Noise Pollution A Menace to Learning in Typical Tertiary Institutions in Nigeria

ABSTRACT

Knowingly and unknowingly, noise pollution hurts the quality of our everyday life. The lecture hall is an auditory-verbal environment that requires pleasant acoustics; however, the main problem of it is noise pollution. Thus, this study aims at assessing students' perceptions of the effect of noise pollution in lecture halls in a typical Nigeria institution, taking the lectures halls in the School of Agriculture and Agricultural Technology (SAAT), School of Environmental Sciences (SOES), the School of Health Teaching (SOHT) all in the Federal University of Technology OwerriFUTO. The study was pursued using a Quantitative and Qualitative approach that entailed the use of structured Questionnaires and observation. A total number of 150 questionnaires were distributed to the students because they are the major users of lecture halls, and a total of 134questionnaires were filled and returned giving a percentage response of 89.3%. Data collected were analyzed using computer-based software statistical package for Social Science (SPSS) version 19.0 and descriptive tools such as frequencies, percentage values and Relative Important Index (RII). The result of the analysis revealed among others that the major causes of noise in lecture halls are generators, automobiles, and Echo of noise from adjacent buildings. Similarly, the study also revealed that noise exposure affects listening ability, concentration of students, and reading ability and its peak period is usually in the afternoonhours (1.00-3.00 pm). Also, one of the effects of noise is that it makes students lose concentration when receiving lectures since the bridge between students and lecturers is limited as a result of interference in communication between students and lecturers. Consequently, It is recommended that noise detectors should be located in lecture halls and school environments to know the noise level in lecture halls and perhaps, operate on the noise level recommended by the World Health Organization (WHO). Also, the use of noise-insulating materials during construction and maintenance, and the planting of natural shield trees within the study area to prevent noise from intruding into the lecture halls should be adopted. Educating students on the effect of noise pollution the and location of the generator set setsin lecture halls far away from the road will reduce noise pollution.

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Keywords: Noise Pollution, Menace, Tertiary Institutions, Nigeria

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INTRODUCTION:

One of the deleterious outcomes of modern civilization in the environment is noise. The evolution of the modern era has come with a lot of factors that deterioratethe acoustic environment,especially in learning environments like halls and classrooms. Recently, student possesses phones and other electronic devices that make the environment noisy and constitute a nuisance in the learning environment. Several types of research carried out on the effect o noise show that there is excessive noise and late reverberation time that degrade the clarity of speech which has a significant impact on student learning as well well-being (Acoust, 2008).

One of the major problematic forms of pollution that have remained unnoticed in most developing countries is noise pollution. The advent of industrialization and urbanization have

made noise pollution gain so much attention as a major environmental hazard ratinthisrs just after air and water pollution (Kilman, 2004; Singh &Daver, 2004).For quite a long time the harmful effect of nisehave not been given the significant attention that it deserves. Stranfeld and Crombie (2011), identified that aide the irritation and discomforting impact o noise, that noise pollution can also be associated with hypertension and ischemic heart diseases. They further reported that acute exposure to environmental noise pollution directly influences the body's compensatory mechanism to stress which can cause increased blood pressure and vasoconstriction (Berglund et al., 2002), learning disabilities, and tinnitus as well as heart attacks (Babisch et al., 2005).Hearing deficiency increases in individuals as theygrow older. The hearing difficultycould either be due to aging or infections, however,statistics have it that one out of every twenty people actually experiences or suffer hearing loss from anthropogenic noise(Chiras, 2001)

Recently, policymakers are paying close attention to the noise produced by educational institutions like universities where some students resort to noise-making in their bid to reduce stress from academic pressure. Hence the need to conduct a study regarding urban noise pollution in the learning environment. Recently, the Nigerian Federal Environmental Protection Agency (FEPA), has taken the lead in increasing and intensifying public education on noise pollution, particularly in secondary and tertiary institutions. It is in line with the educational campaign on noise pollution that birthed this research. It is research was motivated by the general notion that most students are unaware of the impact of noise exposure and its associated health hazard. Thus, this study is channeled to assessing the student's perception of the effect of noise pollution in the study environments.

OBJECTIVES OF THE STUDY:

This research is aimed at assessing the student's perceptions of the effect of noise pollution in lecture halls.

Objectives of the study

The following objectives were formulated to guide the study:

1. To examine the causes of noise pollution in lecture halls.
2. To determine the sources of noise generation within the study area and determine the peak.
3. To establish an overview of research on the health effects of students' exposure to noise during lectures in a theatre or hall.
4. To make sundry recommendations about the ways noise pollution can be reduced in Lecture halls.

Scope:

This work was carried out in a typical Nigerian tertiary institution taking the Federal University of Technology Owerri as a reference point. The choice of this university is because it is one of the largest institutions in Nigeria with business outlet on campuses cited close to lecture halls. the perceptions of the students on noise pollution in lecture halls in SAAT, SOES, and SOHT Federal University of Technology Owerri (FUTO), Imo state. Only materials considered relevant to this work were included. Some critical challenges encountered by students on the noise pollution effect were examined. This work is strongly grounded on students' opinions in assessment and response to noise pollution effect in lecture halls.

Significance Of Study:

The reason why the study of noise pollution in the Lecture hall is important is due to a few factors:

1. This work is expected to help the school body that is responsible for planning to have a better understanding and appreciation of the problems of noise pollution in Lecture halls.
2. This work is also expected to stir up the interest of students in learning since it will enhance massage communication, reduce annoyance responses, reduce mental health effects and avoid interruption by lectures in adjacent lectures or halls.
3. It should be useful to students, lecturers, and the physical planning in proffering suitable solutions to noise pollution in school at large.
4. Its recommendation could serve as a powerful tool to enhance students' academic performance.

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Methodology:

The research design for this study is a questionnaire design approach through which data was collected and also an interview method. The questionnaire design approach was adopted because this gives varying opinions on the subject by different student respondents which were of great influence on the analysis. To achieve the objectives of the research work, the following research method was adopted;

i. The review of related literature such as textbooks, professional journals, and published and internet sources to collect secondary data. This included the review of literature on the effect of noise and the remedial measures, to articulate facts in the area of study.
ii. Research Instrument: a well-structured questionnaire was employed and administered to various students within the area of study to determine their perceptions of how noise pollution affects them during lectures.
iii. The sampling technique that was adopted in the distribution of the question is the random sampling technique which was given to students at all levels in the study area.

With regards to the sampling size in the distribution of the questionnaire, the sampling size was determined based on the formula below because the targeted population is unknown

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$$\mathbf{n= (z^2pq)/d^2} \quad \text{(1.1)}$$

Where;

n = the desired sample size

z = the ordinate on the Normal curve corresponding to α or the standard normal deviate, usually any of the following determined based on the 'margin error formula'

i. A 95% level of confidence has $\alpha = 0.05$ and a critical value of $z_{\alpha/2} = 1.96$.

P = the proportion in the target population estimated to have a particular characteristic (normal between the range of 0.1 - 0.5)

q = 1.0-p

d = degree of accuracy corresponding to the confidence level and Z selected.

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For this study, a confidence level of 95% was adopted because the questionnaire was geared towards evaluating the perception ofthe noise effect.

Consequently, the sample size is determined as thus,

z = 1.96, d = 0.05 where p = 0.9, q =0.1

$\mathbf{N} = (1.96^2 X 0.9 X 0.1)/ (0.05)^2 = 138$

Therefore a total of hundred and fifty students (respondents) were sampled in the area using a random sampling technique.

Data Analysis Procedure

The data collected for this study were subjected to various statistical analyses using frequencies and percentages. The results of the analysis are presented in the form of a table for easy comparison and clear expression of the findings.

Relative importance indices (RII) were also used to rank the parameter in the Linkert Scale The Relative Importance Index (RII) was calculated for each document according to their frequency of use as suggested for use by Memon et al, (2006) and Othman et al, (2005)

It was calculated using the formulae

$$RII = \frac{4n5+3n4+2n3+1n2+0n1}{4N} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1.2)$$

N=total number of respondents

RII ranges between zeros to one. The four and five-point scale ranking was transformed to relative importance indices (RII) for each of the construction contract documents. The weighted average for each item was determined and ranks were assignedto each item, representing the perception of the respondents.

Results are classified into three categories as follows (Othman et al, 2005) when;

RII<0.60 -it indicates low frequency in use

0.60≤RII<0.80 -it indicates high frequency in use.

RII≥0.80 –it indicates very high frequency in use.

DATA PRESENTATION AND ANALYSIS:

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The purpose of this chapter is for data presentation, analysis and interpretation of the data collected from the research source- SAAT, SOES and SOHT FUTO. Tables were used to analyze the data collected and they were arranged concerningthe statement below, which include the personal data, causes, sources, effect and remedial measures. A survey was carried out in the halls to reveal the acoustical defects affecting students in the halls, as well as direct observation considering intrusive noise sources and causes into the space, and the building as a whole.

This research was analyzed based on the 134 returned questionnaires out of the 150 that were administered. The data from the questionnaires were analyzed using descriptive tools such as frequencies, mean values, percentage values and the relative important index, (RII) ranked according to the number of Linkert scales in the questionnaires. The hypotheses were based on the opinions of respondents which are the students in the study area.

Table 1 Percentage response

S/N	Questionnaire	Frequency	Percentage (%)
1	Returned	134	89.3
2	Non returned	16	10.7
	Total	**150**	**100%**

Source: survey 2022

From Table 1 A total number of 150 (one hundred and fifty) questionnaires which represent 100% were administered to the students regarding the initial sample size which is 138, 134 which is 89.3% were returned and 16 were not returned which is about 10.7%. Therefore, 134 returned questionnaires were used as the sample size which was used in the findings, analysis and discussion of the study.

From Table 2 below it was deduced that there are more male students respondents with 74.2% in the study area than their female counterparts with 25.8%. Generally, there are always a greater

number of male students than females in every department atthe Federal University of Technology Owerri. Also, the 100-level students with 42.5% are the main users of lecture halls and lecture theatres followed by 200-level students. This is because they offer general school courses more than other levels. The 400-level students have 0% because they are on their six months industrial training program during the period of the study.

Table 2: Respondent's profile.;

	Profile	Categories	Frequency	Percentage
1	Gender	A male	98	74.2
		B Female	34	25.8
		Total	**134**	**100%**
2	Level	A 100	57	42.5
		B 200	30	22.4
		C 300	24	17.9
		D 400	0	0
		E 500	21	15.7
		F Postgraduate	2	1.5
		Total	**134**	**100%**
3	School or Faculty	A SAAT	39	29.1
		B SOES	70	52.2
		C SOTH	25	18.7
		Total	**134**	**100%**

Source: survey 2022

From the three selected schools or faculties as the study area, more questionnaires were given to the School of Environmental Science (SOES) students with a percentage response of 52.2% thanthe School of Agriculture and Agricultural Technology (SAAT) and School of Health Technology (SOTH) with a percentage response of 29.1% and 18.7% respectively. This response was determined by the administration of questionnaires in which more students in the School of Environmental Science were present than in the other two Schools.

Respondent's Knowledge Of The Causes And Sources Of Noise Generation And The Peak Period.

4. Number of students that experience noise pollution in their lecture halls is 134 which represents 100% of the students (respondents) who experience noise pollution.

5. Ranking of noise pollution causes and sources using a relatively important index; (RII)

Table 3: Ranking of the respondent's knowledge of causes and sources of noise pollution

S/N	Questions	1	2	3	4	5	∑F	∑FX	Mean	RII	Rank
A	Automobiles	5	7	19	33	70	134	558	4.16	0.83	2nd
B	Generators	6	13	0	33	82	134	574	4.28	0.86	1st
C	Echo(reverberation)	21	29	22	35	27	134	420	3.13	0.62	3rd
D	Electronic devices	71	16	12	20	15	134	294	2.19	0.44	5th
E	Hawkers	92	27	3	8	4	134	207	1.55	0.31	7th
F	Construction activities	45	23	18	34	10	134	331	2.47	0.49	4th
G	Public address system	88	6	19	9	12	134	253	1.89	0.38	6th

Source: survey 2022

Where 1=SD, 2=D, 3=UD, 4=A, 5=SA

SD= Strongly Disagree, D= Disagree, UD= Undecided, A= Agree, and SA=Strongly Agree.

From Table 3, it was deduced that the major causes or sources of noise pollution in lecture halls are Generator sets which are usually placed or mounted within the lecture halls and the noise from Automobiles which includes noises from motorcycles and cars. Subsequently, Echo or reverberation of noise from adjacent buildings constitutes greatly as a source of noise pollution in lecture halls. This echo is a result of the proximity of buildings in the study area. Construction activities contribute to noise pollution a little since it produces a sound that can cause reverberation in lecture halls and perhaps, cause noise pollution.

1. The peak period of noise pollution in lecture halls.

Table 4: the peak period of noise pollution

S/N	Period	Frequency	Percentage
A	Morning hours (8am-12pm)	56	41.8
B	Afternoon hours (12pm-4pm)	68	50.7
C	Evening/ Night hours (4pm- dawn)	10	7.5
	Total	**134**	**100%**

Source: survey 2022

From Table 4, the study showed that the peak period of noise pollution within the study area is the afternoon hours (12pm-4pm) which has a percentage of 50.7% followed by the morning hours (8am-12pm) with 41.8%

Students' View On The Effect Of Noise Pollution In Lecture Halls

From Table 5 it was perceived by the respondents that the most common effect noise pollution poses to students is that it alters the listening ability and reading ability of students in lecture halls. It was also perceived that noise pollution makes students lose concentration when receiving lectures since the bridge between students and lecturers is limited as a result of interference in communication between students and lecturers during lectures

Table 5: Respondents' view on the effect/impact of noise pollution in lecture halls

S/N	Questions	1	2	3	4	5	∑F	∑FX	Mean	RII	Rank
A	Reading ability	6	13	8	50	57	134	541	4.04	0.81	3rd
B	Listening ability	2	7	11	36	78	134	583	4.35	0.87	1st
C	Concentration	4	6	13	40	71	134	570	4.25	0.85	2nd
D	Tiredness	11	9	20	51	43	134	508	3.79	0.76	5th
E	Behaviour	44	47	6	19	18	134	322	2.40	0.48	8th
F	Headache	4	21	3	77	29	134	508	3.79	0.76	5th
G	Social interaction	78	24	16	14	2	134	240	1.79	0.36	10th
H	Conflicts	50	42	14	7	21	134	309	2.31	0.46	9th
I	Speech intelligibility	9	28	8	45	44	134	489	3.65	0.73	6th
J	Communication	1	13	36	34	50	134	521	3.89	0.78	4th
K	Comfort level	18	16	35	41	24	134	439	3.28	0.66	7th

Source: survey 2022

Where 5=strongly agree, 4=Agree, 3=Disagree, 2=Strongly Disagree and 1=Have no idea.

It is evident from the survey that the variables like listening ability, reading ability, speech intelligibility and behaviour of students are adversely affected by high lecture hall noise. It has been found from the survey that high background noise has a major negative impact on students' performance. From a comparative perspective, respondents reported a decrease in listening ability and lack of concentration and this corresponds to 1st and 2nd respectively in the ranking.

The results obtained and their variations may be traced to the fact that most of the schools are located close to the main road and are readily affected by noise from vehicle engines in degrees dependant on their individual proximities to the road.

Excessive noise and reverberation interfere with speech intelligibility, resulting in reduced understanding and therefore reduced learning. It is more difficult for students to hear individual sounds clearly, as when learning to read and their concentration is also compromised. The need for good lecture hall acoustics and the methods for attaining them have been known for decades but this information has not been made readily available to students, architects, school planners, administrators, and lecturers.

RESPONDENT'S RECOMMENDATION

From Table 6, it is recommended that noise detectors should be located in lecture halls and school environments to know the noise level in lecture halls and perhaps, operate on the noise level recommended by the World Health Organization (WHO). Also, the use of noise insulating materials during construction and maintenance of lecture halls should be encouraged. Thirdly, planting of natural shield trees within the study area to prevent noise from intruding into the lecture halls should be adopted. Educating students on the effect of noise pollution and location of generator set and lecture halls far away from road will reduce noise pollution.

Table 6 Respondents recommendations on measures to reduce noise in lecture halls

S/N	Questions	1	2	3	4	∑F	∑FX	Mean	RII	Rank
A	Educate students on noise	5	41	31	57	134	408	3.05	0.76	4rd
B	Have noise detector in class	2	19	45	68	134	447	3.34	0.84	1st
C	Restrict vehicles in school	38	49	23	24	134	301	2.25	0.56	10th
D	Stop mobile phones in class	81	25	22	6	134	221	1.65	0.41	11th
E	Use insulating materials	8	18	31	77	134	445	3.32	0.83	2nd
F	Locate halls far from road	28	14	27	65	134	397	2.96	0.74	5th
G	Stop motorcycles in morning hours	37	35	39	23	134	316	2.36	0.59	9th
H	Stop motorcycles in the afternoon	29	8	41	56	134	392	2.93	0.73	6th
I	Stop motorcycles in evening/night	83	33	14	4	134	193	1.44	0.36	12th
J	Ban construction during lectures	17	32	36	49	134	385	2.87	0.72	7th
K	Ban the use of public address	23	30	37	44	134	370	2.76	0.69	8th
L	Planting of shield trees	13	15	35	71	134	432	3.22	0.81	3rd

Source: survey 2022

Where 4=strongly agree, 3=Agree, 2=Disagree, 1=strongly Disagree

CONCLUSIONS

Due to the ignorance of students on the fact that there exist a close nexus between noise pollution and learning, little or no attention is paid to the control of noise pollution in Schools. The execution and implementation of the law as regards environmental pollution which includes noise is never implemented to the letter. It is observed by the writers that the persistence of this problem could endanger the future stability of human health and could aggravate the human health catastrophe in the academic environment. The challenges posed by noise pollution on students health and the environment have not yet received full attention which it deserves. The provision of adequate and pleasant learning environment in Schools is very

important for students in general, since uncoordinated noisy environment can lead to several health hazards.

A lecture hall should be able to handle a wide range of functions. It should be designed with several lighting systems, have acoustically treated walls and ceilings, and be technologically integrated and easily maintained. A well designed lecture hall should be able to satisfy the needs of its assigned functions at reasonably high levels of performance. Whether they are used for multimedia presentations, stage and musical productions, physical education, or sport activities, acoustic issues need to be addressed in the design phase or stage to minimize some of the hazards in the multipurpose spaces/ auditoria and other related buildings in general. They must also be improved upon to ensure pleasant environment for the occupants after completion. It was clearly observed from the study that the major surfaces in an auditorium have important implications on the acoustical quality of a place. As a result acoustic balan

RECOMMENDATIONS

Bill for combating Noise pollution

Considering the adverse effects of noise pollution on student's health and the environment, it is significant to evolve proper approaches to address the issue of noise pollution and protection of human and environmental health in Nigeria. This paper recommends that the School management passed a bill making it mandatory for all Schools or faculties in the study area together with the Physical Planning and Development unit, (PP&D unit) of Federal University of Technology, Owerri to enact similar law to combat noise pollution aggressively in FUTO.

Putting in place a regulating agency

The realization of the importance of sustainable environment is necessary. This is achievable if specific laws are put in place to determine level of acceptable noise and regulate noise pollution in Schools. Putting in place a regulatory agency like task force and monitoring team will assist in stopping Automobiles (motorcycles) in the study area, keeping of generator set close to lecture halls and also proximity of buildings which results to Echo or reverberation of sounds. This will help in control and enforcement of the laws to achieve a desired noise level in lecture halls.

Public awareness campaign on the danger of noise pollution and its nexus with lecture halls

There is a need for students' enlightenment, education, and sensitization on the hazard, dangers, and human health catastrophes associated with noise pollution and also on the nexus between noise pollution and lecture halls. This is of paramount significance because many are still ignorant of the fact that there exist any nexus between noise pollution and the learning or academic environment with the resultant effect we are witnessing in Schools today.

Summary Of The Recommendations And Suggestions

1. The most severe impact of noise pollution on students in the lecture hall is its dampening o listening ability, which leads to a loss in concentration of students during classes, distraction to reading activities, and distortion in the communication in the lecture halls

2. The use of natural terrains such as artificial barriers and trees in addition to the use of acoustic resistant materials in the construction of lecture halls as this will help toprevent automobile noise from intruding into lecture halls from the outside should be introduced.
3. Proper maintenance of the building members to avoid noise transmission through cracked walls, cavities,orbroken pipesand ducts the Presece poorly maintained lecture hall makes it the transmission of noise easy and with more intensity.
4. The study also strongly recommends the replacement of the existing windows with insulated glass casement windows as they promise better soundinsulation. Also the introduction of good electronic sound reinforcement systems that can be used to reduce sounds that mask speech intelligibility.
5. The study also recommends that the university halls should be constructed to be proportionate with the number of student to be admitted as overcrowding can be a major contributor to noise pollution in lecture halls in a typical tertiary institution. For the existing buildings, it is recommended that periodic assessment of the physical condition of the school and the noise level inside halls and lecture halls surrounding

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2) numbering no recommended

REFERENCES

Alton, E. (2001). *The Master Handbook of Acoustics*. New York: McGraw- Hill Companies, Incand Children`s Blood Pressure and Heart rate: the RANCH project. *Noise Health*

Arthur, N. (2002). Auditorium Acoustics. Retrieved from, http://www.church-acoustics.com/aa104.htm6 June. 2011.

ASHA. (2000). Classroom Acoustics: A resource for creating learning environments with desirable listening conditions. Acoustical Society of America, (2), 112 -125. Available: http:/www.Bmj2011;342:d2114.doi;10.1136/bmj.d2114 (April, 2011)

Babisch W. (2001). Noise and Health. . Environ Health Perspect ; 113: A14-15. Available at:

Babisch W. (2006). Stress hormones in the research on cardiovascular effects of noise. Noise Health. 5: 1-11.

Babisch, W. (2005b). Environmental Health Perspect. Noise Health, 113, A14-15

Bagenal, H and Wood, A. (1931). Planning For Good Acoustics. London: Methuen and Co. Ltd

Banbury, S. P., Macken, W. J., Tremblay, S., & Jones, D. M. (2001). Auditory distraction and short-term memory: Phenomena and practical implications. Human Factors, 43(1), 12-29.

Barkley, R. A. (2006). Attention-Deficit Hyperactivity Disorder, Third Edition: A Handbook for Diagnosis and Treatment. New York, NY: The Guilford Press.

Barkley, R. A., DuPaul, G. J., & Connor, D. F. (1999). Stimulants. In J.S. Werry& M.G. Aman (Eds.), Practitioner's Guide to Psychoactive Drugs for Children and Adolescents (2nd ed., pp. 213-247). New York, NY: Plenum Medical Book.

Barron, F. (2003). Industrial Noise Control and Acoustics: U.S.A: Marcel Dekker Inc.

Barron, M. (1992). Precedents in Concert Hall Form. Proceedings of the institute of Acoustics, 14(2), 147-156.

Barron, M. (2008). The Royal festival Hall Acoustic Revisited. Applied acoustics, 24(4), 255-273. Doi: 10.1016/0003-682x (88)90084-9.

Barron, M. (2009). Auditorium Acoustics and Architectural design: London: Spon Press.

Batho, L. P. (2008). An examination of the relations among inattention, working memory, and the irrelevant speech effect in elementary school children. Master's Thesis, University of Toronto.
Batho, L. P. (2008). An examination of the relations among inattention, working memory, and the irrelevant speech effect in elementary school children. Master's Thesis, University of Toronto.

Bell, R., Buchner, A., &Mund, I. (2008). Age-related differences in irrelevant-speech effects. Psychology and Aging, 23(2), 377-391.

Beranek, L. (1979). The Acoustical Design of Boston Symphony Hall. Acoustical Society American, 66, 1220.

Beranek, L. (2002). Music, Acoustics and Architecture. New York: John Wiley & Sons Inc.

Beranek, L. (2004).Concert Halls and Opera Houses: Music, Acoustics and Architecture: New York: John Wiley & Sons, Inc.

Bhatnagar, S. (2002). Neuroscience for the Study of Communicative Disorders. United state of America: Lippincott Williams & Wilkins.

Bies, D and Hansen, C. (2009). Engineering noise control: Theory and Practice. New York: E & FN Spon Press.

Binggeli, C and Greichen, P. (2011). Interior Graphic Standards. New Jersey: John Wiley & Sons Inc.

Bistafa, S and Bradley, S. (2000). Reverberation Time and Maximum Background- Noise Level for Classroom from a Comparative Study of Speech Intelligibility Metric. Acoustical Society of America, 100(1), 408-427.

Blauert, J. (1983). Spatial Hearing. Cambridge, MA: MIT Press,

Borwick, J. (2001). Loudspeaker and Headphone Handbook. London: Reed Education & Professional Publishing Ltd.

Bradley, S et al. (1987). Review of Methods of Measuring Rooms for Speech. Paper Presented at the 113th meeting of the Acoustical Society of America, Indianapolis Inc.

Bradley, S. (1992). Predicting Theater Chair Absorption from Reverberation Chamber Measurements. Acoustical Society of America, 91, 1514-1512.

Bradley, S. (2001). Some Further Investigations of the Seat Dip Effect. Acoustical Society of America. 100(1), 427-436.

Bradley, S. (2006). Predictors of Speech Intelligibility in Rooms. Acoustical Society of America.80, 837-845.

Broner, N. (2008). Effect of infrasound, low frequency noise, and ultrasound on People. In Handbook of Noise Control. (Eds.) Crocker M, (26). Hoboken, New Jersey: John Wiley & sons Inc.

Camhi, J. (2004). Neuroethology; Nerve Cells and the Natural Behavior of Animals. Sunderland. Massachusetts: Sinauer Associates, Inc.

Cavanaugh, W and Wilkes. (2009). Architectural Acoustics: Principles and Practice. Canada: John Wiley & Son, Inc.

Chiras, D. (2001). Environmental Science – Creating a sustainable future. (6thed), London: Jones &Bartlett,pp. 457-459.

Connolly, D., Dockrell, J., Shield, B., Conetta, R., & Cox, T. (2013). Adolescents' perceptions of their school's acoustic environment: The development of an evidence based questionnaire. Noise and Health, 15(65), 269

Cox, T and D"Antonio. (2004). Acoustics Absorbers and Diffusers: Theory, Design and Application. New York: Spon Press.

D"Antonio, P. (2008). Acoustic Absorbers And Diffusers: Theory, Design And Application. London :Spon Press.

Dooley. E.E. (2002) Noise hurts Boys and Girls, The occupational and environmental Medicine, 1,1

Dorman, M. et al. (2007). Speech Intelligibility As A Function of The Number of Channels of Stimulation For Signal Processor Using Sine-Wave And Noise-Band Outputs. Acoustical society of America, 102(4), 2403-2411.

Elert, G. (2004). Frequency Range of Human Hearing. In Physic Factbook Wikipedia (Eds.),The Free Encyclopedia. Retrieved From http://hypertextbook.com/facts/2003/ChrisDAmbrose.shtml

Elliott, E. M. (2002). The irrelevant-speech effect and children: Theoretical implications of developmental change. Memory & Cognition, 30(3), 478-487.

Elliott, E. M., & Cowan, N. (2005). Coherence of the irrelevant-sound effect: Individual profiles of short-term memory and susceptibility to task-irrelevant materials. Memory & Cognition, 33(4), 664-675.

Elliott, E. M., Barrilleaux, M., & Cowan, N. (2006). Individual differences in the ability to avoid distracting sounds. European Journal of Cognitive Psychology, 18(1), 90-108.
Elsevier Science & Technology Ltd.

Enmarker, I., &Boman, E. (2004). Noise annoyance responses of middle school pupils and teachers. Journal of Environmental Psychology, 24, 527-536.

Ervin, S. (2010). Introduction to the Anatomy and Physiology of the Auditory System: Retrieved From, http://www.workplaceintegra.com/hearing-articles/Ear-anatomy.html,17 May. 2011.

Focus, F. (2002): Environmental Health Perspective, 110 3-3

Fuggle, R. F., M. A. Rabie (2002) Environmental management in south Africa. Juta& Co, Ltd, Cape Town, 569-585

Goines, L., & L. Hagler, (2007): Noise pollution: a modern plague. South med Journal, 3, 287-94

Harris, C. (1994). Noise control in buildings: a guide for Architects and Engineers. New York: McGraw-Hill,Inc.

Harris, C. (2001). Acoustical design of Benaroya hall, Seattle. Acoustical Society of America, 110, 2841-2844

Holmes, H. (2005) Building Healthy Communities for Children: The transportation Link, Environmental Health perspective, 103, 1-3

Howard, D and Augus, J. (2009). Acoustics And Psychoacoustics. United kingdom: Elsevier Ltd.
http://www.jiscdigitalmedia.ac.uk/audio/advice/the-physical-principles-of-sound.
http://www.kemt.fei.tuke.sk/Predmety/KEMT320_EA/_web/Online_Course_on_Acoustics/intelligibility.html 12 Jul. 2011.
http://www.pubmedcentral.nih.gov/articlerender.fcgi?article=1253720.
Human Ecology,16(3), 181-187.

JISC Digital Media: Audio The Physical Principle of Sound. Retrieved from

Johnson, R.(2000). Reflection on The Acoustical Design of Halls For Music Performance: V.O. Knudsen Lectures, A paper presented on the 120th meeting of the Acoustical Society of America.

Jordan, N and Rinder, J. (2006). The Alberta Jubilee Halls reborn with Up-To-Date Acoustics. Proceedings of the Institute of Acoustics, (28) 2, 297-298.
Journal, 11(44), 161-168.

Kang, J. (2002). Acoustics of Long Spaces: Theory And Design Practice. London: Thomas Telford Ltd.

Kempen, E. Van., Kamp, I.V., Fischer, P., Davies, H., &Stellator, R. (2006). Noise exposure
Khilman, T. (2004). 'Noise pollution in cities, Curitiba and Goteborg as examples' In: Proceedings of the Seminar – Environmental Aspects of Urbanization – Seminar in Honor of Dr. Mostafa Kamal Tolba, Gothenburg,Sweden.

Kjellberg, A., Landström, U., Tesarz, M., Söderberg, L., and Åkerlund, E. (2006). The effects of non-physical noise characteristics, ongoing task and noise sensitivity on annoyance and distraction due to noise at work. Journal of Environmental Psychology, 16, 123-136.

Marsh, A.(2002). Speech Intelligibility. Retrieved from

Martin BL and Martin GK. (2010). Noise Induced Hearing Loss. Philadelphia, Pa:

Maschke, C., Rupp, T., & Hecht, K. (2000). The influence of stressors on biochemical reactions a review of present scientific findings with noise. International Journal of Environmental Health, 203, 45-53.

Mechel, F.(2001). Panel Absorber. Journal of Sound Vibration, 248(10), 43-70.

Mehta, M et al. (2008). Architectural Acoustics :Principles and Design. New York: Prentice hall.]

Melnick, W. (2001). Human Temporary Threshold Shift (TTS) and Damage Risk. Acoustical Society of America, 90(1), 147-154.

Microsoft Encyclopedia Encarta Standard Edition (2008). Acoustics and Ear. Retrieved from http://encarta.msn.com

Miyaya, F. (1997) Guidelines for an Urban Ordinance, Rosario, Argentina, 10-18

Moment et al 2006 and Othman et al, 2006

Moszynski, P. (2011). WHO warns noise pollution is a growing hazard to health in Europe.

Ramsey, C et al. (2000). Architectural Graphics Standard. New York: John Wiley and Son, Inc.

Salvato, A. (2002). Environmental Engineering and Sanitation. New York: John Wiley & Sons Inc

Schell, L. M., M.V. Gallo, M. Denham & J. Ravenscroft (2006) Effect of Pollution on Human Growth and Deployment, journal of physiological Anthropology, 25, 103-112

Schmidt C. W. (2005) Noise that annoys: Regulating Unwanted Sound, Environmental Health SSPerspectives, 113, 1-3

Singh, N., &Davier, S. C. (2004). Noise pollution- Sources, effects and control. Journal of
Stansfeld, S., & Crombie, R. (2011). Cardiovascular effects of environmental noise: research in

Turner, J and Pretlove, A. (2001). Acoustics For Engineers. London: Macmillan Education Ltd.

Ugwuanyi, J. U., Ahemen, I., &Agbendeh, A. A. (2005). Assessment of environmental noise pollution in Markurdi Metropolis, Nigeria. Zuma Journal of Pure and Applied Sciences, 6(2), 134-138. WHO. (1999). Guidelines for Community Noise. Occupational and Environmental Health (OEH), Geneva
United Kingdom. Noise Health Journal, 13(52), 229-33. http://dx.doi.org/10.4103/1463-1741.80159

Van Der Merwe, B. (2008): Personal Communication. Owner of dBAcoustics

Walter, T et al. (2009). Mechanical and Electrical Equipment for Buildings. New York: John Willey and Sons, Inc

William, C. (1991). Recent Studies of Temporary Threshold Shift (TTS) And Permanent Threshold Shift (PTS) In Animals. Acoustical society of America, 90(1), 155-163. Doi: 10.1121/1.401309.

Williams, S. (2001). Schaum's Outline Series: Theory And Problems Of Acoustics. New York: McGraw-Hill, Inc.

Wilson, O. et al. (2002). Classroom Acoustics: A New Zealand Perspective. Wellington: The Oticon Foundation In New Zealand.

World Health Organization, WHO, (2000).Data and statistics. [online] Available at http://www.euro.who.int/en/health-topics/environment-and-health/noise/data-and-statistics> [Accessed date: 16 November 2013]

Zaidi, S. H. (1999). An epidemiological study of hearing impairment in the Himalayan territories of Pakistan. Hearing International Newsletter, 8, 1-4.

Zeid, Q., She, M., & Abdel-Razia, I. R. (2000). Measurement of the noise pollution in the community of Araba.Acoustica, 86, 376-378.

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