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Journal Name:	**Physical Science International Journal**
Manuscript Number:	**Ms_PSIJ_44985**
Title of the Manuscript:	**Determination of reverberation time and sound pressure level of selected lecture halls in University of Agriculture, Makurdi-Benue State, Nigeria.**
Type of the Article	**Original Research Article**

General guideline for Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty'**, provided the manuscript is scientifically robust and technically sound.
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PART 1: Review Comments

	Reviewer's comment	**Author's comment** *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Compulsory REVISION comments	**Authors have presented acoustic analysis of lecture hall and done some experimental work to check compliance of the hall with reference to international standards.** **The presented work needs major revisions to ensure a quality publication in context to the following:** **1. Mathematical/theoretical formulation is missing in the paper. There should be a mathematical relation in sound level, reverbation time, room dimension and wall properties. Detailed mathematical treatment is expected to be disclosed to reveal effect of these parameters.** **2. Authors should suggest optimum and required room dimensions, wall properties and other factors based on the mathematical formulation.** **3. Detailed and exhaustive literature survey is required.** **4. There should be uniform style for references** **5. Major revision in grammar, sentence formation to make it a technical document.** **Major revision in structure of the paper.**	1. Sound intensity level presented in equation 1 depends on the absorption coefficient α. The expanded sound intensity equation is already well known as Beer –Lambert decay equation ($I=I_oe^{-\alpha x}$). This equation has been reintroduced accordingly. The reverberation time clearly relates the volume of the buildings and the absorption coefficients of each absorbent material enclosed with their surface areas. The absorption coefficients are different per each absorbent material. The absorption coefficient of some key selected materials is also included. 2. This is actually done in the main work under recommendation as follows: 3. Ceiling: Parabolic, deep cell diffusers are the best for sound absorption. Suspended ceiling baffles in a checker board pattern can be used. These ceiling boards can be constructed in a sagged format to help reflect sound in a scattered way. 4. Walls: Wall cladding using absorbent materials would help in the sound dissipation of the room. The walls should be lined with sound absorbent materials like fiber board, cork particle board, felt, expanded polystyrene slaps, wall carpeting, etc. 5. Floor: Though the maintenance is quite expensive the entire floor area should be covered with a carpet especially with thick underlay. This will reduce considerably the impact noise at about 30 dB (A). 6. Furniture: Provision of furniture that will absorb sound and reflect a considerable amount of sound is more preferable to the metal and wooden chairs present in almost all the lecture halls. 7. Fenestrations: Windows and doors are the major paths through which external noise enters a lecture hall. The windows must be double glazed to attain a reasonable sound resistance. Therefore, the metal doors in the L5 and L6 are not good acoustic choices they have a high rate of sound transmittance and should be replaced by a solid wooden door which has lower transmittance and higher absorptions. 8. Sound reinforcement: To ensure proper speech intelligibility, the signal strength of sound source in particularly L1-L4 needs to be increase. Public address systems are designed to amplify sound but can add 20 dB or even more above the background noise to the level of the speaker. Although loud speakers have been provided in these lecture halls but are not functional since the sound amplifier and microphones are not available. The provision of these sound

		amplifiers will improve the acoustic properties of these auditoria. 9. Shape: Future design of lecture halls if considering polygon shapes like L1- L4, the side walls should be arranged to have an angle of not more than 100^{o} with the curtain line this will give a favorable reflection of sound from all sides. Therefore, plain walls are better than concave ones but convex walls are excellent as they reduce the possibilities of echoes to the minimum extent. 10. Further research works: Further researches should be carried out in the same University and beyond for investigating the acoustical parameters in these lecture halls when occupied/unoccupied but however, using the finite element method (FEM) for the determination of T which has the advantages of: (i) distribution of temperature and moisture is considered in analysis; (ii) sound pressure of entire region is obtainable at the same time, and (iii) it is easy to treat of complex geometry. The STI should be measured using the DIRAC TYPE 7841 which has DIRAC PC software which covers a wide range of room acoustical parameters in compliance with IEC 60268-16 and ISO 3382 application standards. **4.** In another development Jalil *et al.* (2011), applied the Finite Element Method to finding the reverberation times of irregular rooms. Their finding was curved surfaces in particular have long reverberation times, leading to bad acoustics. They stated that Sabine's equation gives a reliable estimate of its value in most cases, pointing out that its real importance is in identifying parameters that govern the sound quality of a room and hence it gives a guide on what is necessary to make corrective changes. Lau *et al*. (2011) calculated the Optimum Reverberation time and absorption coefficient for good speech intelligibility in a typical Dutch class room using U50. Their findings showed that to achieve "excellent" speech intelligibility at the back row of a classroom, the reverberation time should not exceed 0.4 s. If the reverberation lies between 0.4 s and 0.6 s, "good" intelligibility (for normal speech and normal hearing) will be achievable. This value should be calculated and measured when students, furniture, bookshelves, etc. are included. Their conclusion was that in a quietly working class, speech intelligibility may be regarded as "good" at the back row if teacher speaks at a level that is "normal" for a classroom. This level increases to "excellent" with decreasing distance between audience and speaker. Therefore, achieving "excellent" speech intelligibility at the back row, the speaker would have to enhance his or her voice by 2 or 3 dB (A) compared with normal speech in a classroom. However, they restricted this finding to smaller classrooms with floor areas less than 50 m^2. For larger areas of say 100 m^2, speakers would have to increase their voice by 5 dB (A). Marina *et al*. (2012), presents the acoustical evaluation of an auditorium using an omnidirectional loud speaker for sound source and linear sweep sine signal for excitation. The auditorium was evaluated for two source positions. For the reverberation time, a photometer was also used for one source

		position. In their research findings, no significant differences were detected between the reverberation times determined in the two source positions with omnidirectional loudspeaker and with photometer. Taking into account the values of reverberation time, the auditorium was found to have poor acoustical properties for speech events like lectures. In a similar analysis Azril *et al*. (2013), conducted a research to examine the difference between the value of the reverberation time gain by calculation using theoretical methods and measurements in real room. The theoretical Methods used were Sabine, Eyring, and Millington-Sette. Measurement in the actual room was based on ISO3382 standard. The study involved a lecture room in University Tun Hussain Onn Malaysia (UTHM). The room setting was divided into three conditions that were empty room, room with curtain and room using egg curtains as sound absorbers. Their calculation method was based on three room conditions. Measurement and calculation results of reverberation time were analyzed with the method of Mean Absolute Error (MAE). In their experiment, Sabine's formula recorded the lowest MAE value of reverberation time. They remarked that, reverberation time value of Sabine's formula was close to the actual room measurement and suitable for LIVE rooms. The best value obtained was 0.069 s in the unoccupied room while Milington-Sette's formula recorded the highest MAE value of 1.09 s. In another development, Silva *et al*. (2013) evaluated the acoustical comfort in 199 primary school classrooms in the city of Joao Pessoa (Brazil) according to Brazilian and International normative guidelines. The reverberation time was calculated using Sabine's formula according to NBR 1017/1992 standard while the STI was evaluated using the Müller and Swen Mediro procedure. Their results showed that only 18.33 % of the classrooms have acceptable values of reverberation time by ANSI S12.60/2002, which sets the 0.4 s – 0.6 s ranges for classroom. A worrying factor was speech intelligibility in classrooms, measured based on the speech transmission index (STI). They verified that in 92.5 % of the classrooms, this index was in the range 0.30 - 0.45, representing poor intelligibly according to IEC 60268-1 speech intelligibility lowers when reverberation time rises. They verified that reverberation time (T) and speech intelligibility (STI) are strongly correlated, which demonstrates that the quality of studies shown that good speech intelligibility levels, even in small classrooms, are related to the adequate predicted reverberation times. Rabab *et al*. (2014) evaluated the acoustic comfort of lecture halls, in Lund University, Sweden according to standard design for university buildings. All their measurements were based on ISO 3382-1, 2009. The sound source was placed at two different positions in each classroom at teacher's position, with 1.5 m above the floor, about 1.5 m from the corners of the classroom. The average reverberation time T_{20} illustrates that T_{20} increases as the volumes of the classrooms increases and decreases with the amount of absorption in it where the maximum reverberation time was 1.29 s above the WHO recorded standard for classroom. 5. To be addressed.

Minor REVISION comments	Pls refer as given above	
Optional/General comments	Pls refer as given above	

PART 2:

	Reviewer's comment	Author's comment *(if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)*
Are there ethical issues in this manuscript?	*(If yes, Kindly please write down the ethical issues here in details)*	The reviewed work is highly educative hence appreciated by the Authors.