

Noise in a Nigerian University

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Abstract Noise level measurement (using a sound level meter GM1352 device) was carried out in Federal University of Technology, Owerri (FUTO). Noise measurements were taken in 36 different locations covering the six schools of the university. These measurements were taken at the onset of working hours (9am), during peak working hours (12pm) and at the closure of work (3pm). The average noise levels measured was 67.78-dB for 9-am, 71.07-dB for 12-pm and 67.79-dB for 3-pm respectively. The higher noise levels were measured when lectures and school activities were at its peak (12 pm) and most of the power generating sets were turned on. The result indicated that the minimum noise level of the school environment is gotten at the morning hours (9am) when daily activities in the school were just kicking off. These noise level from studies were found to be within the range that may cause both cognitive and non-auditory effects on students and lecturers alike.

Keywords: noise, auditory effects, cognitive effects, non-auditory effects, federal university of technology, Owerri

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1. Introduction

Noise is simply an unwanted sound which is evident in a variety of environment. In most cases it is unpleasant and annoying or it is intrusive and distracting. The difference between wanted sound (music) and noise is greatly subjective. In lecture halls, speech is rarely transmitted to student without interference from background noise; at the same time, the effective transmission of auditory information is essential for better academic performance [1]. Noise is commonly measured in decibels (dB). Since the 1950s, the relationship between noise and hearing loss has been the focus of myriads of studies, [2]. However, the effects of occupational noise on hearing have been known for a long time. In a typical school environment, noise is not only a nuisance but can also interfere in student's educational performance [3]. Lecturers have been found to feel uncomfortable while teaching in noisy classrooms, while students find it very difficult in receiving the information as well as in dispersion of attention. There are several national and international guidelines relating to the acoustics of classrooms/lecture halls. These mainly take the form of recommended values for reverberation time and background noise levels in lecture areas, together with sound insulation requirements for schools. A good example of these guidelines can be seen from the World Health Organization (WHO) guidelines for community noise; the guideline specified an appropriate background level for classrooms as 35dB during lecturing session. The executive regulations of the environmental law include values for noise levels

outside schools according to the type of area of the school which is in the range of 50-60 dB in the day period [4]. Modernization has led to people being exposed to very large amount of noise from industrial machines like generators, compressors and articulated vehicles.

Deafness, hearing loss, and hearing impairment are terms most frequently used interchangeably to describe the complete or partial loss of the ability to perceive sound. According to [5], this includes those who are totally deaf and those who are 'hard of hearing' while in others it excludes the hard of hearing. There are also several definitions of hearing impairment [5,6]. Consequently, grades of hearing impairment often cannot be compared directly across studies. The World Health Organization (WHO) defines disabling hearing impairment in adults as a permanent hearing threshold level of 41(dB) or greater. This is based on the unaided hearing threshold in the better ear and is averaged over the 0.5, 1, 2, and 4 kHz frequencies. A hearing threshold level of 41-60 dB is considered 'moderate impairment' (above normal hearing level in surroundings) an individual is able to distinguish words spoken at one meter only if they are spoken in a raised voice [7,8]. Hearing aids are usually required at this level of impairment [8]. In contrast, the World Health Organization defines a hearing threshold level of 26-40 dB as 'slight impairment' as the individual can distinguish normally-voiced words spoken at one meter [7,8,9].

Noise is not only unpleasant; it also affects human health and overall wellbeing negatively. Harmful effects of noise on human consist of auditory and non auditory effects. Auditory effects are physical effects of noise; examples are; hearing loss, hearing impairment, threshold

shift or tinnitus. Non auditory effects of noise are physiological effects. Examples are; interference with speech communication, sleep disturbance, psychological effects (headaches, fatigue and irritability), and performance effect (task performance, distraction and productivity), annoyance, feeling of displeasure, where tolerance vary enormously and noise impulses are more annoying than steady noise [10]. Exposure to loud noise from all sources is the most common cause of hearing loss and impairment [11,12]. This can mean exposure to very loud noise for a short time or prolonged/repeated exposure to moderately loud noise. [13], opined the cumulative and non-linear nature of the risk of hearing loss associated with noise exposure means that this risk can increase significantly with separate brief periods of exposure throughout a work day or shift. Due to the erratic nature of electric power supply when it's available and in most cases the non-availability of electric power supply, in the Federal University of Technology Owerri, most of the Departments and Faculties have resorted to acquiring of individual electric generators for the smooth running of the school activities. There is always a pooled noise level within the nooks and cranny of the school environment. This study was undertaking to measure the noise levels within selected areas of the school during the peak and off-peak of academic activities. Efforts were also made to assay the auditory and non-auditory effects of these noise to the students.

2. Materials and Methods

2.1. The Study Area

Federal University of Technology, Owerri is a school in Owerri West local government area of Imo state, within the rainforest zone of Nigeria which lies between the Latitude of 5.4833 and Longitude of 7.0333. The school covers over 4,048 hectares of land. Federal University of Technology, Owerri is the premier federal university of technology in South-Eastern part of Nigeria. She is characterized by influx of people, both students, lecturers from different tribes and indigenes of the zone. It is also made up of different Schools (faculties) like;

- School of Agriculture and Agriculture Technology.
- School of Engineering and Engineering
- School of Sciences.
- School of Management and Management Technology.
- School of Health Technology.
- School of Environmental Science and Technology.

These schools (faculties) contain different departments in the university.

2.2. Materials

Many materials could be used to measure noise level and hearing impairment. In this particular study, data collection was performed using a Sound Level Meter.

A GM1352 sound level meter was used to measure the noise level of the different parts of the school by placing it in the surroundings of the areas to be measured, ensuring its microphone-like part is focused or aimed at the very point or place that was to be measured. The sound level meter being equipment that measures intensity of sound in a given moment, the measurement was done in three different occasions; in the morning, afternoon, and towards evening. This was to estimate the noise level over a whole day. As the noise level fluctuates, the amount of times noise remains at each of the various location were determined. Measurements were taken from the sides, middle and around the venues at a height of 1-m above ground. This was done for three days-that being a Monday, Wednesday, and a Friday over a period of two weeks in the month of September, 2017; this will help gain much reading that will help in getting an estimated accurate average of noise levels in Federal University of Technology, Owerri.

3. Results Analysis

Noise levels were recorded in 36 different venues, both lecture halls and office areas covering the six schools of the university. This noise levels were measured at intervals of 9 am, 12 pm and 3pm. The results of the experiments as were carried out for different venues during the time intervals are presented in the tables and figures below.

In Table 1, the different noise levels measured in different locations of School of Agriculture and Agricultural Technology (SAAT) for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 1) and the average noise level for the time intervals are presented. Here in SAAT, our average maximum noise level of 66.63 dB was recorded at 12-pm. At this point, a good number of students and lecturers are in the environment coupled with the electricity generators sounds blowing in the area for work purposes, while the minimum noise level was gotten at 9am when the daily activities were yet to commence fully.

Table 1a. School of Agriculture and Agricultural (SAAT) Auditorium

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SAAT AUDIT.	59.80	65.90	62.85
12 pm	SAAT AUDIT.	65.70	71.80	68.75
3 pm	SAAT AUDIT.	57.60	64.80	61.20

Table 1b. In the Center of School of Agriculture and Agricultural Technology (SAAT) Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SAAT COMPLEX.	60.00	67.20	63.60
12 pm	SAAT COMPLEX.	63.70	69.60	66.65
3 pm	SAAT COMPLEX.	60.90	70.20	65.55

Table 1c. School of Agriculture and Agricultural Technology (SAAT) New Lecture Hall (NLT)

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SAAT (NLT)	59.70	66.20	62.95
12 pm	SAAT (NLT)	64.90	70.70	67.80
3 pm	SAAT (NLT)	60.20	75.60	67.90

Table 1d. School of Agriculture and Agricultural Technology (SAAT) ETF Building

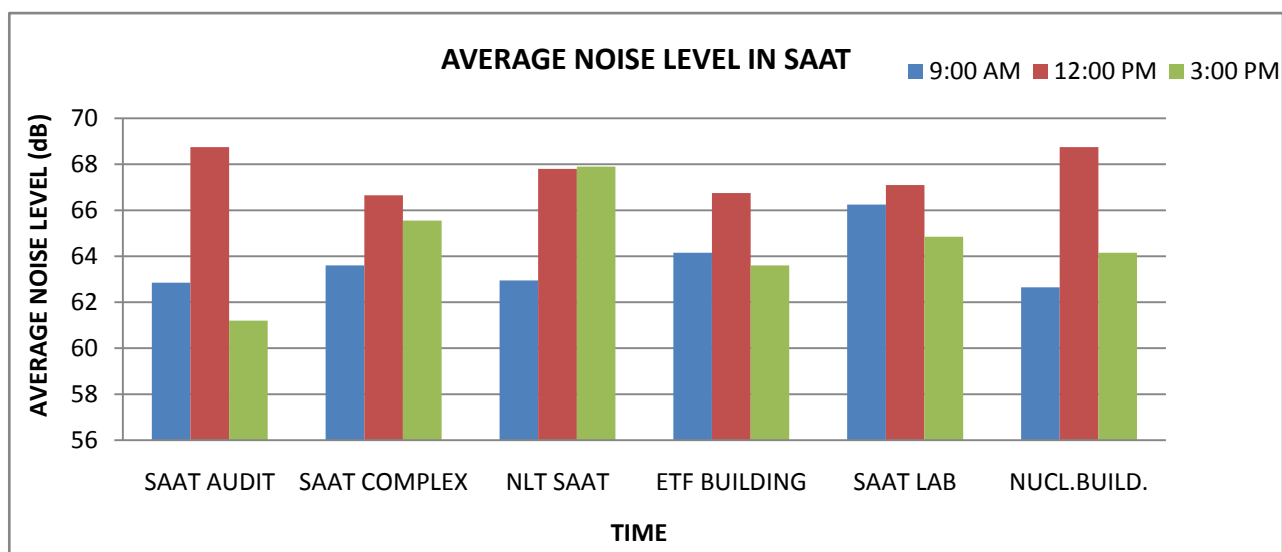
Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	ETF BUILDING.	61.30	67.00	64.15
12 pm	ETF BUILDING.	64.50	69.00	66.75
3 pm	ETF BUILDING.	60.00	67.20	63.60

Table 1e. School of Agriculture and Agricultural Technology (SAAT) Lab 1 Surroundings

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SAAT LAB 1.	62.40	70.10	66.25
12 pm	SAAT LAB 1.	63.00	71.20	67.10
3 pm	SAAT LAB 1.	61.40	68.30	64.85

Table 1f. SAAT Nuclear Building

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	NUCLEAR BUILDING	60.80	68.50	62.85
12 pm	NUCLEAR BUILDING	59.00	66.40	68.75
3 pm	NUCLEAR BUILDING	59.20	69.10	64.15

**Figure 1.** Chart showing the plot of average noise level in SAAT. (Noise level Against Time)

In Table 2, the different noise levels measured in different locations of School of Engineering and Engineering Technology (SEET) for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 2) and the average noise level for the time intervals are presented. SEET lecture halls and offices got the average maximum noise level to be **68.07dB** at 12pm and the average minimum was gotten as **62.84dB** at 3 pm.

Table 2a. Old School of Engineering and Engineering Technology (OSEET)

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SEET HEAD.	58.90	70.00	64.45
12 pm	SEET HEAD.	65.30	73.50	69.40
3 pm	SEET HEAD.	61.40	63.10	62.25

Table 2b. Front of School of Engineering and Engineering Technology (SEET) Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SEET COMPLEX.	58.20	70.00	64.10
12 pm	SEET COMPLEX.	63.90	75.00	69.45
3 pm	SEET COMPLEX.	60.70	68.70	64.70

Table 2c. Material and Metallurgical Engineering (M.M.E) Lecture Hall

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	MME LECTURE HALL.	57.50	69.90	63.70
12 pm	MME LECTURE HALL	62.40	73.00	67.70
3 pm	MME LECTURE HALL	59.60	66.20	62.90

Table 2d. Mechanical Engineering Building

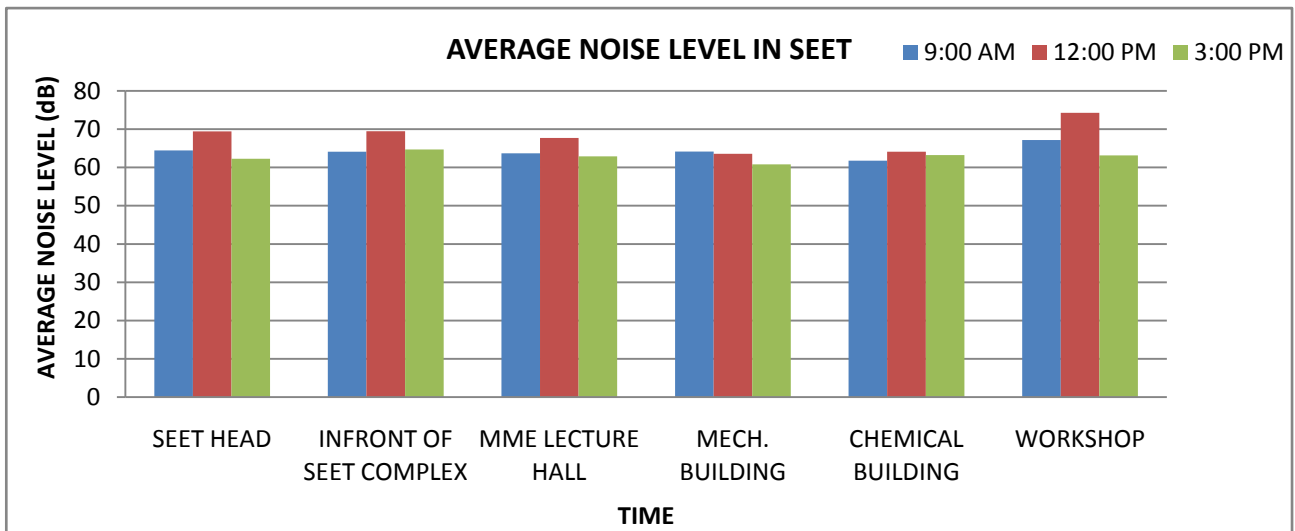
Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	MECH. BUILDING.	58.10	70.20	64.15
12 pm	MECH. BUILDING.	57.50	69.60	63.55
3 pm	MECH. BUILDING.	58.40	63.20	60.80

Table 2e. Chemical Engineering Building

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	CHM. BUILDING.	58.40	65.10	61.65
12 pm	CHM. BUILDING.	59.00	69.20	64.10
3 pm	CHM. BUILDING.	57.50	69.00	60.80

Table 2f. Workshop

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	WORKSHOP.	58.70	75.60	67.15
12 pm	WORKSHOP.	69.00	79.56	74.25
3 pm	WORKSHOP.	59.60	66.70	63.15

**Figure 2.** Chart showing the plot of average noise level in SEET (Noise level Against Time)

In Table 3, the different noise levels measured in different locations of School of Management Technology (SMAT) for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 3) and the average noise level for the time intervals are presented. SMAT being on a high peak as the attained average maximum noise level at 12pm too and it was gotten as **73.80dB** while its average minimum was measured to be **70.43dB** at 9am.

Table 3a. Information Management Technology (IMT) Lecture Hall

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	IMT LECTURE HALL.	60.60	76.40	68.50
12 pm	IMT LECTURE HALL.	63.40	72.10	67.75
3 pm	IMT LECTURE HALL.	75.30	78.20	76.75

Table 3b. Inside SMAT Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	INSIDE SMAT COMPLEX.	70.40	80.20	75.30
12 pm	INSIDE SMAT COMPLEX.	74.00	79.10	76.55
3 pm	INSIDE SMAT COMPLEX.	69.40	75.80	72.60

Table 3c. Maritime Management Technology (MMT) Building

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	MMT BUILDING.	73.30	81.50	77.40
12 pm	MMT BUILDING.	75.40	83.80	79.60
3 pm	MMT BUILDING.	72.50	81.00	72.15

Table 3d. Project Management Technology (PMT) Lecture Hall

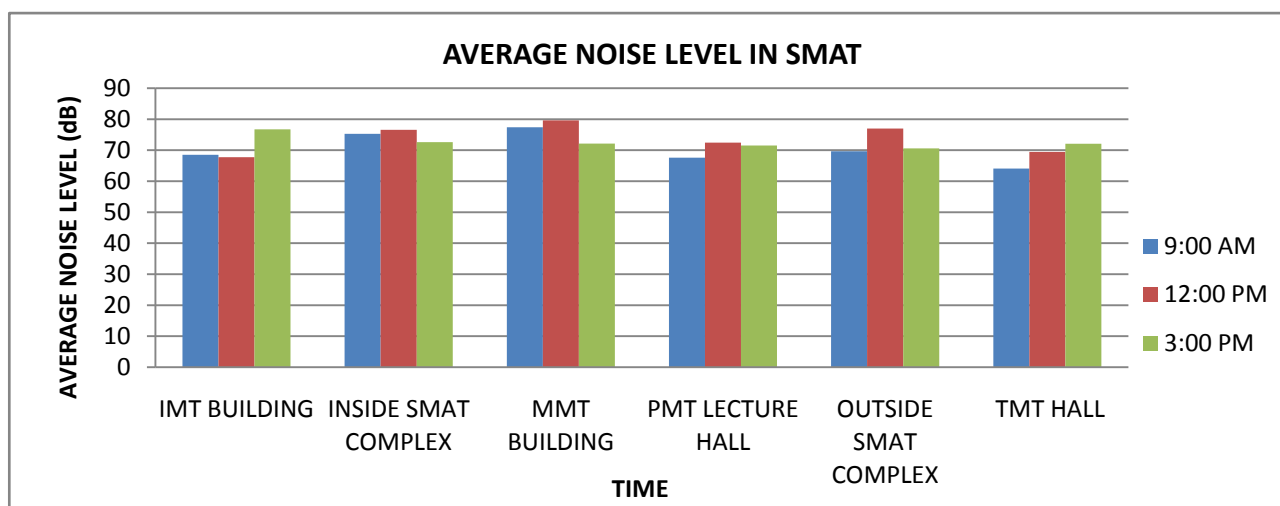
Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	PMT LECTURE HALL.	63.50	71.70	67.60
12 pm	PMT LECTURE HALL.	69.20	75.70	72.45
3 pm	PMT LECTURE HALL.	67.40	75.60	71.50

Table 3e. Outside School of Management Technology (SMAT) Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SMAT COMPLEX OUTSIDE	65.90	73.40	69.65
12 pm	SMAT COMPLEX OUTSIDE.	72.90	81.10	77.00
3 pm	SMAT COMPLEX OUTSIDE.	66.30	74.90	70.60

Table 3f. Transport Management Technology (TMT) Hall

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	TMT HALL.	64.50	72.70	64.10
12 pm	TMT HALL.	65.90	73.40	69.45
3 pm	TMT HALL.	67.40	76.80	72.10

**Figure 3.** Chart showing the plot of average noise level in SMAT. (Noise level Against Time)

In Table 4, the different noise levels measured in different locations of School of Environmental Technology (SOET) for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 4) and the average noise level for the time intervals are presented. In SOET, our average maximum noise level was gotten at 12pm and it was 71.25 dB while the minimum was attained at 3 pm, when working activities are at closure and it read 67.56 dB.

Table 4a. School of Environmental Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SOET COMPLEX.	65.30	75.70	70.50
12 pm	SOET COMPLEX.	69.90	77.80	73.85
3 pm	SOET COMPLEX.	66.70	67.90	67.30

Table 4b. Environmental Technology (EVT) Lecture Theatre

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	EVT LECTURE THEATRE.	63.00	71.30	67.15
12 pm	EVT LECTURE THEATRE	60.90	76.00	68.45
3 pm	EVT LECTURE THEATRE.	62.80	70.80	66.80

Table 4c. Survey Laboratory

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SURVEY LAB.	63.70	73.20	68.45
12 pm	SURVEY LAB.	65.90	78.90	72.40
3 pm	SURVEY LAB.	60.50	68.20	64.35

Table 4d. Environmental Technology Library

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	EVT LIBRARY.	64.20	70.80	67.50
12 pm	EVT LIBRARY.	66.40	72.60	69.50
3 pm	EVT LIBRARY.	65.30	71.80	68.55

Table 4e. SOET Complex Surrounding

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	AROUND SOET COMPLEX.	62.00	69.30	65.65
12 pm	AROUND SOET COMPLEX	70.30	78.10	74.20
3 pm	AROUND SOET COMPLEX.	68.50	74.60	71.55

Table 4f. Lecture Auditorium

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	LECTURE AUDIT.	60.90	76.00	68.45
12 pm	LECTURE AUDIT.	64.80	73.40	69.10
3 pm	LECTURE AUDIT.	62.80	70.80	66.80

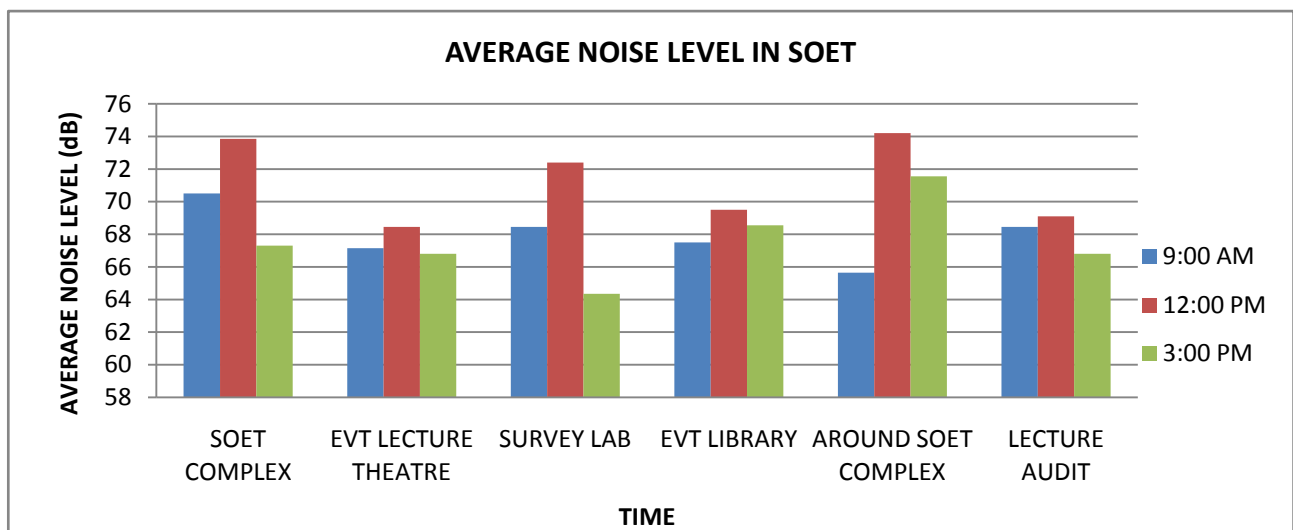


Figure 4. Chart showing the plot of average noise level in SOET. (Noise level Against Time)

In Table 5, the different noise levels measured in different locations of School of Health Technology for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 5) and the average noise level for the time intervals are presented. With regards to the averages found, it was recorded that SOHT, has its maximum average noise level at 9am (72.54 dB) and its minimum noise levels like others were recorded at 3 pm (67.74 dB).

Table 5a. Optometry Department (OPT)

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	OPT. DEPT.	60.40	72.60	66.50
12 pm	OPT. DEPT.	77.10	86.30	81.70
3 pm	OPT. DEPT.	62.00	65.60	63.80

Table 5b. Dental Technology Department

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	DENTAL TECH.	70.20	78.60	74.40
12 pm	DENTAL TECH.	72.00	76.90	74.45
3 pm	DENTAL TECH.	68.30	74.30	71.30

Table 5c. Public Health Department

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	PUB. HEALTH.	72.40	77.20	74.80
12 pm	PUB. HEALTH.	54.90	73.40	64.15
3 pm	PUB. HEALTH.	62.00	65.60	63.80

Table 5d. School of Health Complex

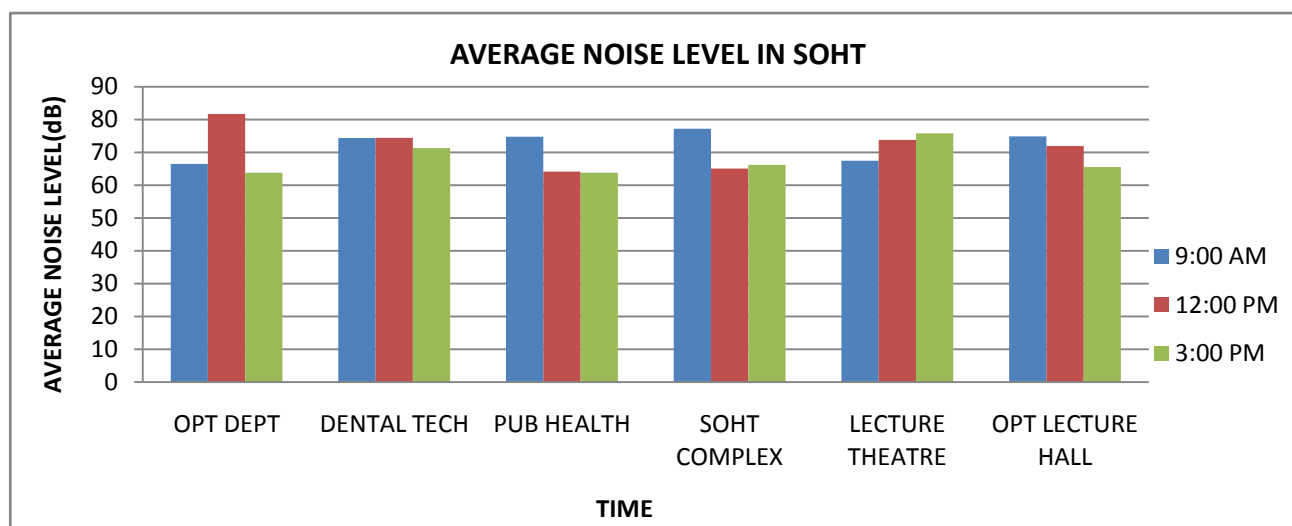
Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SOHT COMPLEX.	75.20	79.20	77.20
12 pm	SOHT COMPLEX.	54.90	75.20	65.05
3 pm	SOHT COMPLEX.	65.10	67.30	66.20

Table 5e. School of Health Lecture Theatre

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	LECTURE THEATRE.	62.40	72.50	67.45
12 pm	LECTURE THEATRE.	69.00	78.60	73.80
3 pm	LECTURE THEATRE.	72.40	79.20	75.80

Table 5f. Optometry Lecture Hall

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	OPT LECTURE HALL.	72.10	77.70	74.90
12 pm	OPT LECTURE HALL.	65.70	78.20	71.95
3 pm	OPT LECTURE HALL.	61.40	69.70	65.55

**Figure 5.** Chart showing the plot of average noise level in SOHT. (Noise level Against Time)

In Table 6, the different noise levels measured in different locations of School of Sciences for 9am, 12pm and 3pm are shown, analyzed with a chart (Figure 6) and the average noise level for the time intervals are presented. SOSC lecture halls and offices, the average maximum noise level was gotten to be 74.84dB at 12pm and the average minimum was gotten as 67.51dB at 9 a.m.

Table 6a. School of Science (SOSC) Complex

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SOSC COMPLEX.	61.20	71.90	66.55
12 pm	SOSC COMPLEX.	69.00	77.80	73.40
3 pm	SOSC COMPLEX.	69.90	76.70	73.30

Table 6b. Biochemistry Department

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	BCH DEPT.	63.20	73.00	68.10
12 pm	BCH DEPT.	68.40	76.60	72.50
3 pm	BCH DEPT.	70.20	78.50	74.35

Table 6c. School of Science (SOSC) Extension

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	SOSC EXTENSION.	60.10	69.30	64.70
12 pm	SOSC EXTENSION.	71.80	81.60	76.70
3 pm	SOSC EXTENSION.	65.60	70.20	67.90

Table 6d. Physics Department

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	PHY DEPT.	64.20	75.70	69.95
12 pm	PHY DEPT.	70.50	78.30	74.40
3 pm	PHY DEPT.	69.40	74.70	72.05

Table 6e. Industrial Microbiology (IMB) Department

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	IMB DEPT.	70.20	78.40	74.30
12 pm	IMB DEPT.	74.30	80.60	77.45
3 pm	IMB DEPT.	69.80	74.80	72.30

Table 6f. Chemistry Laboratory

Time	Venue	Minimum (dB)	Maximum (dB)	Average (dB)
9 am	CHM LAB.	57.90	65.20	61.55
12 pm	CHM LAB.	70.80	78.40	74.60
3 pm	CHM LAB.	60.20	77.20	68.70

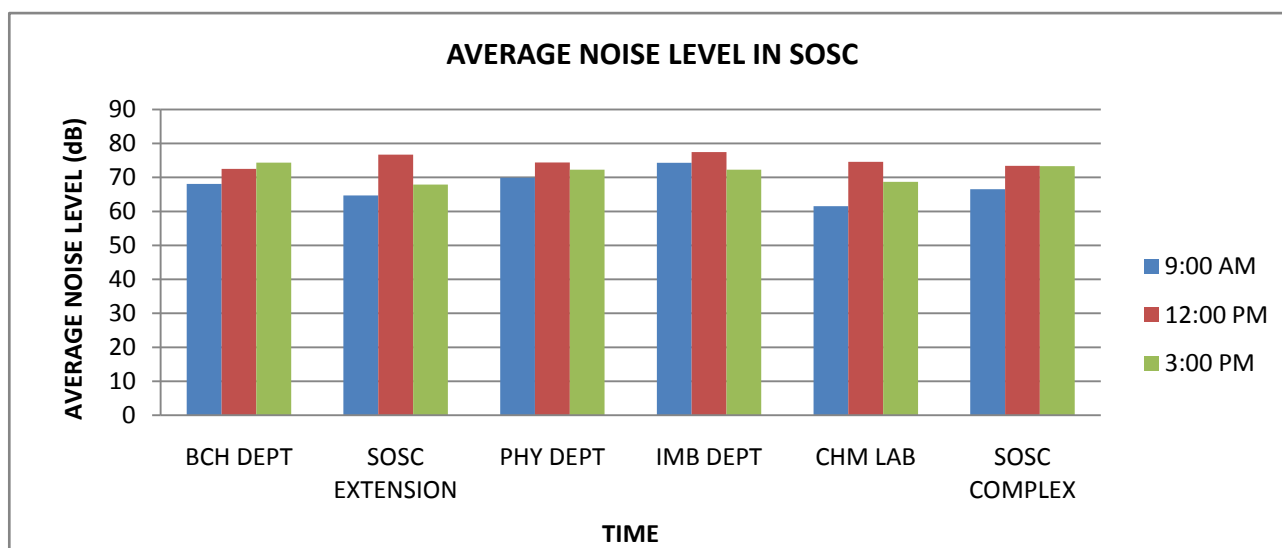


Figure 6. Chart showing the plot of average noise level in SOSC. (Noise level Against Time)

From the tables above and chart representations, the average noise level of Federal University of Technology, Owerri becomes 67.78-dB for 9-am, 71.07-dB for 12-pm and 67.79-dB for 3-pm respectively. From the average noise values, the noise levels in the entire school were found to be higher than the maximum permissible level of 45-dB which is the national standard for Institutions of learning [14,15]. The 45-dB was enshrined in other to ensure maintenance of a healthy environment for all people in Nigeria, the tranquility of their surroundings and their psychological well-being by regulating noise levels and generally, to elevate the standard of living of the people.

According to [16], non-auditory health impacts of noise that leads to increases in stress hormones, hypertension, obesity, cardiac disease, and mortality is averaged at daily exposures of about 55-dB, with activity interference

beginning at 45-dB, it can be clearly seen that the average noise level measured in FUTO, is above these limits. A study by [17], also suggests that noise can lead to reading and memory impairment. [18] found that there was unimpairment for tasks performed during noisy period but recorded impairment for tasks performed after the noise has been switched off. This situation could greatly reduce the students' academic performance after their daily academic routines in the noisy environment as noise exposure has been shown by [19] to slow memory rehearsal, influence processes of selectivity in memory, and choice of strategies for carrying out tasks. [20], also provides evidence that noise may reduce helping behavior, increase aggression and reduce the processing of social cues in people. [21] found that there are deficits in sustained attention and visual attention among school children exposed to noisy learning environment.

Generally, it can be seen that the average noise level measured within the Federal University of Technology, Owerri was above the recommended standard national standard and was found to be well within the noise range that various studies have found to have cognitive effects as well as non-auditory impacts. Efforts should be made by the school authorities to ensure a centralized electricity power supply, since most of the noise was as a result of the individual electric power generators.

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