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Environmental Noise Nuisance in Pedagogical Institutions in Jos Metropolis, Nigeria

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ABSTRACT

This study evaluated environmental noise nuisance in pedagogical institutions located in Jos metropolis. Sixteen senior secondary schools and 282 senior students were selected through stratified and random sampling techniques respectively. Data were collected from 282 students using semi-structured questionnaire. Data were analyzed using frequency counts, percentages and mean, aided by SPSS- 23 software. Results were presented in tables and charts, which revealed that, over 58% of the students are "annoyingly noisy", with only 3% of them claiming their schools are "silent". About one-half claimed noise emanated mainly from road traffic, while demolition and construction contribute the least source of noise. All the sources of noise create setbacks on students' academic outcomes by distracting their: literacy, articulacy, numeracy and graphically abilities (mean = 4.3); concentration ((mean = 4.2), reading tasks & well-being (mean = 4.1); and cognitive tasks (mean = 4.0); among others. The weakening of overall performance of students (mean = 4.3) make them "very much annoyed" (50.4%). The correlation analysis, r value 0.98 showed a strong positive relationship between high noise level and decline in the overall academic outcomes of students. The paper recommended the need for: school owners to insulate classrooms against outdoor noise, raise high fences round schools, plant sound-absorbing trees within school compounds and the Government should relocate all schools to safe environments.

INTRODUCTION

Etymologically, the word "noise" is derived from Latin word for "nausea", meaning sea of sickness, which aptly describes unwanted sound that is loud, unpleasant andunexpected in a given place at a certain time (Tang'an, 2016; Owolabi, 2017). Noise nuisance on the other hand means continuous or repeated noise in a given area, which is offensive, obnoxious, annoying, unpleasant or disagreeable to hearers. Sound is a form of electrical impulses which carry information to the brain, enabling us to hear, but when the sound is in excess, it becomes pollution that hinders effective pollution that hinders effective communication; thereby causing hearing impairment, negative social behavior, cardiovascular disorder and disruption of mental health and sleep (Berglund, Lindvall & Schwela, 1999; Hiral *et al*., 2017; Owolabi, 2017). Noise is one of the environmental hazards affecting occupants of world's cities today, however, a noiseless social environment is one of the potential factors contributing to workers' high level of productivity, and by extension, enhances learners' academic outcomes. It is widespreadly known that noise levels in teaching and learning environment measuring up to 65 decibels (dB) can stifle pedagogical proceedings. The Sustainable Development Goal 4 (SDG-4) of the United Nations emphasizes inclusive education for all gender by 2030, and the realization of this target partly lies on noiseless, healthy and safe environment for both the learners and instructors. This implies that noise management is key to effective lecture delivery in educational environment because 45% of students' daily time is spent in listening. It is very crucial to address the emerging noise pollution in educational environment to ensure learning environment is serene for academic activities. This explains why the World Health Organization (WHO) declared noise as a pollutant in 1972, due to its negative effects on humans, animals and property value. Preceding the declaration by the world's apex health body (WHO), Florence Nightingale had decried in 1859 that "unnecessary noise is the most cruel abuse of care which can be inflicted on either the sick or the well" (Hsu *et al*., 2012). The tempo of urbanization as seen in the growth of world's cities is leading to rapid shifting of mostly able-bodied youths irreversibly from rural areas. Bedung et al. (2003) decried that in 1800, only London city had a million population of people; thereafter, over 326 cities have sprung up, with Tokyo having 28 million people, Mexico City 18 million, Mumbai, Sao Paulo and New York 17 million each, Shanghai 14 million, Calcutta 13 million, Los Angeles, Buenos Aires, Seoul, Beijing and Lagos 12 million each, Osaka and New

Delhi 11 million each while Rio de Janeiro and Dhakar have 10 million people each. According to Aliyu, Lawal and Amadu (2017), urbanization has risen from 13% in 1900 to 29% in 1950, 49% in 2005, and is likely going to approach 60% by the year in 2030. The aforementioned cities are not necessarily the noisest in the world; the world's ten noisest cities as at 2018 were: Guanghou, New Delhi, Cairo, Mumbai, Istanbul, Beinjing, Barcelona, Mexico City, Paris and Buenos Aires (WHO & SINTEF, 2018). Noise in most cities emanates freely from the diverse socio-economic activities of the residents. In most developing countries, including Nigeria, the high population density, lack of empty spaces, inappropriate city planning and lack of political will, have all led to haphazard educational development, regardless of location, proximity, spread and compatible principles of town and country planning. The rapid growth in population has created high demand for educational institutions such that schools are being located in buildings that were not originally designed for teaching and learning (Piwuna & Haggai, 1997). Most of these educational facilities are daily seen springing up within residential areas, near market centers, mechanical workshops, factories and social event sites. Thus, world's cities have become the epicenters of socio-economic activities such as residential, industrial, commercial, educational and entertainment (RICE). Many pedagogical institutions are located near such busy places in the cities because of limited spaces or rapid development have caught up with them. Estimates have shown that the rising noise from such points is severely damaging to human beings, and is responsible for 16,600 premature deaths and more than 72,000 hospitalizations every year in European countries alone (hppt://www.iberdrola.com). Studies across the world have shown that environmental noise affects workers in their workplaces and negates learners' academic ability in language and mathematics; implying that the literacy, articulacy, numeracy and graphicy of the learners are adversely affected. The growth in population of Jos metropolis in recent times is creating high demand for educational facilities such that some dwelling apartments, out of necessity have been converted into educational facilities near residential, industrial, commercial, and entertainment sites (RICE). Jos, the Plateau State Capital, has large number of such private educational institutions springing up and is leading to proliferation of illegal and substandard schools in different parts. Jos has the highest rate of increase in educational facilities in the State, with an estimated 88 nursery, 82 primary and 65 secondary schools being established every year, and many of them located illegally in wrong places consisting of two bedroom buildings and signboards which often bear such inscriptions as "International", "Private", or "Academy" (Daily Trust, February 27, 2014). The environmental noise pollution on students in educational institutions manifests in their frequently reported feeling of tiredness, lack of concentration, communication interference, voice masking, low speech intelligence, among others (Owolabi, 2017). The problem of noise pollution has been bothering mankind for a long time. Society has attempted to regulate the hazard since the early days of the Roman Emperor, Julius Caeser, who either prohibited the movement of horse-drawn chariots in streets at night or cobblestone street roads covered with straw to avoid causing annoyance to nearby residences (Goines & Hagler, 2007; Owolabi, 2017; Maton *et al*., 2021). But it was not until the late 1960s that people started to protest against some specific highways or airports and claimed that citizens must be protected from the adverse effects of noise pollution. This was followed by passage of nuisance lawsuits in different parts of the world, particularly, USA, the Netherlands, France, Spain and Denmark. In Nigeria Federal Environmental Protection Agency (FEPA) was established in 1988 and thereafter transformed to National Environmental Standards, Regulation and Enforcement Agency (NESREA) which was established in 2007, with a mandate to ensure citizens live in a pollution-free environment while pursuing their daily livelihoods and by extension, including education. Despite these efforts, the acoustic environmental quality in Jos metropolitan area still reduces students' comfort, efficiency, health and safety on the one hand, and creates literacy, articulacy, numeracy and graphicy (LANG) problems to learners. It was against this backdrop that this study set to assess environmental noise in educational institutions located in Jos city. Therefore, the study specifically investigated: perceived noise intensity in school premises of Jos city, identified the main noise sources, noise effects on students' academic accomplishments and the extent of students' reactions. It is hoped that the findings of this study will guide relevant authorities to make enforceable policies to create noiseless environment for pedagogical activities located in Jos city.

2 METHODOLOGY

2.1 The Study Area

Jos Metropolis is located between latitudes $9^0$45’00” N & $9^0$55’00” N of the Equator, and between longitudes $8^0$45’00” E & $8^0$58’00” E of the Greenwich Meridian (see map of study area, figure 1). It has an average elevation of 1,238m, dissected by River Delimi, flowing from South to Northwest before curving Northward to empty contents into Lake Chad through River Yobe. Jos Plateau has temperate climate which is caused by high elevation. Orographic rainfall, influenced by high relief is common during rainy season which lasts for 6 Months. Rainfall ranges from 1,400- 1500 mm with mean temperature of 22^0 C. Jos Metropolis comprises major towns in Jos North and Jos South LGAs of Plateau State. Jos is the capital city of Plateau State in North Central Nigeria. Being a cosmopolitan settlement, Jos is inhabited by virtually all the different ethnic groups of Nigeria and foreign nationals. According to Ihemegbulem and Nyong (2002), the discovery of tin ore and columbite in the early 1900s led to rapid growth of Jos, rising from: 8,000 in 1920 to 11,000 in 1931; to 80,000 in 1960; to 637,036 in 1991; but by 2006, the population reached 748,609 in 2006 (NPC, 2006). The residents are engaged mainly in secondary, tertiary and quaternary activities of the economy for livelihood. The city is rapidly growing at an alarming rate due to rural-urban drift, consisting mainly of young people who are pursuing education, job fortunes or safe haven away from conflict-ridden rural areas of the State and neighboring States. However, many of these youthful population do not always possess the requisite qualifications to fit into the employment system of the city hence, some of them resort to noise-generating activities like driving commercial vehicles, metal

fabrication work, operating musical studios and entertainment.

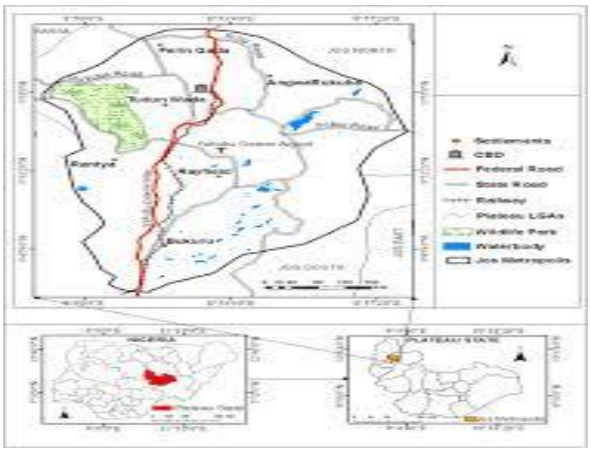

Figure 1: Map of Jos

2.2 Population, Sampling, Data Collection and Analysis

Quantitative research design was adopted, and involved the selection of representative population. There are 200 public and private secondary schools in Jos city. Purposive sampling technique was applied to select 16 senior schools, while 18 students were chosen from each school for the study. Purposive sampling technique was found suitable to select schools within the hub of socio-economic activities that readily generate noise pollution, located at least 50 meters away from main roads. Randomization let to selection of 288 students for the study. The sample size was considered adequate enough in line with Seymour's (1976, as quoted in Meekya, 1992) who suggested that 200-500 elements in urban and regional survey studies for social sciences is justifiable. The study employed questionnaire instrument for data collection. It was structured into open and closed question types. The first section of the questionnaire sought for information on school name, location, level, class, gender and age of the respondent, while the second section solicited for information related to acoustic environment of the school, main noise sources, severity of noise effects on learner's academic tasks, comfort, health, safety and reactions. Respondents were allowed to choose appropriate answers to the questions from the options and could freely make their own comments as well. Section two was designed using a modified 5-point Likert Scale coded thus: 5-Strongly Agree (SA), 4-Highly Agree (AA), 3-Agree (A), 2-Disagree (DA) and 1-Strongly Disagree (SD). The questionnaire was given to two experts in test and measurements for validation. Observations were made and some questions adjusted, thereafter, 15 copies of the questionnaire were administered to fifteen senior students in the neighborhoods to test the reliability of the tool before administering to the subjects. Two hundred and eighty copies of questionnaire were distributed to 18 students each from the following selected schools: Al-Hilal Secondary School, Rikkos; Baptist Grammar School, Nasarawa; Cherubim & Seraphim College, Nasarawa; Faith Academy, Yakubu Gowon Way; Fatimah Private School, Jenta Alheri; Goverment Secondary School, Laranto; Government Secondary School, Township; Imperial College, Abattoir; Islamiyya College, Bauchi Road; Mafeng Private School, Angwan Rukuba; Methodist College, Old Bukuru Park; Nurudeen Educational Center, Adabayo Street; Plateau Private School, Bauchi Ring-Road; St Paul Anglican College, Old Bukuru Park; Tin City College, Laranto; and Trust Academy, Rikkos. Two field assistants, very fluent in both Hausa and English languages were recruited to help in administering copies the questionnaire, which lasted for 5 workdays (April 17-22, 2023). Some Teachers from all the selected schools helped in distributing the questionnaire to their students in SS1, SS2 and SS3, taking gender into consideration. A total of 288 copies of questionnaire were distributed to respondents, but 282 were duly completed correctly and returned, while the remaining 6 copies were partially filled hence, could not be used for the analysis. Meanwhile, the 282 copies of the questionnaire returned represent 98.0% response rate. Data collated from 282 copies of the questionnaire were summarized and analyzed with the use of Statistical Package for Social Sciences version 22.0 software (SPSS-23). A criterion mean of 3.0 (mean of 1+2+3+4+5), where any item or statement with mean = ≥ 3.0 was upheld and accepted as having adverse effect.

3. PRESENTATION OF RESULTS

Data collected from 282 respondents for the study on environmental noise in educational institutions in Jos city were collected, summarized and analyzed, aided by SPSS-22. The results were presented in tables and each with highlights.

3.1 Students' Perception of Noise Intensity in School Premises in Jos City

Information on students' perception of environmental noise intensity (ENI) of their respective educational premises were collected and analyzed. The results are contained in table 1. About one-sixth (58.2%) of the respondents described the noise intensity as "Annoyingly noisy". This means the noise intensity in most educational facilities in Jos city is above the 30-45dB recommended by the WHO. By implications, the acoustic educational environmental quality in Jos city is not very comfortable, healthy and safe for accomplishing academic tasks by students.

Table 1: Perceived Intensity of Noise in School Premises

Acoustic Environment	Frequency	Percentage
Silence	08	2.8
Fairly quiet	15	4.6
Intermittently noisy	42	14.9
Continuously noisy	55	19.5
Annoyingly noisy	162	58.2
Total	282	100

Source: Fieldwork, 2023.

3.2: Main Noise Sources in Educational Institutions in Jos

Information on the main source of environmental noise in schools' environment was sought from students. The analyzed results are contained in table 2. Findings indicated that about half (49.6%) of the total interviewees were of the view that road traffic constituted the main noise source. A total of 20.6% identified promotion adverts, 16.0% welding works, 7.4% grinding mills, 1.8% entertainment, 1.4% worship centers, 1.1% demolition and construction works while 2.1% "others" like classroom infrastructure, playing within school premises, rainfall (2.1%) were the other sources of environmental noise in Jos city. The road traffic as a major source of noise is probably due to the fact that vehicles such as cars, buses, tricycles, motor cycles and heavy-duty trucks and long-vehicles ply the routes especially throughout the school hours.

Table 2: Main Noise Sources in School Premises

Main Source	Frequency	Percentage
Road traffic	140	49.6
Promotion advertisements	58	20.6
Welding works	45	16.0
Grinding mills	21	7.4
Entertainment music	05	1.8
Worship centers	04	1.4
Demolition & construction	03	1.1
Others (colleagues, playing etc)	06	2.1
Total	282	100

Source: Fieldwork, 2023.

3.3 Effects of Environmenal Noise on Students' Academic Accomplishments

The study solicited for information on the deleterious ways in which environmental noise affects students' academic accomplishments. Results of the analysis are contained in table 3. Findings showed, all the items in the table have means higher than the criterion mean of 3.0. Based on the decision rule, all the statements concerning the adverse effects of environmental noise on students' academic tasks are upheld and accepted. Thus, students' academic accomplishments are adversely affected by the environmental noise in all the schools investigated in Jos city.

Table 3: Effects of Environmental Noise on Students' Academic Tasks

Item	5-SA	4-HA	3-A	2-D	1-SD	Total	X	Decision Rule
Noise distracts concentration	745 (149)	224 (56)	171 (57)	34 (17)	03 (03)	1,177 (282)	4.2	Accepted
Prolong noise slows down teaching-learning	560 (112)	360 (90)	111 (37)	44 (22)	27 (27)	1,102 (282)	3.9	Accepted
Noise weakens cognitive tasks	630 (126)	324 (81)	120 (40)	48 (24)	11 (11)	1,133 (282)	4.0	Accepted
Prolong noise distracts reading tasks	655 (131)	312 (78)	159 (53)	32 (16)	04 (04)	1,162 (282)	4.1	Accepted
Noise reduces non-native communication	425 (85)	296 (74)	126 (42)	102 (51)	30 (30)	979 (282)	3.5	Accepted
Noise reduces ability to grasp lesson contents	515 (103)	324 (81)	129 (43)	62 (31)	24 (24)	1,054 (282)	3.7	Accepted
Prolong exposure to noise reduces learner's ability literacy, articulacy, numeracy & graphicy	810 (162)	260 (65)	99 (33)	40 (20)	02 (02)	1,211 (282)	4.3	Accepted
Noise annoys one & threatens well-being	630 (126)	384 (96)	87 (29)	38 (19)	12 (12)	1,151 (282)	4.1	Accepted
Prolong noise lowers overall academic performance	910 (182)	180 (45)	81 (27)	40 (20)	08 (08)	1,219 (282)	4.3	Accepted

Source: Fieldwork, 2023.

3.4: Students' Reactions to Environmental Noise Pollution

Environmental noise as reviewed from scholarly studies is known to cause varying degrees of annoyance. Sequel to this, information gathered from the interviewees was analyzed and presented in table 4. Findings revealed that over half (50.4%) of the entire respondents got very much annoyed with the distracting tendency of environmental noise, while 6.7% did not get annoy at all, 8.2% somewhat got annoy, 10.3% got quite annoy and 24.6% got much annoy. The various degrees of annoyance expressed by students could probably be because environmental noise easily interferes with concentration

during pedagogical proceedings, involving literacy, articulacy, numeracy and graphicy (LANG) as well as students' wellness.

Table 4: Students' Reactions to the Effects of Environmental Noise

Reaction to Noise	Frequency	Percentage
Not at all annoyed	19	6.7
Somewhat annoyed	23	8.1
Quite annoyed	29	10.3
Much annoyed	69	24.5
Very much annoyed	142	50.4
Total	282	100

Source: Fieldwork, 2023.

4. RESULTS AND DISCUSSION

In this study, results have shown that noise levels in pedagogical institutions investigated are very much on the high side (see table 1). This fact was supported by 58.2% of the respondents who described the noise intensity as "annoyingly noisy", which is probably exceeds WHO recommended permissible noise levels for institutions. The results further revealed that students are usually bombarded with all sorts of noise which distract them from concentrating on their studies in their respective institutions, coming mainly from road traffic through exhaust pipes, piercing sirens and honking horns (see table 2). This could happen when schools developed their sites without adequate setbacks from highways where motorized vehicles plying the roads during school hours produce noise through brake squeals, matching of accelerating devices and honking of horns indiscriminately. This finding is in concord with Maton *et al*. (2021) who reportedly found the major source of noise in Jos metropolitan area to be from road traffic, against emanating from classrooms reported by Piwuna and Haggai (1997). It was also interesting that apart from road traffic noise (50.4%), promotion adverts (20.6%) from market centers, welding operations (16.0%) during metallic fabrication, grinding mills (7.4%), musical entertainments (1.8%) loudspeakers from worship centers (1.4%) were others active sources of noise nuisance stifling academic tasks among students. This is because noise stemming from loading parks, road junctions, open air trading and social events are usually at intensity higher than 65dB in Jos metropolis generally (Peter, 2016). The study discovered that, environmental noise have deleterious effects on students' academic accomplishments at various degrees of severity. This is evident from table 3, where the means of all the statements ranging from 3.5-4.3 far exceeded the criterion mean of 3.0. Consequent upon the noise disturbance, students reacted by feeling "very much annoyed" (see table 4). Their annoyance could be justified by the fact that high level of noise has been found to not only hinder pedagogical sessions especially the literacy, articulacy, numeracy and graphicy aspects, but causes irreversible damage to hearing, sleep and cardiovascular disorder (Quartey *et al*. 2021). This result is not different from findings reported from other parts of the world. Studies revealed that chronic exposure to noise negate cognitive functioning and hinders children's comprehension compared to students from quieter schools. Hagler (cited in Anees *et al.* 2014) reported that 340 children aged 8-11years in London exposed to traffic noise pollution led to annoyance, poor reading and less comprehension, and at 55dB, there was low attention, less social adaptability and had negative behavior towards others, compared to undisturbed children. Oni Femi (cited in the Guardian, July 8, 2015), reported findings from studies that exposures to noise pollution in excess of about 100dB can lead to adverse effects on fetus, headache, dizziness, dilatoriness in intestine, stomach problems as well as affect eye sights to the extent that they become incurable.

5. CONCLUSION AND RECOMMENDATIONS

The realization of the United Nations Sustainable Development Goal 4 on education which emphasizes inclusive education for all gender by 2030 stand to suffer setbacks without having comfortable, safe and serene school environment for the smooth flow of pedagogical activities. This study discovered that noise nuisance in pedagogical institutions of Jos metropolis is on the high side, with consequential weakening of students overall academic outcomes, causing great annoyance during pedagogical process. Failure to effectively manage noise nuisance in good time is no doubt going to worsen and stifle academic pursuit in educational environments. Therefore, in the light of this, the paper recommends that:

1. School owners should build classrooms thanks are well-fitted with insulating devices to minimize environmental noise likely to interfere with pedagogical activities.

2. Schools should commit reasonable financial resources to build high fences round schools to minimize distraction coming from outside to stifle academic activities.

3. Trees should be planted within the school premises to help absorb indoor and outdoor noise likely to affect students' academic accomplishments.

4. The Plateau State Ministry of Education should prevent schools situated in incompatible areas of the Jos city from operations.

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