Noise pollution in Nigeria's institutions of higher learning: a review

Abstract

Education is the cradle of development and must be properly guarded. Higher institutions are citadels of learning engaging in high intellectual discourse that require quiet ambience. The high noise level in Nigeria's institutions of higher learning has become a growing concern. This paper carried out a review of the studies done concerning noise pollution vis-à-vis the noise sources, its effects and abatement measures put in place if any. Modular mini electric generators, road traffics and religious organization's activities were found culpable to the majority of noises produced both inside the institutions and their neighbourhoods. More than 90% of the institutions' community are exposed to disturbing noise levels. The review showed that most of the institutions' measured noise levels ranges between 50 dB(A) and 110 dB(A). Also, majority of the exposed persons feels helpless while hoping to habituate with the conditions. There is a need, therefore, for the school management to collaborate with the government to ensure that sustainable noise mitigation measures are put in place in the institutions to avert its negatives consequences on students' performance and staff output.

Keywords: *institutions of higher learning, noise pollution, sources, effects, abatement*

1. INTRODUCTION

Noise pollution study is gaining prominence by the day as the consequential effects get unravelled. Noise is variously described as an unwanted sound or a sound out of place (WHO, 1999; Agbo, 2020). Noise has been rated third, after gas and water, as pollution affecting human overall wellbeing (Zannin, et al, 2013). There has been a growing incidence of noise pollution within the tertiary institutions in Nigeria, despite the institutions' position as citadels of knowledge and intellectual discourse. Interestingly though schools, hospitals and government reserved areas are designated as noise control zones, whereby the noise levels must not exceed that stipulated in Nigeria's National Environmental (Noise Standards and Control) Regulations, 2009 (National Environmental Regulations, 2009), that has not been the case. A review of studies carried out on noise pollution in Nigeria's higher education would show a trajectory for convincing the relevant authorities to implement abatement measures. Nigeria's tertiary education, as at 2020 comprises 175 Universities, 115 Polytechnics, 84 Colleges of education and a few Innovation enterprise institutions spread all over the country. . More than 2,000,000 students are pursuing various programmes whereby each candidate spends between three and six years in the institution depending on the specific course of study. Specifically, in 2016 academic year 560,925 candidates were admitted into the various higher institutions in Nigeria, also in 2017 academic year 568,641 candidates were admitted, in 2018 academic year 583,250 candidates and in 2019 academic year 612,577 candidates were offered admission. These students are exposed while in school to the numerous effects of noise from different sources especially from mini electric power generators, road traffics and religious activities. Most of the students live in school hostels and rented hostels accommodation within the neighbourhoods. Many staff and their wards also live in schools' provided staff quarters within the school premises. Academic activities are carried out within the school at both class and individual level. Classes and laboratory work, including workshop practices, are usually taken between 8.00 am and 6.00 pm. Libraries open by 7.30 am and close around 10.00 pm, while individuals continue

with their private studies at their own personal rate and timing. These activities are expected to be done within a calm and serene atmosphere for maximum achievement. Nonetheless, the noise pollution in these institutions continues to hamper the effectiveness of teaching and learning in the environment.

2. METHODOLOGY

The paper basically reviewed the studies concerning noise pollution in Nigeria's institutions of higher learning within the past three decades. Google search engine mainly was deployed in the collection and assembling of relevant articles. Science Direct database was also explored for relevant materials. Keywords words used in the search include acoustic maps, environmental noise pollution, noise levels in Nigeria's institutions of learning and noise level survey in Nigeria's schools. The results from the search were up to a thousand with many overlaps. More than 102 articles were downloaded out of which 48 were effectively utilized in the study. Data obtained from the studies were analysed and compared with other world-class standards like the World Health Organization's guidelines on community noise to draw inferences on the noise sources, effects and abatement programmes. Various institutions including universities, polytechnics and colleges of education were captured in the review process to determine whether or otherwise the noise pollution cuts across the different educational formations. Reviewed papers covered works carried out in the different geopolitical zones of the country to ensure representative sampling and fair conclusion.

3. RESULTS AND DISCUSSION

The results and discussion contained in the reviewed articles have been organized in three segments covering the sources, effects and abetment strategies. The information contained in the papers reviewed were in some cases juxtaposed with other researches carried out elsewhere to elucidate facts about the claims. Table 1 shows a summary of the higher institutions noise pollution studies included in the review carried out in this paper. The studies were compiled to capture most of the available works from all the geopolitical zones of Nigeria to ensure unbiassedness. North-East zone is however not represented as they have been faced with the challenges of insurgency thereby making the academic activities in the zone regimented.

Table 1 Noise studies in Nigeria's higher institutions of learning

Publication	Location	Year Data	Type of survey	Noise level descriptor	Noise level range	Sources	Perception Percentage dissatisfaction
Ali et al., 2017	Bayero University, Kano, NW zone	2016	Field measurement Questionnaire	L_{Aeq}	48.9 – 62.3 dB(A)	Occupants-43% Road traffic-25%	12%
Ayuba et	Fed. Uni.	2014	Post			Occupants-90%,	

al., 2018	Tech., Minna, NC zone		occupancy survey			Road traffics-40%, Electric generators-10%	
Amakom et al., 2019	Fed. Uni. Tech., Owerri, SE zone	2017	Field measurement	L_d	57.6 – 86.3 dB(A)	Electricity generators	
Onuu, 2000	Enugu, Aba, Onitsha, Owerri, Calabar, PortHarcourt, SE/SS zones		Field measurement/ Questionnaire	L_{Aeq}	77.7 – 90.8 dB(A)	Road traffic-37.3%	44.3%
Ana et al., 2009	Sec. Sch, Ibadan, SW zone		Field measurement/ Questionnaire	L_d	69.5 – 76.1 dB(A)	Road traffic-60%, Religious activities-18%, Markets- 12%	70%
Oguntoke, 2019	Hospitals, Abeokuta, SW zone		Field measurement/ Medical record analysis	L_d	42.4 – 88.2 dB(A)	Road traffics, music players, Electric generators, food grinding machines	
Oyedepo, 2013	Ilorin metropolis, SW zone	2005	Field measurement	L_{Aeq}	46 – 86 dB(A)	Road traffic, commercial activities, electric generators	
Eludoyin, 2016	OAU, Ile-Ife, SW zone		Questionnaire			Road traffic, Domestic pets Religious activities	80%
Usikalu and Kolawole, 2018	Covenant University. Ota, Ogun state, SW zone		Field measurements	L_d	55.5 – 84.4 dB(A)	Road traffic	
Nte and Gbarato, 2019	Uni. Port Harcourt, SS zone		Field measurements	L_d	52 – 112 dB(A)	Electric generators, Road traffic, Occupants	

Ntui, 2009	Uni. Calabar		Field measurements/ Questionnaire		43.5 – 88.5 dB(A)	Occupants, Road traffics, aircraft, Cellular phones, equipment	
Okeke and George, 2015	Port Harcourt metropolis	2014 – 2015	Field measurements	L_{Aeq}	52.1 – 102 dB(A)	Road traffic, commercial, Religious, Social, activities, electric generators	
Omubo-Pepple, 2010	PortHarcourt metropolis, SS zone		Questionnaire			Electric generator- 86%, road traffics- 75%, Religious/Social activities- 82%	
Wekpe and Fiberesima, 2020	Uni. PortHarcourt community, SS zone		Field measurements/ Questionnaire	L_d	67.88 – 84.02 dB(A)	Mobile vendors, Religious activities, Road traffics	
Wokocha, 2013	Schools within Omoku Gas Plant, SS zone		Field measurement/ Questionnaire	L_d	55 – 128.7 dB(A)	A gas turbine, Air compressors, Helicopters	60%

Some of the field measurements of the noise levels and the presentation neither followed the WHO noise descriptor standards (L_{Aeq}), nor the EU Environmental Noise Directive (END) noise descriptor standards (L_{dn} and L_{den}) for a better comparison to be made. The rule of thumb was therefore applied in such cases in deciding the extent of the community noise exposure. This does not, however, obviate the veracity of the conclusions reached looking at the high level of noises involved.

3.1 Noise pollution sources identified

Many researchers have identified the sources of noise pollution in the Nigerian institutions of higher learning to include electric power generators, road traffic, religious activities and classroom internally generated noise by the students themselves. Wekpe (2020) evaluated the problem of noise pollution around the communities of the University of Port Harcourt using both cross-sectional and experimental design. The measured noise values across the study area were beyond threshold limits for acceptable noise levels. The noise pollution was attributed to rapid urbanization and industrialization with the associated high number of automobiles, generating plants, industries, and marketing strategies using mobile advertisement vans and mobile vendors,

and conversion of residential areas to business and artisanal outfit. Nte and Gbarato did a noise survey of the University of Port Harcourt Teaching Hospital for both classroom and hostel's environments of the University. The noise levels within the University community ranged from 52 dBA around the wards, 72 dBA around the vehicle parking arena and 112 dBA at the electric power generator yard. Noise levels of between 52 – 75 dBA were recorded at the lecture halls, and 55 – 78 dBA at the hostels depending on the time of the day and activity taken place. Wokocha (2013) evaluated the impacts of industrial noise pollution on industrial workers and, pupils and teachers of schools located near the industries in Rivers State. It was found that the noise level in the industrial areas was high and can impact negatively on the health of the workers and school people. The extensions of urban development and industrialization have subsumed the schools earlier isolated locations causing the school's environment to be noisy. Omubo-Pepple et al. (2010) studied the problem of noise pollution within the Port Harcourt metropolis and revealed that the main sources of noise pollution come from generators, road traffic, and the use of loudspeakers mainly in religious and social activities. Generators contributed to a great extent the noise pollution within the Port Harcourt city because industries, small scale businesses, and even residential areas largely depend on generators for the supply of power.

Ntui (2009) evaluated the environmental noise levels that inconvenience library users at the University of Calabar library and found that the noise level in the University library exceeded the acceptable level of noise set by WHO, and ranging between 43.5 – 88.5 dB(A). The identified noise sources in decreasing order were noise from people, automobiles, aircraft, cellular phones and equipment. Amakom et al. (2019) conducted noise level measurement at the Federal University of Technology, Owerri (FUTO) using a sound level meter. The average noise levels recorded at FUTO were 67.78 dB at 9.00 am when daily office workers arriving and academic activities are take-off, 71.07 dB at 12.00 pm when lectures and most generating plants were on, and 67.79 dB at 3.00 pm when most activities are winding down, respectively. The high noise was attributed to mini electric power generators used at many different locations in the university.

The following studies which indicated modular electric power generators as the major source of noise within the high institutions have underpinned the consequence of epileptic power supply from the public power supply in Nigeria. Noises within the classrooms by students themselves are getting increasingly high as the number of students per class increases. In a related study outside Nigeria, Servilha and Delatti (2014) identified the perceptions of university students about the noise in classrooms and its consequences on learning quality employing questionnaires with both open and closed questions about the presence, source, type, and valuation of noise, its impact on lessons and strategies to minimize it. The university and the classrooms were considered noisy by the students and indicated themselves as the largest source of the noise. There were, however, other unidentified noise sources not mentioned in the literature reviewed; sudden thunderous cheers and ovations from view centres of European football leagues are now becoming a worrisome noise source within the neighbourhood. This is increasing as more Nigerians play in the league and more fans are joining. Also, noises from churches during all-night vigils and fellowships and from mosques observing early morning call to prayers were underreported or not reported at all. This may be due to faith-based issues, fear of the unknown regarding people's perceptions, depending on which side of the doctrinal divide one finds himself.

3.2 Observed noise effects within the academic community

The literature is inundated with various effects of environmental noise generated both internally and externally in many identifiable communities around the world. These include reduced speech intelligibility, communication distortions, the distraction of attention, annoyance, misbehaviours, physiological and psychological health disorders, hard of hearing and hearing impairments, stress-related problems, hypertension, shouting and high repetitive teaching and learning measures. However, within the Nigerian context, only a few studies have been undertaken and these are mostly subjective in approach as the authors rely heavily on references to the World Health Organization's (WHO) compiled studies. The study by Amakom et al. (2019) inferred that noise exposure could greatly reduce the students' academic performance as it has been shown to slow memory rehearsal, influence processes of selectivity in memory, and choice of strategies for carrying out tasks. Noise reduces helping behaviour, increase aggression and reduce the processing of social cues in people. Noisy learning environment hinders sustained attention and visual concentration among school children exposed it. It causes distractions Ntui (2009). Also, Omubo-Pepple et al. (2010) stated that noise pollution interferes with the ability to comprehend normal speech and may lead to a number of personal disabilities, handicaps, and behavioural changes. Problems with concentration, fatigue, uncertainty, lack of self-confidence, irritation, misunderstandings, decreased working capacity, disturbed interpersonal relationships, and stress reactions were associated with noise. Some of these may lead to increased accidents, disruption of communication in the classroom, and impaired academic performance. Memory recall of subject content, memory recall of incidental details, reading attention and problem solving, are all affected by noise pollution. In experimental research done at a gas plant located at Omoku in Rivers State, Nigeria, the noise levels were found to impact negatively on the blood pressure of the plant workers and teachers, and school children's performance (Wokocha, 2013). The experiment, however, did not take into consideration the likely confounders among the categories of workers tested such as sedentary office work compared to physical activity workshop work. Inhalation of particulate materials and chemical compounds which depends on the worker location within the plant might also be a co-factor not related in the observed results.

Adeyemi (2014) agreed that good acoustics are fundamental to good academic performance. He recognized that higher student achievement is associated with schools that have less external noise, that outside noise causes increased students' dissatisfaction within their classrooms, and that excessive noise causes stress on students. Evidence of the cumulative effect of excessive classroom noise on student's academic achievement level is more acute for students with hearing impediments and may affect the detection of such impediments. Noise pollution influence verbal interaction, reading comprehension, blood pressure and cognitive task success and may induce feelings of helplessness, inability to concentrate and lack of extended application to learning tasks.

Onuu (2000) observed that in most schools in South-Eastern Nigeria less than 45% sentence intelligibility is possible. The analysis showed that 33.7% of the people interviewed were most annoyed at home by road traffic noise, 44.3% in schools and places of study work. More than 79% of the residents would prefer to live in a quieter area even as there is subjective evidence of adaptation to road traffic noise within the boisterous cities in the region. Egunsola (2014) used ex-post facto and correlation survey to investigate the influence of the home environment on academic performance of senior secondary students in Adamawa state. It was observed that pupils from homes located in an environment where there is noisy traffic, market and noisy

sound of the machine from plywood industry were affected negatively in their performance in school because the noisy environment disturbs them from concentrating while reading and studying at home and even while listening to educative radio programmes.

Eom et al. (2006) investigated the determinants of students perceived learning outcomes and satisfaction in university online education using e-learning systems. Aural learners learn by listening. They like to be provided with aural instructions. They enjoy aural discussions and dialogues and prefer to work out problems by talking. They are easily distracted by noise. Assessment of noise and associated health impacts at selected secondary schools in Ibadan, Nigeria carried out by Ana et al. (2009) found out that noise levels indoors (classrooms) and outdoors (playgrounds) across schools were higher than WHO permissible levels for community learning environments. The study by Ajala (2012) analysed the influence of workplace environment on workers' welfare and productivity in government parastatals of Ondo state, Nigeria. He stated that the characteristics of a room or a place of meeting for a group have consequences regarding productivity and satisfaction level. In the open office plan, noise existence is stressful and demotivating, poses a high level of distortion and disturbance coupled with low privacy level. Noise has a negative influence on communication, frustration levels increase while productivity decreases in relation to persistence and loudness of the noise. A reason adduced for this is that spoken communication becomes progressively more difficult as noise levels increase. Less noise in the office means less distraction and full concentration on the assigned job.

Ali et al. (2017) studied the comfort in higher education facilities involving lecture theatres and laboratories in Bayero University, Kano, Nigeria. Although some of the measured and calculated physical parameters have not met the threshold by ASHRAE 55 and EN15251, the respondents expressed their acceptance of the laboratories' situations subjectively. The acceptance of the condition as normal maybe because the ASHRAE standards were often based on experiments implemented in developed countries, where the severity of the climatic conditions and the culture are dissimilar to Sub Saharan Africa and subjectivity of comfort. It was noted that acoustic discomfort causes fatigue, headaches, annoyance, changes in behaviour and attitude leading to a decrease in intellectual working ability and sleep disorders.

According to WHO (1999), the critical effects of noise in schools are on speech interference, disturbance of information extraction (eg comprehension and reading acquisition), message communication and annoyance. School classrooms and pre-schools, indoors environment for speech intelligibility, disturbance of information extraction and message communication.

According to WHO (1999), the capacity of noise to induce annoyance depends upon many of its physical characteristics, including its sound pressure level and spectral characteristics, as well as the variation of these properties over time. If the noise includes a large proportion of low-frequency components, the adverse effects may increase considerably. For full-sentence intelligibility in listeners with normal hearing, the signal-to-noise ratio should be at least 15 dB(A). Because the sound pressure level of normal speech is about 50 dB(A), noise with sound levels of 35 dB(A) or more interferes with the intelligibility of speech in smaller apartments. The acoustical energy of speech is within the frequency range of 100 – 600Hz, with the most important cue-bearing energy being between 300 – 3000Hz. Since sound reduction is also greater at higher frequencies most problems occur at lower frequencies, where most environmental noise sources produce relatively high sound pressure levels. Noise-induced hearing impairment occurs

predominantly in the high-frequency range of 3000 – 6000Hz, the effect being largest at 4000Hz and above 75 dB(A). Also, students' perception of annoyance is much more correlated with the frequency of occurrence of noise rather than with their intensity Classroom acoustics are an important, often neglected, aspect of the learning environment. Inappropriate levels of background noise, reverberation, and signal to noise ratios can inhibit reading and spelling ability, behaviour, attention, concentration, and academic performance. Loud or reverberant classrooms may cause teachers to raise their voices, leading to increased teacher stress and fatigue, and risk voice impairment (Acoustics in Schools, 2009).

Similar researches carried out outside Nigeria also indicated that environmental noise exposure, especially at high levels, is related to mental health symptoms and possibly raised anxiety and consumption of sedative medication (Loreti et al., 2016). Ralte (2014) assessed noise pollution and its effects on human health in Aizawl, Mizoram, India. Evidence has suggested that noise in learning environments has considerable effects on the learning abilities and the general productivity of children in terms of their academic performance as compared to children in serene learning environments. Noise pollution impairs task performance at school and at work, increase errors and decrease motivation. Reading attention, problem-solving, and memory are most strongly affected by noise. Two types of memory deficits have been identified under experimental conditions: recall of subject content and recall of incidental details. Both are adversely influenced by noise. Noise affects the quality of information delivered by the teacher as well as the message received by the students (Larsen et al. 2017). It is well known that proper acoustic environments help students comprehend and retain classroom instruction. According to Poll et al. (2014), writing fluency dropped drastically and the number of pauses longer than 5 s increased at speech transmission index (STI) values above 0.23. Realistic work-related performance drops even at low STI values. The study shows that relatively low speech intelligibility can have negative/disturbing effects on word-processed writing which is dominant activities in classrooms and open-office settings. Liu et al. (2017) investigated the effects of noise type, noise intensity, and illumination intensity on reading performance. Results indicate that all three independent variables had significant effects on reading performance. Reading performance was best with classical music, low noise intensity (<45 dBA) and normal illumination intensity (600 lx) conditions. A study conducted to examine the impact of chronic exposure to external and internal noise on the test results of children aged 7 and 11 in London (UK) primary schools indicated significant negative impact upon performance, the effect is greater for the older children (Shield and Dockrell, 2008). Servilha and Delatti (2014) reported that many university students reacted to noise with an effort to listen (difficulties in hearing the teacher), difficulty in concentration, irritation, aggravation and given up on paying attention, all inadequate conditions which interfere with information processing in learning, grades and health. Hammer et al. (2014) posited that people in noisy environments experience subjective habituation to noise, but their cardiovascular system does not habituate and still experience activations of the sympathetic nervous system and changes from deep sleep to a lighter stage of sleep in response to noise. Children in noisy environments have poor school performance, which leads to stress and misbehaviour. They also have decreased learning; lower reading comprehension, and concentration deficits. Children with noise-induced hearing loss (NIHL) suffer from decreased educational achievement and impaired social-emotional development, score significantly lower on basic skills, and exhibit behavioural problems and lower self-esteem. Exposures from recreational activities and music are not "noise" in the sense of being unwanted sound. But adverse health effects are possible even from desirable sounds. According to Servilha

and Delatti (2014) employment of active learning methods, in which the students are involved and feel like co-builders of knowledge, may possibly result in more effective learning and in the conservation of teacher's voice.

3.3 Noise abatement programmes

There were noise abatement measures adopted in the past which are no longer very effective in most of the higher institutions in Nigeria. These include isolated location, wall fencing, regulation measures (no traffic horn, traffic speed limit, no loitering, no noise signposts, etc). Even though some developed countries have adopted modern approaches to achieve considerable improvements in noise levels, the high financial costs involvement might make them unsuitable for the poorer less developed countries like Nigeria (WHO, 2009).

3.3.1 Noise abatement by isolation

Wokocha (2013) recalled that previous arrangements provided that schools were usually located in the outskirts of the towns and villages quite away from the boisterous areas to encourage effective teaching and learning. However, recent developments in industrialisation and commercialization and expansions in a residential area have subsumed these institutions and therefore distorted the earlier arrangement. Good and proper planning before building a school is very important. The best way to protect the institutions from noise disturbance is to locate the institutions in isolated areas (Ralte, 2014). WHO (1999) suggested that reduction may be achieved by encouraging quieter equipment or by the zoning of land into industrial and residential areas. A long building can be an effective screen but gaps between buildings will reduce the sound attenuation. Ayuba (2018) recommended the need to anticipate future development trends around the libraries, provision of special reading rooms- escapist reading areas and group study rooms, installing noise barriers to dampen noise from external sources and given sufficient distance (at least 40m) from a road traffic source. Only soundproof generating plants and solar inverters/ batteries are to be encouraged around the libraries for quieter operation. This was collaborated by Shield and Dockrell (2008) suggesting that the siting and the internal layout of a school should be such that classrooms are not exposed to high levels of noise from external sources such as road traffic.

3.3.2 Noise abatement through regulatory measures

There are also regulations at the national level and guidelines from the WHO to noise exposures for different settings (see Tables 2 and 3). The purpose of the regulations is to ensure the maintenance of a healthy environment for all people in Nigeria, the tranquillity of their surroundings and their psychological well-being by regulating noise levels and generally, to elevate the standard of living of the people. The regulation, however, does not apply to noise caused at or by an educational class or recreation in or around a school, college, university or other educational institutions; noise caused by the horn of a vehicle for the purpose of giving sufficient warning of the approach or position of the vehicle; noise caused or continuance of noise caused by a person as a result of a temporary or accidental cause which could not have been prevented by the exercise of due diligence and care on the part of that person; noise caused at a cultural activity or cultural show, funeral service or rite, marriage ceremony held between the hours of 10:00 am and 8:00 pm of the same day in any area.; noise caused during a period, or by such a cause or for a purpose as the Agency may by notification specify.

Table 2 WHO (1999 & 2001) Community noise guideline values

Environment	Critical effect	L_{eq} (dBA)	Timebase (h)	L_{max} (dBA)
Bedroom	Sleep disturbance	30	8	45
Dwelling room	Annoyance, Speech interference	50	16	-
Outdoor (day)	Serious annoyance	55	16	-
School classroom	Speech interference	35	6	-
School courtyard	Serious annoyance	55	Playtime	-
Hospital	Sleep disturbance	30	8	45
Patient/ward rooms	Communication interference	30	16	40
Concert hall	Hearing impairment	100	4	110
Discos Headphones		85	1	110
Public addresses		85	1	110
Impulse sounds	Hearing deficits	-	-	140

Table 3 Maximum permissible noise levels for the general environment in Nigeria (NASREA, 2009)

Column 1		Column 2	
Facility		Max permissible noise limit dB(A) (L_{eq})	
		Day	Night
A	Any building used as a hospital, convalescence home, home for the aged, sanatorium and institutes of higher learning, conference rooms, public library, environmental or recreational sites	45	35

B	Residential buildings	50	35
C	Mixed residential (with some commercial and entertainment)	55	45
D	Residential + industry or small scale production + commerce	60	50
E	Industrial (Outside perimeter fence	70	60

Above noise levels is a weighted average in the facility over the hours defined for night and day. Time frame: use duration, Day 6:00am – 10:00pm; Night 10:00pm – 6:00am. The time frame takes into consideration human activity.

A juxtaposition of the noise levels at the different locations having high institutions of learning in Nigeria (see Fig. 1) with the standards prescribed by WHO (1999) and NESREA (2007) indicates hazardous environmental noise pollution levels.

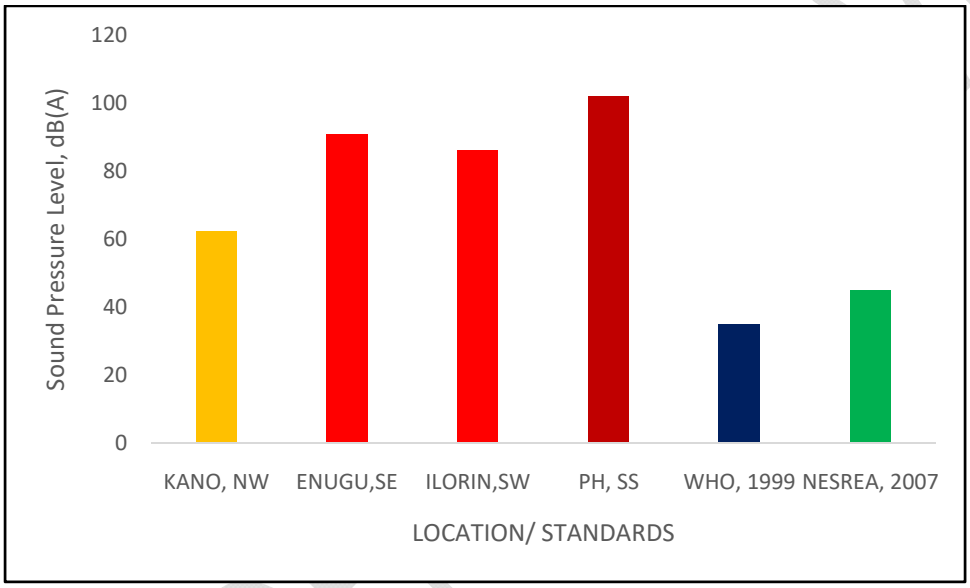

Fig. 1 Noise levels in Nigeria's high institutions of learning compared to the prescribed standards

Hammer et al. (2014) posited that source control through direct regulation and altering the informational environment was the least costly, most logistically feasible, and most effective federal level noise reduction interventions. Product disclosure including labels that disclose the noise emitted from products promotes informed consumer choice. In Argentina, Brazil, China, and the European Union, mandatory labelling of noise emission is required for certain products. Ralte (2014) recommended that the public must be aware and educated about noise nuisance through adequate news media, lectures, radio talks and other programmes. Use of loudspeaker outside close premises induce public nuisance, be it religious or sports or political campaigns or banquet hall should be controlled. To reduce the noise created by vehicles, creation of "No Vehicle Zone" around silence zone is recommended. Old vehicles and bike without silencer should be banned. Avoid unnecessary use of horn and whistle. Control the speed limit of vehicles near school surroundings. Playing loud music by vehicle during night time should be banned.

3.3.3 Passive noise abatement at the receiver end

Sustainable building design programmes regarding background noise, site considerations and sound-absorptive finishes to limit reverberation are required in schools. Evans and Himmel (2009) presented that signal-to-noise ratio (SNR) needs to be +/-15 dB for enough words to be heard that listeners do not have to rely on their limited vocabularies "fill in blanks". Acoustically absorptive ceilings and wall surfaces reduce the build-up of reverberant noise and undesirable reflections while improving speech communications. They suggested 'de-tuning" school building design natural frequencies to resist sympathetic vibration when external events transmit disturbance vibration into the foundation. WHO suggested that in warmer climates, in particular, insulation is not a serious option and excessive noise exposure (above 55 dB) must be avoided either by removing the people exposed or removing the source if source related measures fail. Azkorra (2015) supported the use of greenery on buildings as a way to improve the quality of life in urban environments. Some of the benefits associated with greenery systems for buildings include energy savings, biodiversity support, storm-water control and noise attenuation. A comparison of the sound absorption coefficient value of common building materials showed that fibreglass board (25mm (1") thick) has the highest coefficient at frequencies above 375 Hz followed by the vertical green wall, coarse concrete block, plywood panel, glass window, painted concrete-block, unglazed brick, marble/tile, smooth plaster on tile/brick, unglazed brick and painted in that order. Destefani et al. (2016) evaluated how noise mapping can be used as a tool for decision making about facade design and building location. Improvement was obtained on buildings facades with simple shape and location modifications, without excessive changes in size or architectural concept. There was significant improvement not only for the higher floors but also at the ground level, on which the main entrance and lobby are located. By offsetting the tower towards the rear of the plot it is possible to plan green areas in front of the building, with enough vegetation to form a visual barrier to the avenue with high traffic flow. This also allows the use of thinner glass, reducing costs.

A 1.5 km long and 3.0 meters high innovative noise barriers made of pre-galvanized sheets were mounted on boundary's retaining wall of the Indian Institute of Technology, Bombay, Mumbai, India. The barriers were found to reduce the decibel levels from 98 dB to 55 dB in a similar installation (Tembhekar, 2012). Building a high fence using concrete wall or wood around the institutions proves to be useful for protecting the institutions from noise disturbance. Planting of evergreen trees around or nearby areas of noise can prove to be an effective measure for control of noise pollution as green trees reduce the intensity of noise (Ralte, 2014).

3.3.4 Noise abatement through acoustic map and soundscape

Zannin et al. (2013) performed a computer-assisted noise mapping of a school campus in Southern Brazil using the SoundPLAN software. Despite the noise pollution, the acoustic maps revealed several islands of acoustic tranquillity on campus. These islands were observed adjacent to buildings where sound levels range from 45 to 48 dB(A) and from 48 to 51 dB(A). Brown (2014) posited that in noise control, the sound is a waste product managed to reduce the immission of sounds that cause human discomfort. The soundscape approach, by contrast, considers the acoustic environment as a resource, focusing on sounds people want or prefer. He argued that quiet is not a core condition for acoustic preference in the outdoor acoustic environment, but a congruence of soundscape and landscape.

From the foregoing, it is clear that little is been done to combat the noise pollution in Nigeria. Some of the abatement activities were more of incidental actions rather than planned. The erection of perimeter fences around schools was done primarily to protect the school property from encroachment. Establishment of religious centres and religious villages will confine the noise from the activities which hitherto struggle for space within the lecture halls and offices.

4. CONCLUSION

Higher institutions in Nigeria have been described as noisy. The sources of the noise have been identified to include electric mini generators, road traffic both motor vehicles and motorbikes and religious activities. It was observed that noise affects academic activities in various ways. Noise poses health challenges, disrupts effective communication flow and inhibits overall academic performance. There are no standard measures to combat noise pollution in Nigeria's higher institutions. The existence of perimeter fencing is advantageous as noise abatement measure even though they were not planned for that purpose. Efforts should be made by the school managements to ensure centralized electricity power supply since most of the noise was as a result of the individual electric power generators. Existence of potholes which delay vehicular movement causes steady noise (long term noise).

The regulatory body charged with noise control in Nigeria, National Environmental Standards and Regulations Enforcement Agency (NESREA) is seen not to perform up to expectations. Adeoluwa (2018) interrogate the purposes of the extant national environmental regulations to determine the reasons behind their seemingly non-efficacious as opposed to the spirit of the NESREA Act from where they derive their lifeblood. It was argued that the awareness creation about these regulations and their enforcement are generally poor. NESREA has not demonstrated any serious enforcement of the Regulations in a manner that positively impacts on the Nigerian masses for right environmental behaviours. It appears these Regulations are massively made to fulfil mere political goals. Nonetheless, Ibijola (2015) submitted that the quality of Nigerian university education is not poor as perceived by most stakeholders in education and that there existed a significant relationship between the performances of the regulatory agency and the quality of university education. Education in general and university education, in particular, is fundamental to the construction of a knowledge economy and society in all nations.

It is an inclusive recommendation of this paper, therefore, that the school management should work hand-in-hand with governments at all levels to undertake a holistic measure towards the provision of acceptable conducive teaching and learning environment devoid of noise pollution. This would go a long way, not only to improve the academic performance of students but also enhance staff output in our various institutions of higher learning. Further research in the area of cross-sectional and longitudinal experimental design to evaluate the immediate and cumulative effects of noise pollution within our peculiar environment will consolidate or dismiss otherwise literature assertions.

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