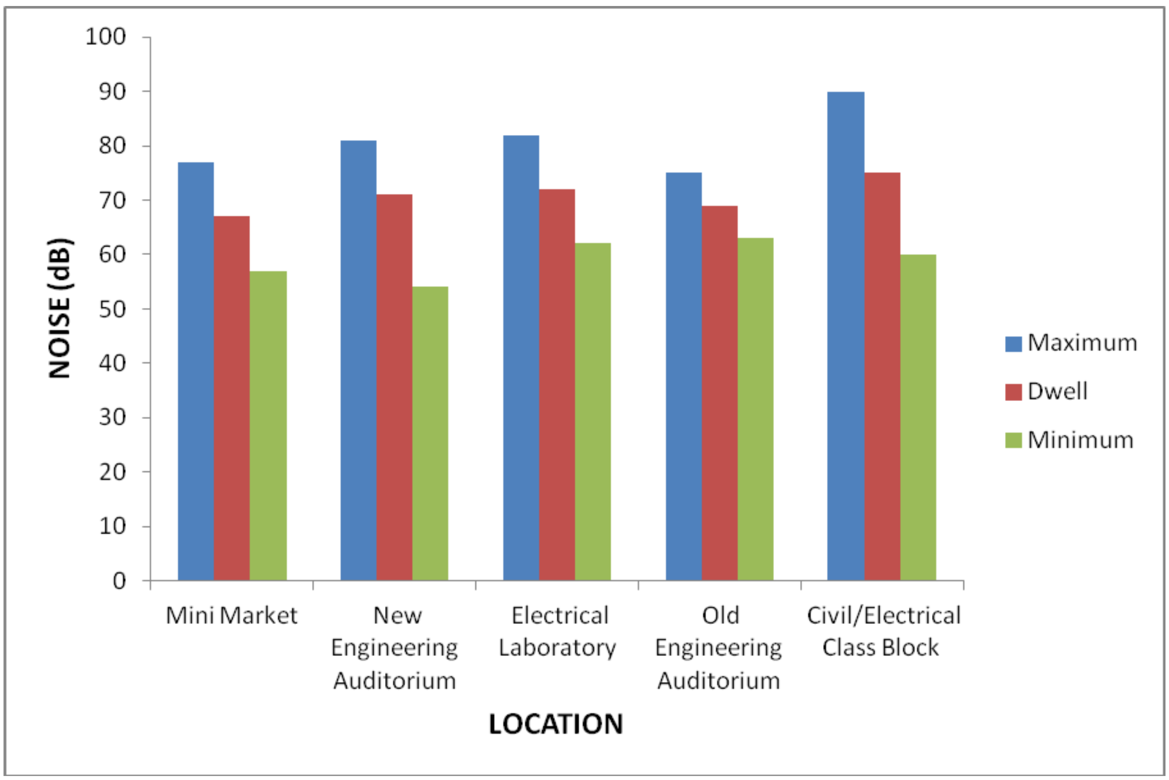

FIGURE 4: College of Engineering

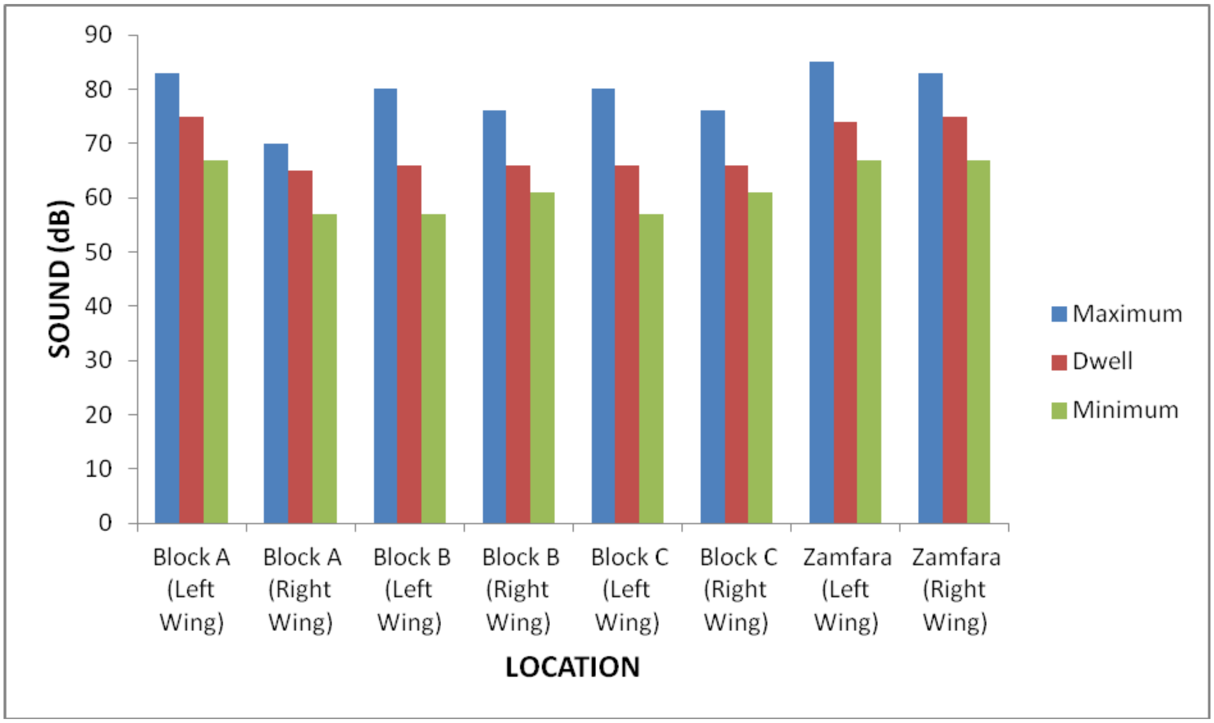

FIGURE 5: Hostels

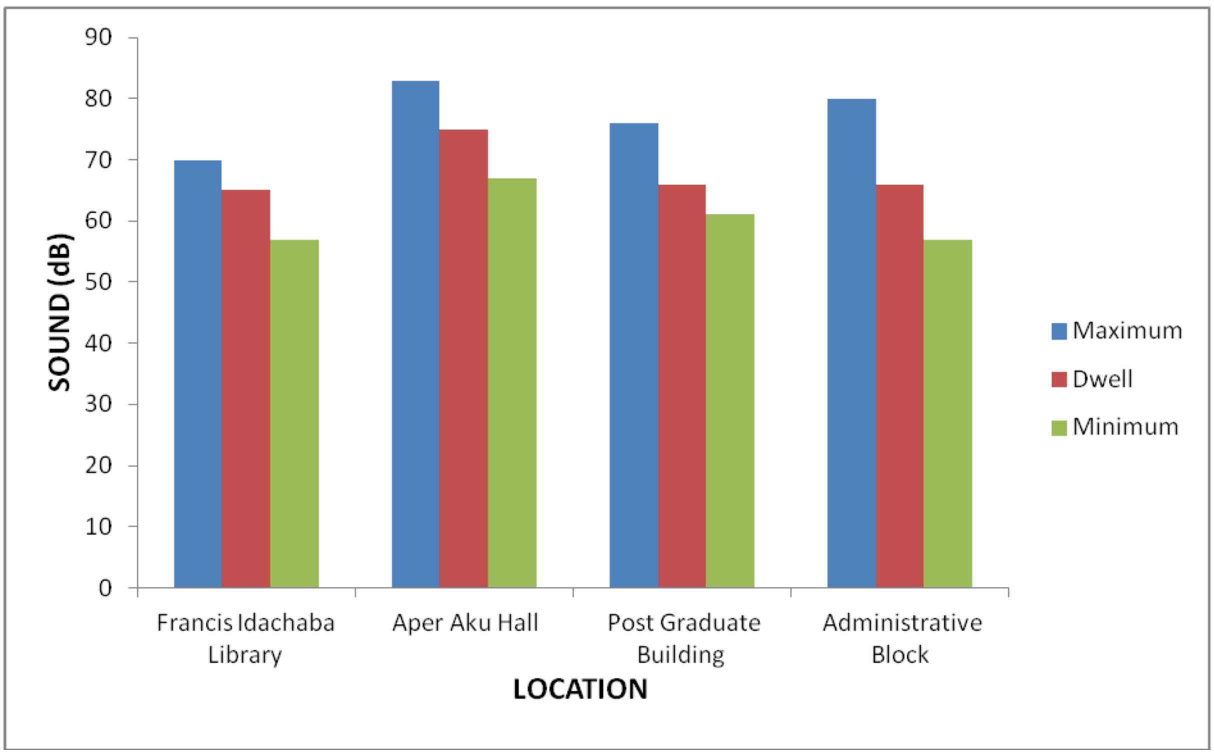

FIGURE 6: North Core

IV. CONCLUSION

To conclude, there is sufficient evidence to suggest that chronic noise exposure at schools affects students' health and performance. Since research results are consistent, it may be wise to apply the precautionary principle of environmental law for improving the school environment around noisy areas using the recommended WHO noise levels as guidelines (Berglund et al., 2000). To date, the potential negative and positive effects of interventions have not been thoroughly researched enough to provide policy makers with clear guidance. The development of future interventions and policies must be concurrent with a thorough research evaluation to determine the efficacy of the intervention to reduce exposure and reduce the adverse health effects of noise on students.

There is a need to evaluate sound insulation programmes and policies to reduce noise exposure in a well controlled large scale study to determine the impact of these programmes on a range of performance and health effects associated with students' noise exposure. Future studies need to evaluate the protective and restorative effects of accessibility to quiet zones (or options for protection of such quiet zones i.e. natural areas, parks, etc.) on students health.

However, educational institutes should have buildings that have sound insulation system and high fence using concrete walls which protect noise from outside. They should also be aware of plantation of trees and vegetation buffer zone because trees and vegetation can absorb 4dB-6dB noise intensity depending on their characteristics.

Students, Teachers and Public awareness would also be helpful in the reduction of noise level in educational institutes. Moreover a strict law concerning noise pollution in educational institutes should be implemented and also vehicular movement within or nearby the educational institutes should be restricted, while speed limit should be applied to vehicles near the educational institutes.

ACKNOWLEDGEMENT

The authors extend sincere gratitude to the university of Agriculture, Makurdi for cooperation in carrying out the rsearch.

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