Noise Induced Stresses in School Workshops and Students' Task Performance in Workshop Practice

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Abstract *– The study determined whether noise induced stresses in school workshops affected students' task performance in workshop practice. The study used 185 Nigeria Certificate in Education (NCE) Technical students in 300 Level which comprised 75 and 112 from the Federal Colleges of Education (Technical), Asaba and Omoku respectively. The Noise Stressor and Performance Questionnaire (NSPQ) were used to collect data. The reliability of the instrument was 0.65 using the Cronbach Alpha coefficient test. Data was analyzed using Arithmetic Mean, Standard Deviation; and the hypothesis was tested with Z-test at 0.05 level of significance. From the findings, it was the opinion of the students that noise induced stresses in the school workshops affected task performance in workshop practice. There was no significant difference in the two groups of students that noise induced stresses from power tools and equipment affected their task performance in workshop practice. It was recommended that, noise from workshop power equipment and tools which affected students should be reduced below threshold for them to carry out effective task performance in workshop Practice.*

Keywords*: task, workshop; noise; stressor; stress; equipment/tools; performance; practice*

I. INTRODUCTION

Noise is an unwanted sound or an extraneous sound (Vesilind, Peirce & Weiner, 1997; Asthana & Asthana, 2003; Bell, Greene, Fisher & Baum, 2005; Jain & Rao, 2006). Noise is also a wrong sound in the wrong place at the wrong time (Canter, 1996; O'Cinneide, 2009). Noise according to Sanders and McCormick (1993) is an auditory stimulus bearing no informational relationship to the presence or completion of the immediate task. Bhatia (2001) described noise as a sound without value, it is unwanted, unpleasant or disagreeable sound that cause discomfort and undesired by the recipient. Also Bridger (2003) reported that noise is a sound or sounds at such amplitude as to cause annoyance or to interfere with communication. Further, Heerwagen (2004) defined noise as any sound that interferes with our ability to gather useful information from the world around, that impairs our pursuit of some activity (e.g. sleeping or talking with a friend or performing some work function), or that merely annoys us. According to Miller (2005) noise is any unwanted, disturbing, or harmful sound that impairs or interferes with hearing, causes stress, hampers concentration and work efficiency or causes accidents. In addition, Santra (2005) described noise as a sound that causes irritation on the hearing of healthy human being.

Noise can be emitted from machines, equipment and tools. Industrial noise involves motors and machinery in numerous factories, industries and mills (Bhatia, 2001; Heerwagen, 2004). Machines in industrial and manufacturing process produces noise when the moving parts rub against each other or strike each other or simply vibrate (Heerwagen, 2004). Construction noise originates from pneumatic power machines used in cutting or drilling, concrete mixers, block moulding machines, hoists, cranes, dumpers, etc (O'Cinneide, 2009). Industrial noise particularly from mechanical saws and pneumatic drills are unbearable and a nuisance to the public.

A person's reaction to noise as a stressor mostly involves subjectivity because it cannot be measured (Heerwagen, 2004); and of all the pollutants, noise is the only one that does not leave a residue (Bhatia, 2001). Therefore, noise as a stressor causes stresses in individuals when it produces stress behaviours such as irritation, disturbance, annoyance, distraction, mental fatigue, hearing impairment and affects our ability to

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concentrate and increase work output (Bridger, 2003; Heerwagen, 2004). Noise is a source of annoyance for people exposed to it; with some kind of noises more annoying than others. Though, the types and levels of noise that do so are difficult to determine but depends on how much the noise is unwanted. Annoyance therefore is a frequent result when our mood or emotional strata does not enable us to respond with grace to a noise (Heerwagen, 2004). Many persons who have been exposed to certain noises over long periods of time develop tolerance so that they may not even hear the noises without conscious effort. The same noises may annoy other persons who have not developed the tolerance to such a degree that their efficiency is degraded. They may become more prone to make errors, leading to accidents (Hammer & Price 2002). However, the louder the noise, the more annoying it can be, especially when it is emitted from sources that we cannot control (Bell, Greene, Fisher & Baum, 2005). The extent of annoyance from intrusive sound depends on the sound level and its duration, the listener, the type of use and activity being undertaken at that time. However, it is not possible to state noise levels below which no one will be annoyed and above which everybody will be annoyed (Jones, 2002). Noise also distracts especially when talking to a person in the vicinity can distract the attention of other persons even if it does not annoy them. In this regard, Hammer and Price (2002) observed that accidents have occurred when persons engaged in hazardous activities were spoken to, thus distracting their attention momentarily so that they failed to respond during critical instant.

Uncontrollable noise is more arousing, stressful; and more difficult to adapt to; and requires more attention than it is with controllable noise. Lack of control over noise can lead to psychological reactant and one may attempt to regain freedom of action by trying to assert control. If such efforts are unsuccessful, learned helplessness can result. Noise interferes with the ability to communicate with speech. Most human work depends on verbal communication; and interference with communications can create misunderstandings about information transmitted from one person to another. And when such communications relate to hazardous activities, concentration will suffer and any misunderstanding can lead to accidents. But the degree of interference with speech communication from intensive noise depends on the distance between the talker and the listener, the noise level, and on whether the voice is normal or increased (Jones, 2002). People exposed to noise will therefore experience auditory fatigue and hearing impairment that interferes with receipt of sound and the understanding of speech in sentence form (Hammer & Price 2002; Asthana & Asthana, 2003).

Physiological damage to the ear due to noise occurs when the mechanisms of the ear are incapable of providing self-protection. When noise is very loud and of sufficient duration; it will induce great air pressure which causes damage to the eardrum (Hammer & Price 2002). The amount of hearing damage varies with the sound levels, length and number of times one is exposure, and individuals' susceptibility to noise. So, for a person with hearing loss, what is actually heard can often appear distorted (Heerwagen, 2004). Health or physiological effects may accompany exposure to noise due to stress reactions. Most industrial workers, who are exposed to job-related noise, have been found to experience increased anxiety, arousal, and the feeling of psychological stress. A sudden loud noise will increase aggravate the release of the adrenaline gland into the blood, as the body instinctively prepares to defend itself. This causes fatigue, irritability, headache and anxiety in industrial workers (Bhatia, 2001; Hammer & Price 2002; Asthana & Asthana, 2003).

The noise that causes stresses, also hampers concentration, and causes reduction in the performance of skilled tasks both in terms of production quality and work rates. However, whether noise affects performance adversely, favourably, or not at depends on the intensity, predictability, controllability, the type of task performed, and stress tolerance and other personality characteristics of the individual (Canter, 1996; Heerwagen, 2004; Miller, 2005). Noise interferes with task performance by masking important information thereby making the task more difficult to perform. Task performance is impaired because noise masks the auditory feedback or inner speech by blocking an individual performing a task being able to "hear themselves" think (Bridger, 2003; Bell, Greene, Fisher & Baum, 2005). When inner speech is blocked or cannot be used, noise has more negative effects on task performance or leads to slower performance.

Noise interferes with speech communication and masks useful sounds that characterize the work procedure (Heerwagen, 2004; O'Cinneide, 20096). This usually leads to less efficiency in operation and the ability to perform complex tasks. Further, noise funnels/narrows of an individual performing a task to only the most important aspects of a task leaving out some peripheral information that may also be relevant to the task performance. That is poorer recall of

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peripheral information available during a task or rarely used information (Bell, Greene, Fisher & Baum, 2005) and this could lead to performance decrement. In another report Sanders and McCormick (1993) also observed that at high noise levels, a person typically focuses attention on the most important aspects of task and performance usually suffers if relevant task information is missed owing to this funnelling phenomenon. Thus, work requiring high degree of skill and precision is considerably affected by lack of concentration from noise effect. Noise that causes distraction, disturbance and irritation induces lack of concentration on individuals and this had led to performance decrement. The mildest effect of noise is often physical or mental fatigue and lack of concentration. In industrial situations, this has resulted to low efficiency, reduced work rate, and high potentials for accidents and injuries (Asthana & Asthana, 2003; Blum & Naylor, 2004; Santra, 2005). In addition, noise affects performance of tasks negatively when the noise generated is not a necessary accompaniment to the job. It affects performance in terms of energy loss, arousal, accuracy, motor performance, mental performance, continuous work without rest as well as when two jobs are to be performed simultaneously (Blum & Naylor, 2004). However, noise only reduces the accuracy and quality of task performance but do not affect the quantity of production adversely (O'Cinneide, 2009; Heerwagen, 2004). Further, noise affects motor and mental performance under long exposure. Noise increases worker fatigue, slows motor reflexes leads to mistakes in delicate work and impairs performance where balance is involved (Sanders & McCormick, 1993; Bhatia, 2001; Heerwagen, 2004). However, total productivity in heavy works may not be decreased. Noise also affects perceptual motor tasks when work is continuous without rest pauses by creating gaps in performance where no recorded response is made (Sanders & McCormick, 1993). However, the overall performance may not suffer, but the variability in performances increases. Noise affects the performance of vigilance and complex task especially when an individual must perform two activities simultaneously by momentarily distracting an individual from a task and thereby causing errors (Bell, Greene, Fisher & Baum, 2005). That is, where two tasks are carried out simultaneously it can reduce accuracy in vigilance and precision tasks if the noise is very loud.

In this study, therefore, noise which impinges and threatens the well-being of a person is considered as a stressor while the reaction to the effect of noise stressor on individuals is considered as stress (Bell, Greene, Fisher & Baum, 2005). Further, noise as a stressor has been established to have relative effect on individuals' task performance, and this necessitated the study.

II. PURPOSE OF THE STUDY

The purpose of the study is therefore to determine noise from power equipment/tools as a stressor affect students' task performance in workshop practice. The specific objective is to establish: the extent to which in the opinion of the students noise induced stresses in school workshops affects students' performance in workshop practice; and whether the opinion of students will differ in the extent to which noise induced stresses in workshops will affect their task performance in workshop practice.

III. METHODOLOGY

One hundred and eighty- five 300 level NCE (Technical Education) students in the Federal Colleges of Education (Technical) at Asaba, Delta and Omoku, Rivers State participated in the study. Data were obtained from the Schools of Technical Education during the 2008/2009 academic session and the population of 185 comprised 73 and 112 students from Asaba and Omoku respectively. The third year students were chosen for the study because they offer the entire courses listed in the first and second years of the NCE programme before choosing an area of specialization in third year (National Commission for Colleges of Education, 2008). The NCE (Technical) programme has duration of three years leading to the award of the Nigeria Certificate in education. The colleges were funded by the Federal Government of Nigeria with common workshops used for workshop practice. The final year students are expected to have reasonable knowledge of workshop practice. No sample was taken because the population was manageable.

Data for the study was collected using the Noise Stresses and Performance Questionnaire (NSPQ) designed to elicit students' perception of noise from workshop equipment/power tools as stressor affecting their task performance in workshop practice. The NSPQ instrument contained six items in form of statements and had five response options of; very great extent (VGE), great extent (GE), moderate extent (ME), low extent (LE), and very low extent (VLE) using the 5-point scale.

The Noise Stresses and Performance Questionnaire (NSPQ) was administered to the third year NCE

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(Technical) students of the Schools of Technical Education at the Federal Colleges of Education (Technical), Asaba and Omoku during the 2008/2009 academic session The questionnaire for Omoku was administered by the researcher. A trained research assistant who teaches School Workshop Management administered that of Asaba because the course is offered by all NCE third year students who are expected to be in the lecture when the questionnaire was administered. The research assistant was instructed to tell the students the purpose of the study and to ask them to respond by ticking the options against the question items. The students were given a week or the next lecture period (the one that comes earlier) to submit the completed questionnaire to the research assistant. The researcher personally collected the completed questionnaire from the research assistant. Retrieval of questionnaire was 70 copies from the students at Asaba out of the 73 copies administered, representing 95.89 percent; and 97 copies from students at Omoku out of 112 copies administered, and representing 86.60 percent.

The NSPQ was face-validated by professional colleagues at the Federal College of Education (Technical), Omoku. The reliability of the instrument was tested by using 30 NCE Technical students in 300 Level at Federal College of Education (Technical), Umunze, Anambra State, Nigeria during the 2008/2009 academic session who were not part of the study. The college was used for the test because it ran the same NCE Technical Education programme. The Cronbach Alpha Coefficient test result was 0.55 indicating the reliability of the (NSPQ) instrument.

Data was analyzed using Arithmetic mean and standard deviation to establish the extent to which in the opinion of the students, noise stresses in school workshops affected their task performance in workshop practice. With a 5-point scale, the decision rule assigned to the students' opinion scores were: very great extent, (4.50-5.00); great extent, (3.50-4.49); moderate extent, (2.50-3.49); low extent, (1.50-2.49); and very low extent, (1.00-1.49).

Z-test was used to test significant difference in the opinion of the students from Asaba and Omoku in the extent to which noise induced stresses from workshop equipment and power tools affected their task performance in workshop practice at 0.05 level of significance. Further, if the calculated Z-value is equal to or greater than the critical table value, reject the null hypothesis and if it is otherwise, do not reject the null hypothesis.

IV. RESULTS AND DISCUSSION

The results of the students' opinion scores in Table 1 revealed that noise induced stresses affected task performance in workshop practice to a great extent with Grand Perception Mean (xG) scores of 4.09.

Table 1. Students' Mean opinion Scores on Noise as a Stressor affecting their task Performance in Workshop Practice

	Noise stress indicators	Fed. Coll. of Edu. (Tech.), Asaba		Fed. Coll. of Edu. (Tech.), Omoku		Decision
		X_A	SD_A	X_A	SD_A	
1.	Noise from machines causes irritation (restlessness) which affects tasks requiring greater efficiency.	4.34	0.93	4.11	1.15	Great extent
2.	Noise from machines/power hand tools brings about disturbance (interruption) which affects two motor performance tasks carried out simultaneously.	4.06	1.01	4.14	1.04	Great extent
3.	Noise from machines/power hand tools causes distraction (lack of attention) which affects speed of work.	3.69	1.05	3.90	1.10	Great extent
4.	Noise from machines/power hand tools causes annoyance (anger) which affects accuracy of precision tasks.	3.66	1.18	3.96	1.07	Great extent
5.	Noise from machines causes mental fatigue (lack of concentration) which affects uniformity in task performance.	3.71	1.09	4.27	0.92	Great extent
6.	Noise from machines/power hand tools impaired hearing which affects tasks requiring speech communication.	3.57	1.33	4.16	1.14	Great extent
	Grand mean (X_G)	3.84	1.10	4.09	1.07	Great extent

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In Table 1, the students' Grand Mean **(x_G)** scores of 3.84 and 4.09 for Federal College of Education (Technical), Asaba and their counterparts from Omoku respectively indicated that, it was the opinion of the students from the two colleges that, noise induced stresses from workshop equipment and power tools affected their task performance in workshop practice to a great extent. The Grand Mean Standard Deviations **(x_G)** of 1.01 and 1.07 from the students' opinion scores from Asaba and Omoku were small; not widely dispersed but clustered and close to the mean. This indicated that, the students' opinion scores had a small variability and therefore homogeneous.

From the findings, it was the opinion of the students that noise induced stresses from machines, equipment and power hand tools in the school workshop which caused irritation (restlessness). disturbance (interruption), distraction (lack of attention) annoyance (anger), mental fatigue (lack of concentration); and impaired hearing affected task performance in motor tasks, speed of work, accuracy, uniformity, and tasks requiring speech communication during workshop practice. This finding was consistent with Sundstrom, Town, Rice, Osborn and Brill (1994) and Bhatia (2001,) where they reported that noise stresses emanating from machines, etc in factories and other industrial set up affected the task performance of individuals. Therefore, when excessive noise produced by machines, equipment etc is not minimized in the workshops; students will exhibit noise-related stress-behaviours such as irritation, disturbance, distraction, annoyance, mental fatigue, and impaired hearing which in turn affect their task performance in workshop practice.

The results of the Z-test presented in Table 2 indicated that the Z-calculated of 1.46 was less than the Z-critical value of 1.65. Thus, the null hypothesis was not rejected. Therefore, at $P \leq 0.05$, there was no significant difference in the opinion of the students from Asaba and Omoku in the extent to which noise induced stresses affected their task performance in workshop practice. That is, the opinion of the two groups of students that irritation (restlessness), disturbance (interruption), distraction (lack of attention), annoyance (anger), mental fatigue (lack of concentration) and hearing impairment as noise induced stresses negatively affected their task performance in workshop practice did not differ significantly. This finding agreed with Sundstrom, Town, Rice, Osborn and Brill (1994) who reported that noise bothered employees at work and that nosier work places reduced job satisfaction. Foss, Ison, and Wansack (1989) and Fosnaric and Planinsec (2008) also reported that noise not only impairs hearing ability but also hindered speed, accuracy, variability and uniformity in task performance.

Table 2. Z-test for significant difference in opinion scores from Asaba and Omoku

Lecture halls	N	X	SD	df	Z-calculated	Z-critical	Decision
Fed. Coll. of Edu. (Tech.), Asaba	70	3.84	1.10	165	1.46	1.65	Not significant
Fed. Coll. of Edu. (Tech.), Omoku	97	4.09	1.07				HO: Accepted

V. CONCLUSION AND RECOMMENDATIONS

The study established that, noise from workshop power equipment/tools as perceived by students as stressor affected task performance in workshop practice. Further, the perception of the students did not show a particular preference for any of the stress indicator that affected task performance in workshop practice. The significance of the study was that, no meaningful workshop practice can take place in a school workshop that is characterized by noise stressor from machines/power tools that induces stresses in students. And through scholarly publication of the findings, stakeholders concerned with workshop related programmes shall become aware that noise from machines/power tools can also affect students' workshop practice even where students are taught by competent and qualified teachers.

However, to improve on the present study, a pilot study where students will carry out task performance while exposed to the present noise levels from machines/power tools should be conducted. The performance levels between gender groups should also be ascertained. In addition, a similar study should be carried out based on a gender groups to establish whether their perceptions of noise from machines/power tools as stressor affecting workshop practice shall differ.

Based on the findings of the study, the following recommendations have been made: Noise levels from machines/equipment and other power tools should be reduced to enhance students' task performance in workshop practice. This can be achieved through periodic and regular maintenance to keep the machines free from chatter, impact and

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vibration-generating motion. And where the noise levels of machines are due to frictions of moving parts, loose, worn-out or unbalanced machine parts, such defective parts should be replaced, adjusted, tightened, repaired and lubricated timely.

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