Unmasking The Noise Level in Some Lecture Halls of Captain Elechi Amadi Polytechnic, Using A Technological Tool

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Abstract

Unmasking the noise level in some lecture halls of Captain Elechi Amadi Polytechnic was carried out to determine the level of noise, its sources and effects on the students. With the use of technological tools like the sound level meter, noise level was measured in the morning, at noon, and in the evening. The selected study are lecture halls are the hall 1, A1, A2, TF1, GC3, A3, TF4 ICT Block, TF9, TF8, TF3, TF6, TF7, GC4, D2, B3, D1, B2 and GC2. The average sound level (dB) was calculated and recorded for each of the halls. It was found that the hall 1, occupied by the Public Administration students had the highest noise levels of 77.33 dB, followed by the Mass Communication Students in B3 with a noise level of 76dB. The Computer Science in TF4, Banking and Finance in GC3, Accountancy in TF1, Electrical and Electronics Technology in A2 and Science Laboratory Technology in ICT block had the noise level of 71.67dB, 69.67dB, 68.33dB, 68dB and 68dB respectively. Since the normal sound level is 65dBA, it then means that the halls which generate an average sound level above 65dBA, adequate fenestrations and ventilations should be provided, number of students in the lecture halls should be reduced, air conditions and fans should be installed and a steady power supply. Generally speaking, the polytechnic environmental noise level of 61.72dBA is less than the normal sound level.

INTRODUCTION

Noise is any sound that is undesired by the recipient and also referred to as unwanted sound. It is also characterised by the intensity, frequency, periodicity and duration of the sound. It consist of acoustic, electric or electronic signal with a random mixture of wavelengths [Filippi, 1998]. Noise pollution being a bye – product of modern developments in technology is a major constraint on the quality of life in urban settlements. Population explosion and increasing human activities gave rise to noise pollution in many cities and urban areas of the world. In most urban areas according to mansouri, et al (2006), noise pollution is caused as a result of unplanned settlements. The noise level to which the population is exposed is related to the

quality of life in any environment in terms of economic, social development and population increase. Noise is a growing health threat and if unchecked, could result to hazardous conditions (Adejobi, 2012).

In Nigeria, the problem of noise pollution is wide spread. A study on environmental noise pollution in Nigerian urban centres found that increase in population, commercial activities and road traffic volume, increases the level of noise generation. Records shows that even in medieval times, carriages and horseback riding were banned during the night in some cities in Europe in order to prevent sleep disturbance (world health organisation, 2000)

In addition, noise pollution is recognised as a major problem for the quality of life in major urban centres of the world. Because of the increase in the number of cars and industrialization, noise pollution has also increased. Noise in cities, especially along main arteries has reached up disturbing levels.

ENVIRONMENTAL NOISE

Environmental noise is the accommodation of all noise present in a specified environment. The principal sources of environmental noise are surface motor vehicles, aircraft, trains and industrial sources (Swinburn et al, 2014). These noise sources expose millions of people to noise pollution that creates not only annoyance but also significant health consequences such as elevated incidence of heat ring, environmental noise loss and cardio vascular disease (Bhatia, 2014). There are varieties of mitigation strategies and controls available to reduce sound levels including source intensity reduction, land use planning strategies, noise barriers and sound baffles, time of day use regimens, vehicle operational controls and architecture acoustics design measures- certain geographic area or regulation specific occupations may be at a higher risk of being exposed to constantly high levels of noise; in order to prevent negative health outcomes, regulation may be set.

Noise regulation includes statutes or guidelines relating to sound transmission established by national, state or provincial and municipal levels of government. Environmental noise is governed by laws and standards which set maximum recommended levels of noise for specific land uses such as residential areas, areas of outstanding natural beauty or schools. These standards usually specify measurement using a weighting filter, most often A-weighting (Environmental Protection Agency, 2013)

In 1972, the noise control Act was passed to promote a healthy living environment for all Americans, where noise does not pose a threat to human health. This policy's main objectives were;

i) Establish coordination of research in the area of noise control.
ii) Establish federal standard on noise emission for commercial products, and.
iii) Promote public awareness about noise emission and reduction.

The Quiet communities Act of 1978 promotes noise control programs at the state and local level and developed a research program on noise control (CDC 2016). Both laws authorised the environmental protection Agency to study the effect of noise and evaluate regulations regarding noise control (CDC, 2016). The National Institute for Occupational Safety and Health (NIOSH) provides recommendation on noise exposure in the work place. In 1972

(revised in 1998), NIOSH published a document outlining recommended standard relating to the occupational exposure to noise, with the purpose of reducing the risk of developing, permanent hearing loss related to exposure at work (NOISH, 2016). The recommended exposure limit (REL) of noise in an occupation setting is 85dBA for 8 hours using 3-dB increase in level, duration of exposure should be cut in half, i.e 88dBA for 4hours, 91 dBA for 2 hours, 94dBA for 1hour, etc. However, in 1973 the occupational safety and health conservation program to workers exposed to 85dBA average 8-hour workdays (Europeans Environmental Agency, 2016).

The European Environmental Agency regulates noise control and surveillance within the European Union. The environmental noise directive was set to determine levels of noise exposure, increase public access to information regarding the reduction of environmental noise. Additionally in the European Union, underwater noise is a pollutant according the Marine Strategic Framework Directive (MSFD) (Passchier - vermeer and passchier, 2000). The MSFD requires EU member states to achieve or maintain good environmental status, meaning that the "introduction of energy, including unseen water noise is at levels that do not adversely affect the marine environment" (passchier -vermeer and passchier, 2000).

NEGATIVE IMPACT OF NOISE

Existing evidence indicates that noise pollution may have negative impact on human health and comfort are divided into four categories;

i) Physical effect, such as increased blood pressure, irregularity of heart rhythms and ulcers.
ii) Psychological effect such as disorders, sleeplessness and going to sleep late.
iii) Performance such as irritability and stress; and finally.
iv) Effect on work performance such as reduction of productivity and misunderstanding what is heard, (marius et al, 2005).

USEFULNESS OF NOISE

Noise does not only have harmful effect but sometimes it is very useful.

Some of the examples of its usefulness includes;

i) Study of heart beats; noise produced by the heart beats is very useful to diagnose the person's health accordingly.
ii) Masking effect; sometimes it is necessary that nobody should hear the conversation between two persons. In the doctor's chamber, if a doctor wants that nobody should hear conversation with the patient, he uses masking effect by putting on a noisy exhaust fan which makes noise outside the room.
iii) Music and entertainments; the effect energy produced from sounds in a coordinated frequency and amplitude transform unto pleasurable hearing (music). This however, translates to entertainment depending on the circumstances.

Fundamentally, sound is produced as a result of some mechanical disturbance, creating pressure variations in an environment such as air or water, or in fact any elastic medium which can transmit a pressure wave. To be able to hear the sound, there must always be air or other elastic medium at the ear, the magnitude of the pressure variations (the amplitude of the loudness of the sound. The number of pressure cycle's per second determines whether we hear a sound of high or low pitch, the higher the frequency the higher the pitch. If a device which can detect small pressure variations (microphone), is placed in the sound field, it will produce an electric signal proportional to the sound pressure. The unit of sound pressure is Pa (Pascal-N/m^2). The range of audible sound pressure variations is very wide, ranging from $2x10^{-5}$Pa = 20µPa, which is threshold of hearing (Pt) to approximately 100Pa, the threshold of pain (Pp). The ratio between the threshold of hearing and the threshold of pain is 5,000,000:1 equivalent to 134dB is logarithmic ratio which defines the sound pressure level L as follows: L = 20xlog10Pt/Pp.

The growth in noise pollution is unsustainable because it involves direct, as well as cumulative and adverse health effects. Due to the ignorance on human nature with respect to the fact that there exists a close nexus between noise pollution and sustainable environment, little or no attention is paid to noise pollution in Nigeria. It is on this note, that this paper examines the noise pollution level in Captain Elechi Amadi Polytechnic lecture halls using Technological Tools.

SOUND MEASUREMENT

Sound is measured based on the amplitude and frequency of a sound wave. Amplitude measures how forceful the wave is. The energy in a sound wave is measured in decibels (dB), the measure of loudness or intensity of a sound; this measurement describes the amplitude of a sound wave. Decibels (dB) are expressed in a logarithmic scale. On the other hand, pitch describes the frequency of a sound and is measured in hertz (Hz). The main instrument to measure sound in the air is the Sound Level Meter.

There are many different varieties of instruments that are used to measure noise – noise dosimeters are often used in occupational environments, noise monitors are used to measure environmental noise and noise pollution and recently smart phone – based sound level meter applications (apps) are being used to crowd source and map recreational and community noise (Audio shapers, 2016).

A-weighting is applied to a sound spectrum to represent the sound that humans are acceptable of hearing at each frequency. Sound pressure is thus expressed in terms of dBA. Zero dBA is the softest level that a person can hear. Normal speaking voices are around 65dBA and a rock concert can be about 120dBA.

NOISE CONTROL

The hierarchy of controls concepts is often used to reduce noise in the environment or workplace. Engineering noise controls can be used to reduce noise propagation and protect

individuals from over exposure. When noise controls are not feasible or adequate, individuals can also take steps to protect themselves from the harmful effects of noise pollution. If people must be around loud sounds, they can protect their ears with hearing protection e.g ear plug or ear muffs (CDC, 2015). In recent years, buy Quiet programs and initiatives have arisen in an effort to combat occupational noise exposures. These programs promote the purchase of quieter tools and equipment and encourage manufacturers to design quieter equipment (IANS, 2016). Noise from roadways and other urban factors can be mitigated by urban planning and better design of roads. Roadway noise can be reduced by use of noise barriers, limitation of vehicle speeds, alteration of roadway surface texture, limitation of heavy vehicles, use of traffic controls that smooth vehicle flow to reduce braking and acceleration and tyre design. An important factor in applying these strategies is a computer model for roadway noise that is capable of addressing local topography, meteorology, traffic operations and hypothetical mitigation. Cost of building in mitigation can be modest, provided these solutions are sought in the planning stage of a roadway project. Aircraft noise can be reduced by using quieter jet engines. Altering flight paths and time of day runway has benefited residents near airports.

CONCLUSION

Students of Public Administration occupying hall 1 had the highest noise levels of 77.33 dB, followed by the Mass Communication Students in B3 with a noise level of 76dB. The Computer Science in TF4, Banking and Finance in GC3, Accountancy in TF1, Electrical and Electronics Technology in A2 and Science Laboratory Technology in ICT block had the noise level of 71.67dB, 69.67dB, 68.33dB, 68dB and 68dB respectively.

RECCOMMENDATIONS

For the lecture halls which generate an average sound level above 65dBA, the followings are to be done to reduce the noise level and improve on hearing each other in the halls and the polytechnic environment;

i) Adequate fenestrations and ventilations should be provided
ii) Number of students in the lecture halls should be reduced.
iii) Air conditions and fans should be installed
iv) There should be a steady electricity

Since the normal sound level is 65dBA, it then means that should use a public address system or Generally speaking, the polytechnic environmental noise level of 61.72dBA is less than the normal sound level.

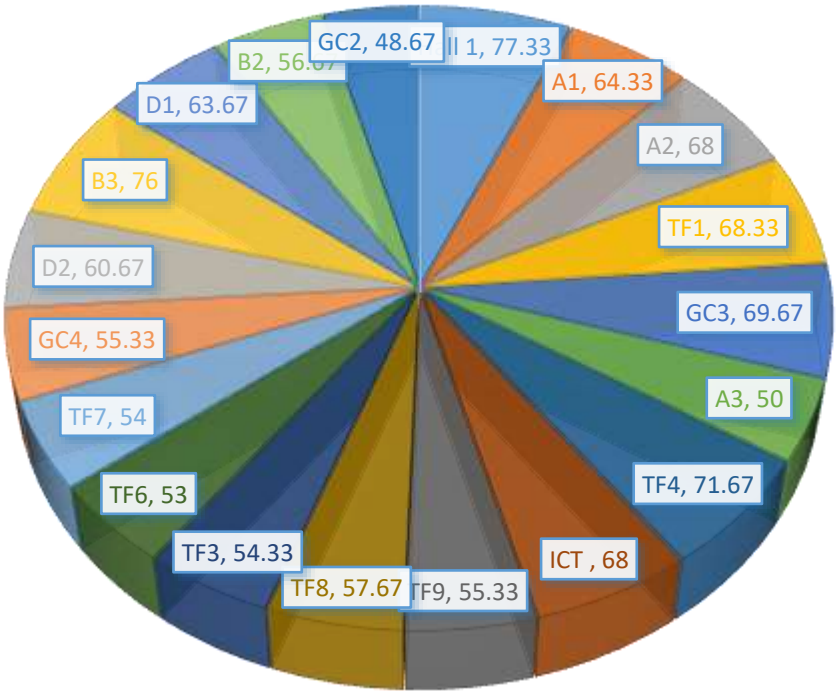
Table 1.1: showing the average sound levels in various lecture halls. (Field Survey, 2019)

S/No	Department	No. of Students	Venues	No. of Doors	No. of Windows	Sound Level (dBA) 9:00am –	Sound Level (dBA) 12:00pm –	Sound Level (dBA) 4:00pm	Sound Level

						9:10am	12:10pm	– 4:10pm	(dBA)
1.	Public Administration	206	Hall 1	3	8	72	89	71	77.33
2.	Computer Engineering Technology	128	A1	1	3	53	76	64	64.33
3.	Electrical and Electronics Technology	130	A2	1	4	74	77	53	68
4.	Accountancy	164	TF1	1	3	76	80	49	68.33
5.	Banking and Finance	154	GC3	1	4	79	77	53	69.67
6.	Agricultural Technology	64	A3	1	3	53	56	41	50
7.	Computer Science	185	TF4	1	3	79	80	56	71.67
8.	Science Laboratory Technology	125	ICT Block	2	6	66	74	64	68
9.	Statistics	82	TF9	1	3	57	60	49	55.33
10.	Architectural Technology	97	TF8	1	3	60	62	51	57.67
11.	Building Technology	72	TF3	1	3	56	60	47	54.33
12.	Surveying and	64	TF6	1	3	55	59	45	53

	Geo-informatics								
13.	Urban and Regional Planning	69	TF7	1	3	56	59	47	54
14.	Transportation Planning and Logistics	79	GC4	1	3	57	61	48	55.33
15.	Library and Information Science	88	D2	2	6	60	64	58	60.67
16.	Mass Communication	198	B3	2	6	71	87	70	76
17.	Business Administration / Management	115	D1	2	8	65	72	54	63.67
18.	Marketing	95	B2	2	6	58	60	52	56.67
19.	Office Technology Management	72	GC2	1	3	48	57	41	48.67
	AVERAGE					62.89	69.97	53.32	61.72

A 3-D PIE CHART SHOWING THE AVERAGESOUND LEVELS OF VARIOUS DEPARTMENTS *(FIELD SURVEY, 2019)*



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