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Effects of Sawmill Machine Noise on Hearing Levels and English Language Performance of Students in Technical Colleges, Plateau State, Nigeria

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Abstract. This study examined the effects of sawmill machine noise on hearing levels and English language performance of students in technical colleges, Plateau State, Nigeria. This study was true experimental in nature. Specifically, pre-test-post-test control group with randomization design type was adopted. The population of the study comprised of all National Technical College students in Plateau State who have spent three years learning Woodwork in three schools identified. The researcher purposefully chose one of the schools, Government Technical College Bukuru which has 8 students as the target sample for the study. These students were randomly assigned to experimental and control group. The instruments used were Diagnostic Audiometer Machine (DAM) and Teacher Made English Language Performance Test (TMELPT). The validity of the two instruments were obtained. DAM reliability index was 0.905 and TMELPT had a reliability index of 0.865. The researcher adopted both descriptive and inferential statistics in analyzing the data generated in the course of the study. Graph was used to connote differences in audiogram result computation of Pure Tone Average (PTA) for research questions one and two and research questions three and four were answered using Mean and Standard Deviation. In testing the hypotheses, descriptive statistics (Mean and Standard Deviation) was used for hypothesis one. Inferential statistics T-test for independent samples was used to analyze hypotheses two at 0.5. The Statistical Package for Social Sciences (SPSS) version 23.0 software was utilized for hypotheses two. The findings showed that sawmill machine noise effected the hearing levels of students and can hamper their performance in English language. Again it showed that usage of ear protective measures in the form of Foam Ear Plug can improve the hearing of students which can lead to improvement in their English language performance. Based on these findings, the researcher recommended that hearing conservation programmes should be introduced in technical colleges. Technical College students learning woodwork and other related subjects should be provided Foam Ear Plug in their workshops as a means of hearing conversation.

Keywords: Sawmill machine noise, Foam Ear plug, English language performance.

1. Introduction

Sense organs in human body are very important and they perform different functions. For normal living, the sense organ functions are essential to human existence. Any damage to any of them could pose a threat to the whole body. Hearing is one of the sense organs in human body. It is

through the ear that this function is performed. Any damage to the hearing organ either at birth or later in life will affect the individuals hearing level which may lead to hearing impairment.

Human hearing level is shown in the different pitches an individual can perceive sound. These pitches range from normal to abnormal levels. When the hearing is at abnormal level, the individual will be having hearing impairment at different levels. These hearing levels can be at mild, moderate, severe and profound hearing impairment levels. Hearing levels can be determined when audiometric screening is carried out using audiometer screening machine to get the pure tone threshold. This process is important because hearing impairment does not show physically like other special needs conditions. Owobi (2015) asserted that hearing impairment is a hidden disability. This author said that physical observation alone cannot show hearing impairment but in the context where verbal communication is involved, the individuals hearing limitations will be exposed.

One of the things that can affect and damage the hearing organ of an individual is noise. Noise is an unwanted sound, especially one that is loud, unpleasant, that causes disturbance and health hazards especially to the hearing organ. Noise can disrupt concentration, and interfere with speech communication which may affect academic performance of an individual. Marshark (2006) said that the academic performance gap between students who hear and those who have hearing impairment are frequently reported to be enormous and in favour of those who hear. This explains why the researcher wants to find out the hearing levels and academic performance of technical college students whose ears are always exposed to noise while learning woodwork.

Among the types of noise is industrial noise. Industrial noise pollution is any over the board sound originating from industrial equipment such as sawmill machines. These industrial noises can impact company personnel and the host community negatively (Davies, 2008). It is also good to note that noise can interrupt concentration and impede speech communication between individuals. If this happens in a school setting, academic performance and safety of such individual exposed may be affected. In the case where this noise exposure is continuous, it can cause deafness. On the other hand, if the noise is occasionally and loud, it can cause temporary change in hearing threshold such as; ears stuffed up and ringing ears (tinnitus). These short-term problems may go away either in few minutes, hours or days after leaving such noise environment.

Sawmill machine is an industrial equipment used in sawmills for sawing logs into timbers, then timbers into planks. This is one of the equipment used in training technical college students learning woodwork. Sawmill machines produces a lot of noise. The noise that sawmill machines produce is referred to as sawmill machine noise (World Health Organization, 2009). This organization submits that noise produced from Sawmill machine causes noise induced hearing impairment and that it is one of the most prevalent irreversible occupation hazard which has rendered about 120 million people into hearing impairment.

Students learning woodwork in technical colleges learn it to become experts in cabinet making, wood carving and other carpentry activities in other to be self-reliant. However, in this type of environment, as students expose their ears to such a loud noise without hearing protections such as Foam Ear Plug (FEP), it can pose a challenge to the hearing organ leading to noise induced hearing impairment (Stephenson, 2012). Stephenson opined that to prevent this menace among students learning woodwork in technical schools, there is the need for hearing conservation, such as the wearing of earmuffs or foam ear plugs. Foam ear plug is one of the methods of hearing conservation practices.

Performance is the measurable behaviour of a person in a particular situation. This implies that academic performance of a student can be regarded as the observable and measurable behaviour of the student in a particular situation, for example, in this study, the academic performance of students in English language.

This academic performance consists of the scores the students obtained from the teacher made test pre-test and post-test of English language. Academic performance can be influenced by a number of variables. These include; poor teaching, employment of unqualified teachers, unavailability of teaching material and environmental factors.

Noise environment is an environmental factor and can be detrimental to students' academic performance. This could be short or long term exposure to noise. For some reasons, students may be attending training in sawmill machine in technical colleges learning woodwork without adequate ear protection measures (hearing conservation which is any method put in place to protect the ear from noise). This can endanger their health and subsequently affects them academically. Newton (2015) study revealed that when core subjects such as English language is hampered; it retards students' performance in other subject areas in technical colleges. As the effects of these noises on the hearing level and English language performance of students in the Technical colleges remain groundless, the researcher took the challenge to examine the effects of sawmill machine noise on the hearing levels and English language performance of Technical College Students in Plateau State, Nigeria.

2. Statement of the Problem

In Nigeria Technical Colleges, woodwork is part of the school subjects where sawmill machines are used, and in the process of learning this skill, students often expose their ears to noise emanating from the machines. They might not be using Foam Ear Plug (FEP) as a means of hearing conservation measure either. The effect of the noise on them may be hearing impairment of different levels. A situation that can affect their hearing and communication abilities required for academic activities. This can also diminish their ability to cope in classroom instructions for school subjects. Also in Nigeria system of education out of all school subjects, English language regarded as one of the most crucial subject that determine students' academic excellence and progress. Distractions such as environmental noise affect hearing ability and might subsequently lead to an individual's poor performance in English language. Therefore, these assumptions raised the curiosity of the researcher to carry out this study.

3. Purpose of the Study

The purpose of this study was to examine the effects of sawmill machine noise on the hearing levels and English language performance of students in Technical Colleges, Plateau State, Nigeria.

Specifically, the study investigated:

- The hearing levels of NTC III students in experimental and control groups learning Wood-Work before exposure to Sawmill Machine noise.
- The hearing levels of NTC III students in experimental and control groups learning Wood-Work after exposure to Sawmill Machine noise.
- Determined the level of English language performance of NTC III students in experimental and control groups learning woodwork before exposure to Sawmill Machine noise.
- Determined the level of English language performance of NTC III students in experimental and control groups learning woodwork after and exposure to Sawmill Machine noise.

4. Research Questions

The following research questions were formulated to guide the study:

- What is the hearing levels of NTC III students in experimental group before exposure to Sawmill Machine noise?
- What is the hearing levels of NTC III students in control group before exposure to Sawmill Machine noise?
- What is the level of English language performance of NTC III students in experimental and control groups before exposure to Sawmill Machine noise?

- What is the level of English language performance of NTC III students in experimental and control groups after exposure to Sawmill Machine noise?

5. Hypotheses

The following null hypotheses were postulated and tested at 0.05 level of significance:

- There is no significant difference between the pure tone average scores of NTC III Students in experimental and control groups after exposure to sawmill machine noise.
- There is no significant difference between Pre-test and Post-test English language performance mean score of NTC III Students in experimental group.

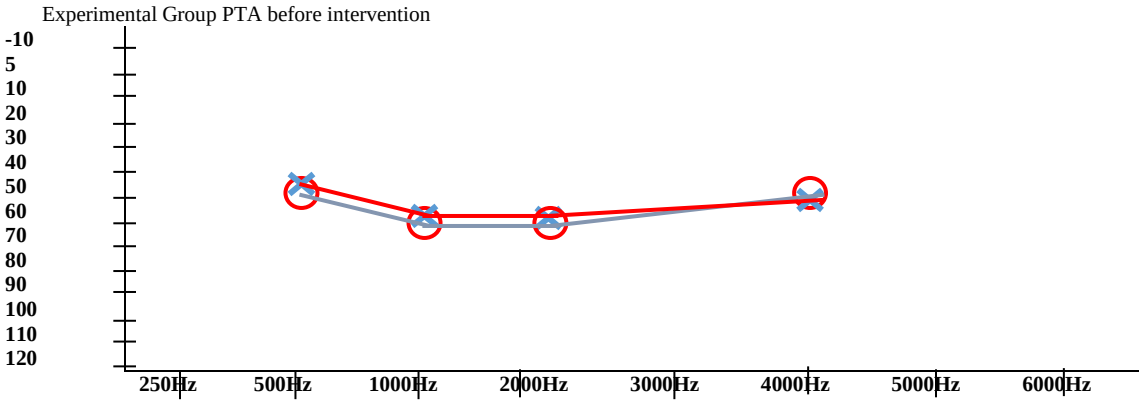
6. Methodology

This study was true experimental in nature. Specifically, pre-test-post-test control group with randomization design type was adopted. The design was chosen because it allows the researcher to compare the final post-test result and the pre-test of both groups. This study involved a group of students who were randomly assigned into experimental and control groups. Experimental group that was exposed to sawmill machine noise in their normal learning period in woodwork wearing Foam Ear plugs (manipulation) and the control group that was exposed to sawmill machine noise in their normal learning period in woodwork without Foam Ear plugs (X). And both groups were subjected to pre-test in hearing level and English language. The population of the study comprised of all National Technical College students in Plateau State who have spent three years learning Woodwork in three schools identified. The researcher purposefully chose one of the schools, Government Technical College Bukuru which has 8 students. These students were randomly assigned to experimental and control group. The instruments used to collect data were Diagnostic Audiometric Machine (DAM) used for measuring hearing level of students and Teacher Made English Language Performance Test (TMELPT) used for testing students' scores in English language. The test comprises of 16 questions on from phrase and 14 for verb amounting to 30 questions taken from Macmillan Brilliant English for senior secondary schools book 3 (Osisanwo, Alabi, Owoeye, Onuoha & Ahmed, 2010). The validity of the two instruments was obtained. Diagnostic Audiometer Machine (DAM) reliability index was 0.905 and Teacher Made English Language Performance Test (TMELPT) had a reliability index of 0.865. The researcher adopted both descriptive and inferential statistics in analyzing the data generated in the course of the study. Graph was used to connote differences in audiogram result computation of Pure Tone Average (PTA) for research questions one and two and research questions three and four were answered using Mean and Standard Deviation. In testing the hypotheses, descriptive statistics (Mean and Standard Deviation) was used to describe and summarize the data collected for hearing levels in a meaningful way for hypothesis one. Inferential statistics T-test for independent samples was used to test and analyze hypotheses two at 0.5. The Statistical Package for Social Sciences (SPSS) version 23.0 software was utilized for hypotheses two.

7. Results

Research Question One: What is the hearing level of NTC III students in experimental group before exposure to Sawmill Machine noise?

To determine the hearing levels of NTC III students in the experimental group during the pre-test, the ear screening test was conducted on all the participants. Their ears were tested at different Hz and dB level. The result is seen in Figure 1 below.



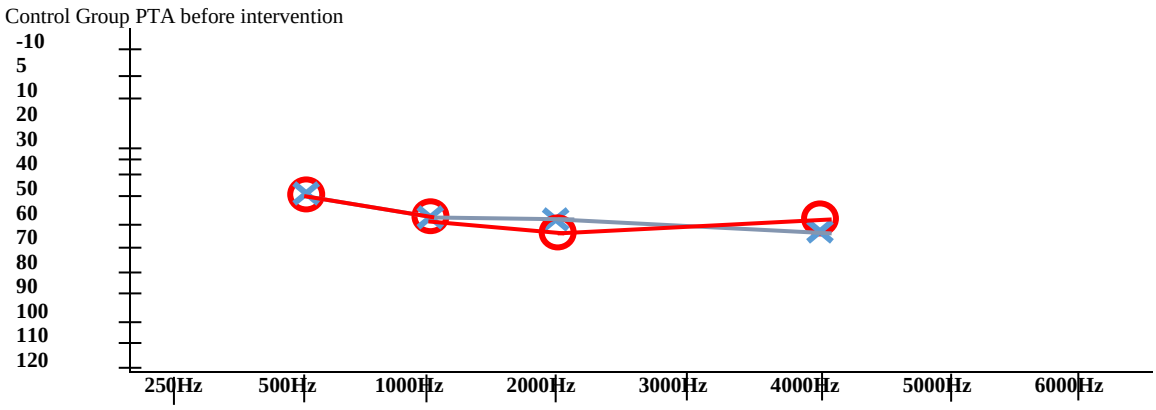
Key:
Left Ear – **X** (with blue coloured line)
Right Ear – **O** (with red coloured line)

Fig. 1: *Chart showing the Pure Tone Average (PTA) Hearing Level of NTC III Students in Experimental Group before Exposure to Sawmill Machine Noise*

Fig. 1 revealed that the hearing level of NTC III students learning woodwork before intervention is as follows at 500Hz is 45dB, at 1000Hz is 50dB, at 2000Hz is 50dB and at 4000Hz 45dB. This implies that majority of the students in experimental group had mild hearing loss immediately they finish woodwork practice which may interfere with other class subject learning and not beneficial for academic performance. The four students were tested individually at these levels and their hearing levels obtained. Then the average of each level at different frequencies of the students were calculated to give the picture of the groups hearing level. This is called Pure Tone Average (PTA).

Research Question Two: What is the hearing level of NTC III students in control group before exposure to Sawmill Machine noise?

To determine the hearing level of students NTC III control group during pre-test, the ear screening test was conducted on all the participants. Their ears were tested at different Hz and dB level. The result is seen in Figure 2 below.



Key:
Left Ear – **X** (with blue coloured line)
Right Ear – **O** (with red coloured line)

Fig. 2: *Chart showing Hearing Level of NTC III Students in Control Group before Exposure to Sawmill Machine Noise*

Fig. 2 revealed that the hearing level the hearing level of NTC III students learning woodwork before intervention is as follows at 500Hz is 45dB, at 1000Hz is 50dB, at 2000Hz is 50dB and at 4000Hz 45dB. This implies that majority of the students in control group had mild hearing loss immediately they finish woodwork practice which may interfere with other class subject learning and not beneficial for academic performance.

Research Question Three: What is the level of English language performance of NTC III students in experimental and control groups before exposure to Sawmill Machine noise?

Table 1: Level of English Language Performance of NTC III Students in Experimental and Control Groups Before Exposure to Sawmill Machine Noise

	Experimental Group	Control Group
MEAN	3.5	3.25
SD	0.58	0.96

Table 1 reveals the Level of English Language Performance of NTC III Students in Experimental and Control Groups Learning Woodwork before Exposure to Sawmill Machine Noise. The experimental group had a mean and standard deviation of 3.50±0.58 and the control group had a mean of 3.25±0.96 which showed that students in the experimental group differs by 0.25 from students in the control group. This implies that majority of the students in experimental and control groups had low English Language Performance before exposure to intervention.

Research Question Four: What is the level of English language performance of NTC III students in experimental and control groups learning woodwork after exposure to Sawmill Machine noise?

Table 2: Level of English Language Performance of NTC III Students in Experimental and Control Groups after Exposure to Sawmill Machine Noise

	Experimental Group	Control Group
MEAN	7.5	4
SD	0.58	1.15

Table 2 reveals the Level of English Language Performance of NTC III Students in Experimental and Control Groups Learning Woodwork after Exposure to Sawmill Machine Noise. The experimental group had a mean and standard deviation of 7.50±0.58 and the control group had a mean of 4.00±1.15 which showed that students in the experimental group differ by 3.50 from students in the control group. This implies that majority of the students in experimental groups had high English Language Performance Level after exposure to Sawmill Machine Noise using Foam Ear Plugs.

Hypotheses One: There is no significant difference between the pure tone average scores of NTC III Students in experimental and control groups after exposure to sawmill machine noise.

Table 3: Mean and Standard Deviation of Pure Tone Audiometric Test Levels of NTC III Students in Experimental and Control Groups after Exposure to Sawmill Machine Noise

	Experimental Group	Control Group
Child 1	21.25	51.25
CHILD 2	17.5	52.5
CHILD 3	20.62	53.12
CHILD 4	20	53.12
MEAN	0.02	3.10
SD	-0.05	1. 40

Low Level (score 0.1.-2), Moderate Level (score 1.2-.3) and High Level (score 2.4.-6)

Table 3 shows the Hearing Level in Pure Tone Audiometric Test of NTC III in Experimental and Control Groups Learning Woodwork after Exposure to Sawmill Machine Noise. The experimental group had a mean and standard deviation of 0.02±-0.05 and the control group had a mean of 3.10±1.40 which showed that students in the experimental group differ by 3.08 from students in the control group. This implies that the hearing level of majority of the students in experimental group has improved greatly than the students in control group after exposure to Sawmill Machine Noise.

Hypotheses Two: There is no significant difference between Pre-test and Post-test English language performance mean score of NTC III Students in experimental group.

Table 4: t-test Analysis of Mean Scores English language performance of Pre-test and Post-test NTC III Students in experimental group

Experimental	N	$\bar{X}$	SD	df	t_{cal}	P-value
Pretest	4	3.50	0.58	6	-9.798	0. 000
Post-Test	4	7.50	0.58			

Table 4 shows the t-test Analysis of Mean Scores English language performance of pre-test and post-test NTC III Students learning Woodwork in experimental group. The pre-test means score and standard deviation is 3.50±0.58 while the post-test means score and standard deviation of 7.50±0.58. In addition, the calculated t-value of -9.798 with a p-value of 0.000 which is less than 0.05 ($P<0.05$). Therefore, the researcher accepts the alternative hypothesis and rejects the null hypothesis, which implies that there is a significant difference in Mean Scores English language performance of pre-test and post-test NTC III Students learning Woodwork in experimental group.

8. Summary of the Findings

It was discovered that Sawmill machine noise can affect hearing level of students.

This study showed that this sawmill machine noise effect to the hearing organ of students can hamper their performance in English language.

The findings showed that usage of ear protective measures in the form of Foam Ear Plug can improve the hearing of students which lead to improvement in their English language performance.

9. Discussion of the Findings

In this study, results showed that the hearing levels of the students in experimental and control groups were poor before intervention as was seen in research questions one and two analysis. It showed mild hearing impairment for both groups as the students were tested after woodwork without the intervention of hearing protective measure (Foam Ear Plug). Which means that exposure to loud noise can cause

temporal or permanent hearing impairment. The study of U.S. Department of Health and Human Services (2015) supports this finding. In that they found out that noise can be harmful when they are too loud, even for a brief time, or when they are both loud and long-lasting. Also Department of Labour (2016) expressed that exposure to high levels of noise can cause permanent hearing loss.

However, the finding showed that the hearing levels of the experimental group appreciated over the control group after intervention because they used hearing protective measures in the use of Foam Ear Plug during their presence at noisy woodwork environment. This appreciation is seen in hypothesis one which lead the researcher to reject the null hypotheses in favour of the alternative. This finding have proved right the assertion of American Speech-Language-Hearing Association (2004) which said that hearing conservation is an attempt to minimize the handicap of hearing impairment. That hearing conservation is prevention of significant permanent hearing loss that may result from on-the-job exposure.

Another finding of this study is in the area of English language performance of the students before intervention. The test result showed poor performance in the subject by experimental and control groups before intervention as shown in research question three analysis. This indicated that learning environment dramatically affects the learning outcomes of students. Noise is a distracting factor to students' academic performance and could course damage to their hearing organ. Opara (2007) study attested to these finding. This researcher discovered that in teaching English reading at schools in noisy environment, noise plays a great role in students' performance in school subjects including English language.

The finding of this study indicated that NTC III students in technical colleges who made use of Foam Ear plug in Sawmill workshop performed better in English language than those who did not. This was clearly seen as tested in hypotheses two postulated. The researcher rejected the null hypotheses and accepted the alternative. This was attested by where t-calculated table values being higher than the t-critical values which showed a significant difference between the post-test mean scores of the experimental group and the control group. To lend credence to this findings, Davis, Elfenbein, Schum, and Bentter (2010) in their study on extensive psychoeducational evaluation revealed that hearing loss of any degree appeared to affect psycho educational development adversely, leading to the conclusion that even minimal hearing loss places students at risk for language and learning problems.

10. Recommendations and Conclusion

Based on these findings, the researcher recommended that hearing conservation programmes should be introduced in technical colleges.

Technical College students learning woodwork and other related subjects should be provided Foam Ear Plug in their workshops as a means of hearing conversation.

In conclusion, this study has shown that learning environment, equipment used by students to learn and hearing levels can play a huge roll in academic performance of students. Authorities in-charge of students in technical colleges' welfare while they learn should at all cost provide them with good learning environment to learn. It is the rule all over the world that those who work with very noisy equipment be provided hearing protection and their hours of noise exposure be monitored. This will go a long way to aid the students preserve their hearing and excel in their academic pursuit.

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