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Investigating The Effect Of Classroom Amplification On Students' Listening Behaviour In Akwa Ibom State, South- South Nigeria

[1]aniefiok Otu Akpan, [2]augustine A. Umoh And [3]ubon E. Asuquo
[1]Department of Physics, Akwa Ibom State University, PMB 1167, Uyo Akwa Ibom State, South South Nigeria.
[2]Deparment of Physics, University of Uyo, Uyo, Akwa Ibom State, South- south Nigeria.
[3]Department of Physics, University of Calabar, PMB 1115, Calabar, Cross River State, South- South Nigeria

Abstract

Investigation of the effects of classroom amplification on students' listening behaviour in Akwa Ibom state has shown high correlation between the teachers' rating of the listening behaviour of students studying under a sound field amplified classroom conditions which was rated excellent by 14.5% ,very high by 53%, good by 22.3% of the respondents and the SNR of the lecturers amplified speeches. A correlation coefficient of 0.87 between these two variables clearly shows that sound field amplification of classrooms greatly increases the SNR of the lecturers speeches which in turn positively influences the listening behaviour of the students . It is therefore necessary to encourage the teaching of students in amplified classroom conditions as this will enhance their listening and attending behaviour and their academic performance as a whole. Schools should not be sited close to major and busy highways where vehicular noise will greatly increase their background noise as this will negatively affect the listening and attentive behaviour of the students which of course will have adverse affect on their general academic performance. If sited close to highways, the schools should be well shielded from vehicular traffic.

Key Words: Classroom amplification, Students' listening behaviour, Signal to noise ratio, Background noise

1.0 Introduction

According to the American Speech Language Hearing Association (ASHA) poor acoustical environments can affect the students attention and listening behaviours, speech perception and ultimately academic performance. The effects of the acoustical environment become greater if the student has a hearing loss (ASHA, 1995), students with hearing loss may have difficulty with understanding of auditory information (Beattie and Zipp, 1990 ; Woglemuth et al, 1998). Acoustical environment of a classroom is a critical factor in the academic, psychoeducational and psychosocial achievement of students with normal hearing and with hearing impairment. For optimal academic achievement, accurate transmission of acoustical information is imperative. Acoustical variables that can compromise the perception of speech include level of background noise, level of speech signal relative to the background noise, reverberation time and the distance from the teacher to the student (Crandell and Smaldino , 2000). Speech intelligibility of the pupils in Federal Airport Authority of Nigeria (FAAN) nursery primary/secondary school and that of the students of the Federal Government girls college, Calabar is greatly affected by aircraft noise (Akpan et al, 2012).

Background noise refers to any undesired auditory stimuli that interferes with what a student wants or needs to hear and understand (Crandell et al, 1995). This can affect a student's concentration causing misinterpretation of lessons thereby making learning to suffer (Johnson, 2001). Background noise sources in classrooms include external noise, i.e noise that is generated outside the building such as aircraft, construction sites, vehicular traffic and play ground. It can also be internal noise, ie noise that generates from the building but outside the classroom such as rooms adjacent to cafeterias, lecture rooms, gymnasiums and busy hall ways, and room noise ie noise that is generated within the classroom (Bess and McCoonnell, 1981; Crandell and Smaldino, 1994, 1995, 1996, 2000b; Olse, 1981, 1988)

Level of speech signal relative to the background noise is referred to as the signal to noise ratio (SNR). Speech perception ability is highest at favourable SNR and decreases as a function of reduction in SNR (Crum, 1974; Finitzo-Hieber and Tillman, 1978).

SNR = Speech signal - Background noise.....(1)

Signal to noise ratio of the classroom environment can be improved by effecting changes to the classroom environment which will reduce the background noise while the teacher's voice remains the same. Alternatively, this can be done by increasing signal to noise ratio of the teachers voice using amplification systems such as personal frequency modulated (FM) systems, sound field amplification, induction loop amplification or infra

red systems while the classroom environment remains unchanged.

Reverberation is the persistence or prolongation of sound within an enclosure as sound waves reflect of hard surfaces. The major determinant of room acoustics is reverberation time (RT) , it is the time in seconds required for sound pressure at a particular frequency to decay 60 dB after the sound source has stopped (Siebein, Crandell and Gold, 1997). A decrease of 60dB represents a reduction of $1x\ 10^{-6}$ of the original intensity of the sound. Mathematically

$RT_{60} = 0.161V/\sum S\alpha$.....(2)

Where RT_{60} = RT in seconds, 0.161 is a constant, V = room volume in cubic feet and $\sum S\alpha$ = the sum of surface area S of the various materials in the room multiplied by their respective absorption coefficients α at a given frequency (Sabine, 1964)

There is spatial decay of sound levels as the distance of the sound source increases from the receiver, the intensity of the sound decreases as distance from the receiver increases. Direct sound pressure obeys the inverse square law which states that sound level decreases 6dB for every doubling of distance from the sound source.

Crook and Langdon (1974) observed that teachers performance is also affected by classroom noise. Information received from 1200 teachers concerning the effect of noise in the classroom on teachers showed that noise related to classroom activities and traffic or airplane correlated with teacher fatigue, increase tension and discomfort and an interference with teaching and speech recognition (Ko, 1979). Additional studies reported that teachers exhibit a significantly higher incidence of vocal problems than do the general population and it is reasonable to assume that these vocal difficulties are caused at least in part by having to increase vocal output to overcome the effects of classroom noise during the school day (Crandell et al,1995; Sapienza, Crandell and Curtis, 1999).

Research results have shown that there are benefits from the use of amplification devices in classrooms, these studies show that the listening and attending behaviours of students improved after implementation of the amplification system (Flexer et al, 1994; Rosenberg et al, 1995; Arnold and Cannig,1999)

1.1 Materials and Methods

With digital sound level meter S-100 (voltcraft product) set at fast time evaluation and frequency evaluation filter (weighting) set at A, background noise levels were measured in selected classrooms in institutions listed in table 1.0. The classroom background noise levels were taken when the classrooms were occupied by the students and the lecturer. After a long term observation of the students thought in Sound field amplified classrooms where amplified signal is sent out to a loud speaker placed in the classroom, students' listening behaviour was evaluated through questionnaires by their lecturers. For the purpose of analysis the institutions were coded in line with the parameter being investigated, SLB stands for " students' listening behaviour". Speech signals of the lecturers were measured 25 meters from the lecturers lecturing position, this was at about the centre of the lecture halls for all assessed institutions. The students' listening behaviour was rated excellent (4 points),very good (3 points), good(2 points), moderately good (1 points) and poor (0 points) as the case may be . Pearson's product moment correlation is used to correlated the rating with the signal to noise ratio (SNR) of the lecturers' amplified voices to see the strength of their relationship. The signal to noise ratio of amplified lecturers' speech were calculated using equation 1.0

Table 1.0 Institutions and Codes

S/N	Names of Institution	Codes
1	Akwa Ibom State University, Mkpat Enin	SLB1
2	University of Uyo,	SLB2
3	Akwa Ibom State Polytechnic, Ikot Osurua	SLB3
4	School of Art and Science, Nnung Ukim Ikono	SLB4
5	College of Education, Afaha Nsit	SLB5
6	Maritime Academy, Oron	SLB6
7	School of Nursing, Nwaniba, Uyo	SLB7
8	School of Health Technology, Etinan	SLB8
9	School of Nursing, Urua Akpan	SLB9
10	Heritage Polytechnic, Eket	SLB10
11	School of Accountancy, Ikpa Road, Uyo	SLB11

1.2 Result

A total of 410 (four hundred and ten) questionnaires were distributed to lecturers in the 11 (eleven) assessed institutions out of which 296 (two hundred and ninety six) valid response were received representing 72.2% of the total. Table 1.1 shows the number of received questionnaires from each institution, the background noise levels of occupied classrooms and the signal to noise ratio of the lecturers voice in non amplified and amplified situations. Figure 1.0 shows the lecturers' evaluation of the students' listening behaviour in amplified classroom situations.

Table 1.1 Data for the evaluation of SLB

Institution Codes	No. Of received questionnaires	Average occupied background levels (dBA)	SNR of unamplified lecturers speech (dBA)	SNR of amplified lecturers speech (dBA)
SLB 1	19	59	+1	+4
SLB 2	68	61	0	+2
SLB 3	45	65	-2	+1
SLB 4	34	68	-4	+3
SLB 5	21	57	+2	+5
SLB 6	12	69	-1	+1
SLB 7	19	75	-6	+2
SLB 8	18	70	-2	+2
SLB 9	10	58	+2	+3
SLB 10	28	56	+2	+4
SLB 11	22	72	-3	+1

TOTAL 296

Fig 1.0 Lecturers' rating of the listening behaviour of students studying in amplified sound field conditions

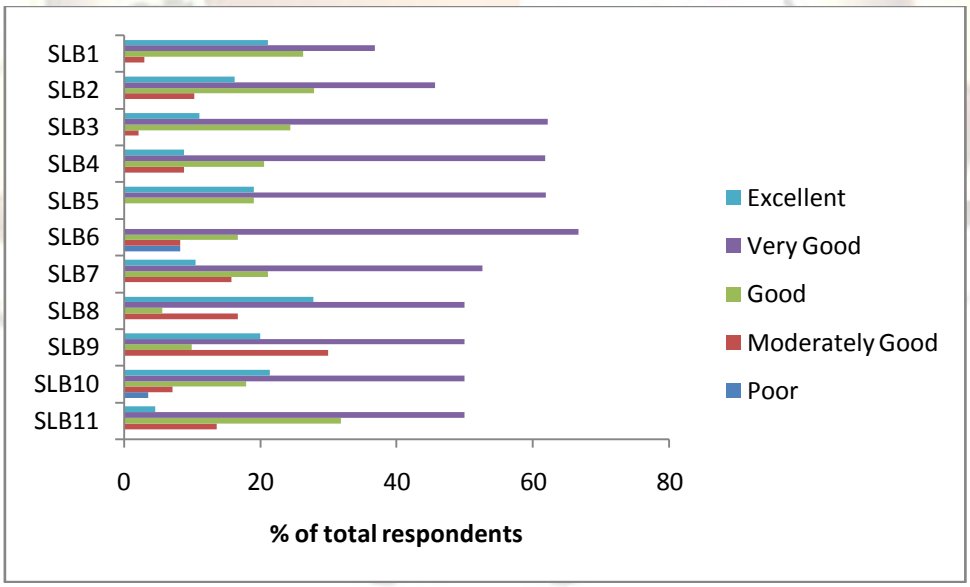

Table 1.2 Overall students' listening behaviour rating by lecturers

Institution	Excellent (4)	Very good (3	Good (2)	Moderately Good (1)	Poor (0)	Response per institution (n)	Weighting rating (nx)	Average value per institution (nx/n)
SLB1	4	7	5	3	0	19	50	2.6
SLB2	11	31	19	7	0	68	182	2.7
SLB3	5	28	11	1	0	45	127	2.8
SLB4	3	21	7	3	0	34	92	2.7
SLB5	4	13	4	0	0	21	63	3.0
SLB6	0	8	2	1	1	12	29	2.4
SLB7	2	10	4	3	0	19	49	2.6
SLB8	5	9	1	3	0	18	52	2.9
SLB9	2	5	1	3	0	10	28	2.8
SLB10	6	14	5	2	1	28	39	1.4
SLB11	1	11	7	3	0	22	54	2.5
TOTAL	**43**	**157**	**66**	**26**	**2**	**296**	**765**	**28.4**

Table 1.3 Correlation between SNR (X) of amplified lectures' voices and the average response value per institution (Y) on the effect of classroom amplification on students' listening behaviour

Institutions	X	Y	XY	X^2	Y^2
SLB1	4	2.6	10.4	16	6.76
SLB2	2	2.7	5.4	4	7.29
SLB3	1	2.8	2.8	1	7.84
SLB4	3	2.7	8.1	9	7.29
SLB5	5	3.0	15	25	9.0
SLB6	1	2.4	2.4	1	5.76
SLB7	2	2.6	5.2	4	6.76
SLB8	2	2.9	5.8	4	8.41
SLB9	3	2.8	8.4	9	7.84
SLB10	4	1.4	5.6	16	1.96
SLB11	1	2.5	2.5	1	6.25
TOTAL	**28**	**28.4**	**71.6**	**90**	**75.16**

Correlation coefficient = 0.87

1.3 Discussion of Results

Table 1.0 shows that the school of nursing, Nwaniba road (SLB 7) has the highest background noise level of 75 dB (A). This school is situated along a major street with heavy traffic flow at Uyo, the state capital. The high level of background noise is not therefore unconnected with vehicular noise from this major street. This has greatly affected the SNR of unamplified and amplified speeches of the lecturers which were -6 and +2 dB(A) respectively. Ikpa road is also major road in Uyo metropolis where the school of accountancy is situated, it recorded second in terms of background noise again due to vehicular noise from this major road. The SNR of the lecturers unamplified and amplified speeches are equally affected, -3 and + 1 dB (A) respectively. The Heritage Polytecnic, Eket (SLB 10), College of Education, Afaha Nsit (SLB 5), School of Nursing, Urua Akpan (SLB 9) and Akwa Ibom State University main campus, Mkpat Enin have low background noise of 56, 57, 58 and 59 dB(A) respectively as compared to others. These schools are located away from the highways such that the vehicular noise from the highways have little or no effects on increasing their background noise. It can be seen that the SNR of the lecturers amplified speeches are also significantly high, +4, +5, +3 and +4 respectively.

Figure 1.0 shows that majority of the respondents acknowledged the fact that the students' listening behaviour under amplified classroom conditions was excellent, very good and good, this is also reflected in table 1.2. This observation by the respondents correlates well with the SNR of amplified lecturers voices hence the high correlation coefficient of 0.87. This shows that classroom amplification has a positive effect on the students' listening behaviour, this is in line with the research findings of Flexer et al, 1994, Rosenberg et al, 1995 and Arnold and Cannig, 1999. They all observed that the listening and attending behaviours of students improved upon implementation of amplified systems.

Conclusion

The investigation of the effect of classroom amplification on students' listening behaviour in Akwa Ibom State has shown that sound field amplification of classrooms greatly improve the SNR of the amplified teachers speech and this in turn makes the students to be more attentive to the teachers.

Recommendation

It is therefore highly recommended that schools should not be sited close to major and busy highways where vehicular noise will greatly increase their background noise as this will greatly affect the listening and attentive behaviour of the students which of course will have adverse affect on the general academic performance of the students. If sited close to highways, the schools should be well shielded from vehicular traffic.

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