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Acoustic Measurement and Analysis of Sound Levels in Auditorium of the Niger Delta University

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ABSTRACT: This study was conducted basically to assess the noise levels in Niger Delta University, Amassoma, Bayelsa State, Nigeria. Three campuses where selected for this research work namely CHS campus, Main campus and New site campus. Using a sound level meter that had been factory adjusted, the institution monitored the noise levels in its lecture halls. The Main Campus Auditorium's noise levels vary from 76.7 to 95.7 dB(A), with a mean value of 90.9 dB(A), according to the study's findings and an ambient value of 70.5dB(A), For new site, the noise level ranges from 50.4- 68.4dB(A), with mean and ambient values of 65.5 dB(A) and 56.7dB(A) respectively, while for college of Health Sciences the noise levels range from 79.5- 96.7dB(A) with a mean value of 91.6dB(A) and an ambient value of 68.5dB(A). On comparing the noise level for the various auditorium, College of Health Sciences (CHS) has the highest noise level value of 96.7dB(A) at the main gate in day 4, followed by main campus at 95.7dB(A) at the side gate in day 3 while the new site auditorium has the least noise value at 68.4dB(A) at the side gate at day 4. These noise levels when compared to World Health Organization's recommended standard level of 75dB(A) shows that Main campus auditorium and CHS auditorium noise levels were high, and this could have advance effect on the students. This study offers a straightforward way for routinely assessing the noise levels in various settings while raising awareness of the effects of noise in schools and learning facilities.

KEYWORDS: Noise Level, Noise Exposure, Environment, Sound level

I. INTRODUCTION

The optimal circumstances for a student's physical and intellectual growth should be provided by the school, including the management of excessive ambient noise, as these factors are crucial for children's cognitive, creative, and social development [1]. While in school, students are exposed to a wide variety of sounds. There are many various noise levels that have been tested inside of schools, and these levels greatly change depending on the type of space and the activities taking place in the lectures [2]. While university students' normal total exposure level has been estimated to be approximately 72 dB(A), pupils at schools are often exposed to the "lecture room chatter" of other students at levels of around 65 decibels (dB(A)) for the most of the day [3]. Noise generally has a negative effect on one's physical, social, and mental health [4]. High amounts of noise in schools are a serious public health concern. Sound exposure for more than six hours a day above 85 dB(A) may be harmful to your health [1]. Additionally, it is well acknowledged that exposure to any kind of noise at school impairs students' ability to study and succeed academically [3]. The World Health Organization (WHO) recommends that in school lecture rooms and pre-schools, the background sound level should not exceed 35 dB(A) during teaching sessions (Industrial area 75dB(A) at daytime while 70dB(A) at night, Commercial area 65dB(A) at day time while 55 at night, Residential area 55dB(A) while 45dB(A) at night, Silence zone 50dB(A) at day time while 40dB. Furthermore, school outdoor/playground noise levels should not exceed 55 dB(A), which is the same figure specified for outside residential areas throughout the day [5]. There are various national and international criteria for lecture room acoustics. These mostly take the shape of suggested values for reverberation time and background noise levels in classrooms, as well as school sound insulation regulations [6]. For example, the American National Standards Institute (ANSI) in the United States establishes guidelines for noise levels, reverberation durations, and sound insulation in schools [7]. In addition, school buildings in England and Wales must adhere to Building Regulations [2, 3]. The National Environmental Standards and Regulations Enforcement Agency of Nigeria's [8] maximum permissible noise level specification for the general environment, including buildings used as hospitals, convalescence homes, homes for the elderly, sanatoria, is 75dB(A) during the day and 65dB(A) during the night for industrial areas, 55dB(A) during the day and 45dB(A) during

the night for residential areas, and 50dB(A) during the day and 45dB [8]. Considering these requirements, a large number of pupils in Nigeria lack access to ideal or peaceful learning settings [9]. Despite the established importance of noise exposure at school, it is unknown how many schools are impacted by noise from various sources, and there is a dearth of information on usual noise levels within and outside of schools [10]. In order to ascertain the noise dB(A) levels in Niger Delta University Bayelsa State, Nigeria, this study was primarily undertaken.

II. MATERIAL AND METHOD

The equipment's used in carrying out the research work include Digital Sound Meter, Global Positioning System (GPS), SPSS statistics software, version 21.

Physical and Acoustic Measurement

A Bk accuracy Digital meter set on (A) weighting is used to assess physical and auditory parameters since [11] advocate it for usage in industrial and environmental investigations. The average human ear-to-ground distance was around 1.2 meters; thus, the digital sound meter was held with its microphone at that height [12].

Field Measurement

Different sound levels were measured and recorded at different location within the Niger Delta University auditoriums ranging from new site, Main campus and College of Health Sciences. In order to assure adequate accuracy at the time the reading was recorded, the digital sound meter was set to A weighting and at a slow reaction rate. In essence, it chooses low frequency sound energy that has a good correlation with human reaction. Every recording was always written as dB (A), where A stands for A-weighting. The digital sound meter is a tool created to satisfy the high standards of sound level for safety engineers. Health and quality control in a variety of settings, including at home, in factories, schools, workplaces, and on the road, as well as studios, auditoriums, and residential Wi-Fi installations. The digital sound meter has various frequencies ranging from 30Hz-12KHz and can carry out measurements in a range A-weighting.

All the frequency ranges for digital sound level meter include the following

Features of Digital Sound Level Meter

Low	30-80 dB (A)
Medium	50-100 dB (A)
High	80-130 dB (A)

Weighting Selector

A-weighting is noise level determination, C-weighting is for measuring sound level acoustic materials.

III. RESULTS AND DISCUSSIONS

The excessive exposure to noise possess a health and safety risk, Table I-III shows the results of data obtained from the various Auditoriums of the Main campus, New site and College of Health Sciences (CHS). Figure 1-4 shows the Bar chart of the noise distribution levels for the various individual days from day 1-4. Figure 5-7 shows the Bar chart of the mean and ambient noise distribution levels in the various auditorium locations of Main campus, new site and College if health sciences. Figure 8-10 shows the bar chart of the noise distribution levels of the location for the individual four days. The main campus auditorium noise level from table 1 shows that the highest noise is 95.7 dB(A) as recorded at side gate of the hall in day 3 and lowest noise value of 76.7dB(A) at the stage also in day 3, the highest mean of noise level of 90.9dB(A) was recorded at the stage while the ambient noise level is at 70.5dB(A) at the mid hall. The new site auditorium highest noise is at the side gate at 68.4dB(A) and the lowest at 50.4dB(A) at the stage in day 3. The mean noise level and ambient noise value for the new site are 65.5dB(A) and 56.7dB(A) respectively. The College of Health science auditorium has a highest noise level value of 96.7dB(A), and lowest noise level at 79.5dB(A) both at the main gate in day 4 sand side gate in day 1. Their mean highest noise level is 91.6dB(A) and mean lowest value is 84.4dB(A) at the center of the hall, while the ambient noise level is at 68.5dB(A) at the backstage and lowest at 54.5dB(A) at stage of the hall. On comparing the noise level for the various auditorium, College of Health Sciences (CHS) has the highest noise level of 96.7dB(A) at the main gate in day 4, followed by main campus at 95.7dB(A) at the side in day while the new site auditorium has the least noise value at 68.4dB(A) at the side gate at day 4

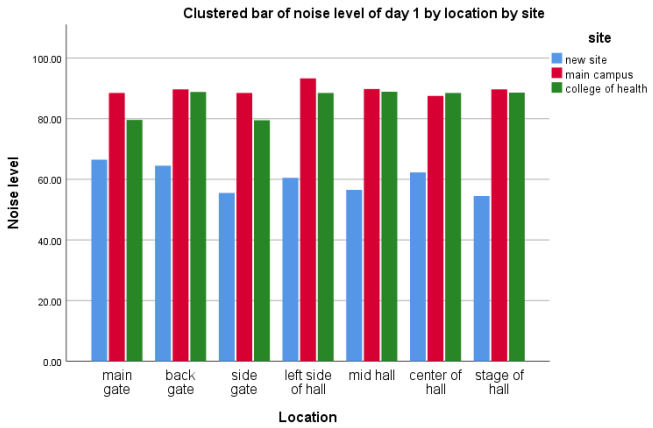

Fig 1. Clustered bar of noise level against location for day 1

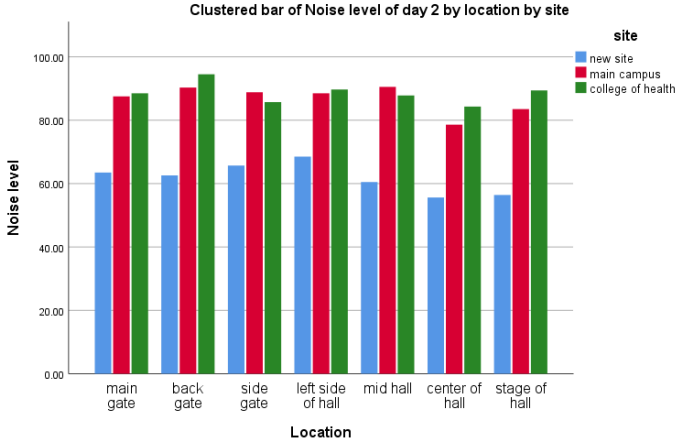

Fig 2. Clustered bar of noise level against location for day 2

Table I. Showing Main Campus Noise Levels Values from the Sound Meter

LOCATIONS	GPS	DAY1 Db(A)	Day 2 dB(A)	Day3 dB(A)	DAY4 dB(A)	MEAN dB(A)	AMBIENT NOISE dB(A)
MAIN GATE	$5^0$40'E and $4^0$20'N	88.5	87.5	83.5	88.7	87.1	56.5
BACK GATE	$5^0$40'E and $4^0$20'N	89.7	90.3	87.8	89.7	89.4	67.8
SIDE GATE	$5^0$40'E and $4^0$20'N	88.5	88.8	95.7	90.5	90.9	69.6
LEFTSIDE OF HALL	$5^0$40'E and $4^0$20'N	93.3	88.5	87.8	78.9	87.1	69.5
MID HALL	$5^0$40'E and $4^0$20'N	89.8	90.5	90.3	83.0	88.4	70.5
CENTER OF HALL	$5^0$40'E and $4^0$20'N	87,5	78,6	88.6	86.8	85.4	69.6
STAGE OF HALL	$5^0$40'E and $4^0$20'N	89.7	83.5	76,7	85.5	83.8	65.5

Table II. Showing New Site Noise Levels Values from The Sound Meter

LOCATIONS	GPS	DAY1 Db(A)	Day 2 dB(A)	Day3 dB(A)	DAY4 dB(A)	MEAN dB(A)	AMBIENT NOISE dB(A)
MAIN GATE	$6^0$06'E and $4^0$59'N	66.5	63.5	67.8	64.3	65.5	53.3
BACK GATE	$6^0$06'E and $4^0$59'N	64.5	62.6	65.7	67.5	65.5	56.7
SIDE GATE	$6^0$06'E and $4^0$59'N	55.5	65.7	65.7	68.4	63.8	40.5
LEFTSIDE OF HALL	$6^0$06'E and $4^0$59'N	60.5	68.5	64.4	55.5	62.2	47.5
MID HALL	$6^0$06'E and $4^0$59'N	56.5	60.5	62.7	61.3	60.3	55.3
CENTER OF HALL	$6^0$06'E and $4^0$59'N	62.3	55.6	61.7	60.3	60.0	42.3
STAGE OF HALL	$6^0$06'E and $4^0$59'N	54.5	56.4	50.4	53.6	53.7	51.3

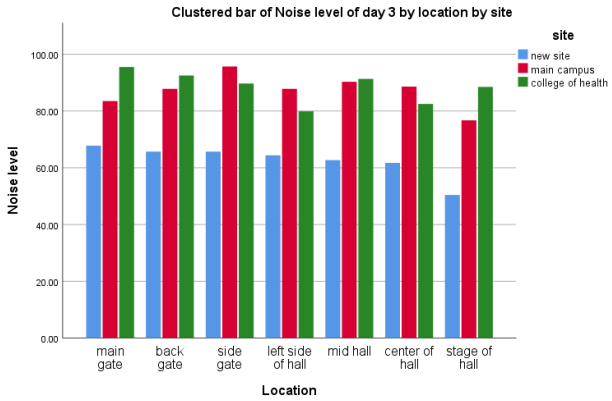

Fig 3. Clustered bar of noise level against location for day 3

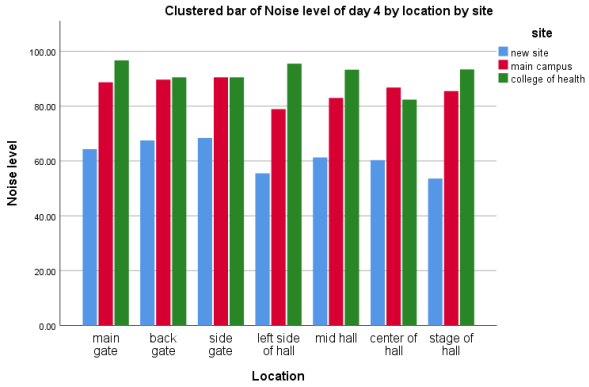

Fig 4. Clustered bar of noise level against location for day 4

Table III. Showing CHS noise levels values from the sound meter

LOCATIONS	GPS	DAY1 Db(A)	Day 2 dB(A)	Day3 dB(A)	DAY4 dB(A)	MEAN dB(A)	AMBIENT NOISE dB(A)
MAIN GATE	$6^0$05'E and $4^0$58'N	79.6	88.5	95.5	96.7	90.1	67.5
BACK GATE	$6^0$05'E and $4^0$58'N	88.8	94.5	92.5	90.5	91.6	68.5
SIDE GATE	$6^0$05'E and $4^0$58'N	79.5	85.7	89.7	90.5	86.4	65,7
LEFTSIDE OF HALL	$6^0$05'E and $4^0$58'N	88.5	89.7	79.9	95.5	88.4	60.5
MID HALL	$6^0$05'E and $4^0$58'N	88.9	87.8	91.3	93.3	90.3	60.8
CENTER OF HALL	$6^0$05'E and $4^0$58'N	88.5	84.3	82,5	82.4	84.4	58.5
STAGE OF HALL	$6^0$05'E and $4^0$58'N	88.6	89.4	88.5	93,4	89.8	54.5

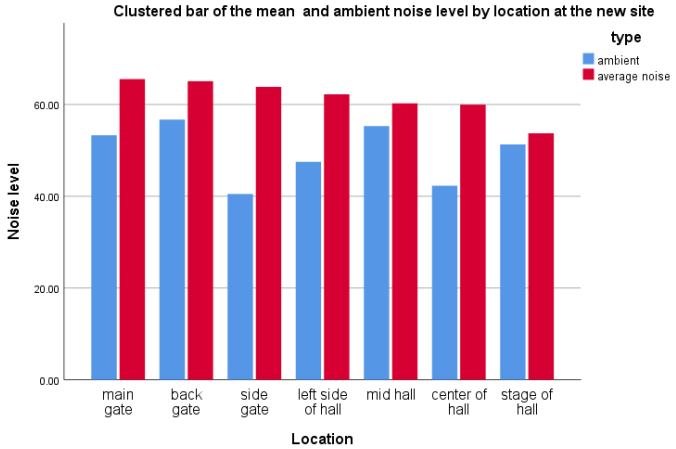

Fig 5. Clustered bar of the mean and ambient noise level at new site.

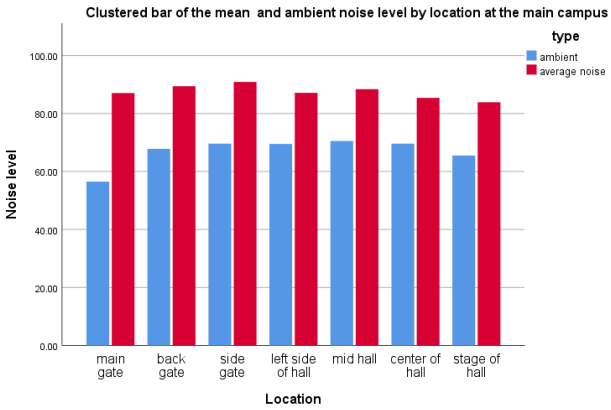

Fig 6. Clustered bar of the mean and ambient noise level at main campus

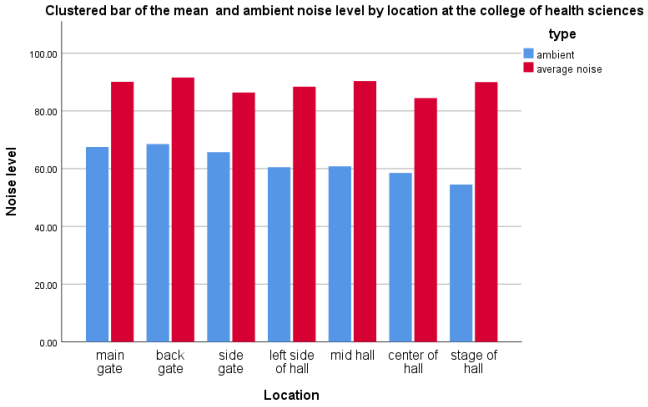

Fig 7. Clustered bar of the mean and ambient noise level at college of health sciences

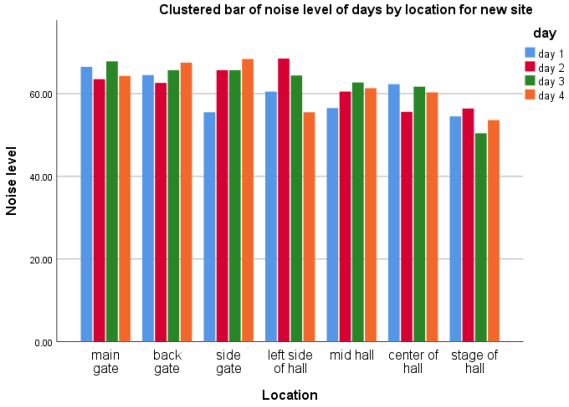

Fig 8. Clustered bar of noise level of days for new site.

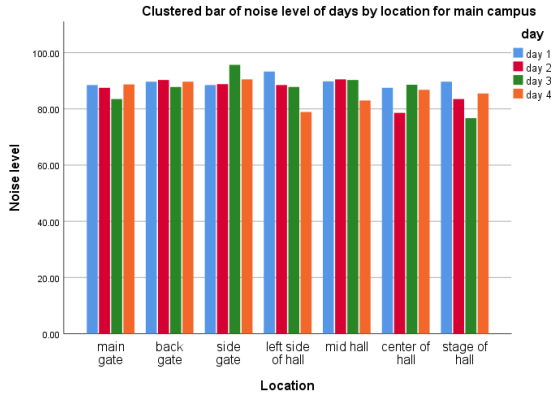

Fig 9. Clustered bar of noise level of days for main campus.

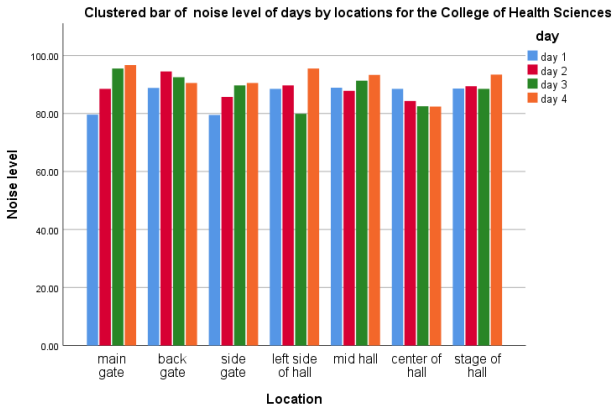

Fig 10. Clustered bar of noise level of days for college of health science

IV. CONCLUSIONS

Results of our study reveal that the noise levels in the auditoriums in Niger Delta University in Amassoma were significantly above the WHO's recommended maximum noise levels which is 75 dB(A) for schools respectively due to vehicular and commercial activities close to the auditorium, studies have shown that people who are exposed to noise are no able to perform tasks requiring skills of retention, learning and analytical processes. Giving this development the work is recommending that proper acoustic insulations be provided to the various auditoriums, also learning auditoriums should be built in areas far from vehicular and commercial activities.

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