Vibration Induced Stresses from Equipment/Tools in a School Workshop as a Factor Affecting Students' Task Performance in Workshop Practice

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Abstract
The study investigated the effect of perceived vibration induced stresses from equipment/power tools in a school workshop on students' task performance in workshop practice. Seventy-three and one hundred and twelve NCE Technical Education students in 300 Level from Federal Colleges of Education (Technical), Asaba and Omoku, Nigeria respectively during the 2008/2009 academic session was used for the study. The Vibration Stresses and Performance Questionnaire (VSPQ) were used to collect data. Reliability of the instrument was 0.56; and the Arithmetic Mean, Standard Deviation; and the Z-test at $P \leq 0.05$ was used to analyze the data. The perceived vibration induced stresses from equipment/power tools in the school workshop had effect on students' task performance in workshop practice and no significant difference in the mean response scores of students from the two colleges with respect to the effect of perceived vibration induced stresses on their task performance in workshop practice was established. It was recommended that, vibration induced stresses from workshop power equipment/tools which affected students to exhibit stress-related behaviours should be mitigated if effective task performance in workshop Practice must be carried out.
Keywords: Task, workshop, vibration, stressor, stress, equipment/tools, performance, practice, perceive, effective

1. Introduction

The manpower needed for rapid development of a nation is the technical manpower because it induces the acceleration of scientific and technological development. This is in line with the philosophy of the Nigerian Certificate in Education (NCE) Technical programme which is aimed at providing technical teachers with intellectual and professional background adequate for teaching technical subjects and to make them adaptable to any changing situation in technological development not only in the country but in the world at large (National Commission Colleges for Education (NCCE), 2002). The philosophy of the NCE (Technical) programme has not been able to achieve its aim of accelerating scientific and technological development because, the enabling environment has not been provided by policy makers.

In addition, when students in technology and vocational training are exposed to effective workshop practice as opposed to only theoretical teaching, some of the aims of the NCE Technical programme will be achieved. Students exposed to effective practical training utilize the knowledge they acquired in the school workshop and apply it later in future employment in industries or factories that manufactures the products that are related to students' specialized area of study. That is, the practical training received by students in the workshop should compare in terms of skills with that of the industry where the trainee will subsequently work (Elobuike,1998; and Duru 2001). Thus, the philosophy of the NCE (Technical) programme which is aimed at providing technical teachers with intellectual and professional background adequate for teaching technical subjects and to make them adaptable to any changing situation in technological development (NCCE 2002) can only be achieved when students of technical education have adequate manipulative skills in workshop practice.

A lot of research work has been carried out over the years because of the concern among technology and vocational teachers on the need for students to acquire adequate and effective workshop practice. They range from the teachers' instructional method; inadequate workshop spaces, equipment/tools and training materials; entry qualifications of students; and the qualification and experience of the teacher (Enamali 2006; Wodi 2005; Etukudo 2004; Georgewill 1996; Ihiegbulem 1992 and Bajuwoye 1989. However, adequate consideration has not been given to other factors that may contribute to ineffective workshop practice even when some colleges had competent and qualified lecturers who sufficiently engage their students in workshop practice. These research works on the lack of manipulative skills by students in technical education were mostly pedagogical in nature. The study, therefore, considered vibration induced stresses from power equipment and tools as a likely factor that may affect students' task performance in workshop practice. Vibration in this study is a stressor that impinges and threatens the well-being of a person while stresses are the various reactions of an individual to the

effect of the stressor (Bell *et al.* 2005).
The rest of the paper is organized as follows: literature review, section 2; objectives of the study, section, 3; method and material, section 4; results, section, 5; discussion of the findings, section 6 and conclusion/recommendation, section, 7.

2. Literature Review

Cunningham & Saigo (2001) referred to stress as the physical, chemical or emotional factors that places a strain on an organism for which there is inadequate adaptation. Sanders & McCormick (1993) defined stress as, some undesirable condition, circumstance, task or other factors that impinges upon the individual. Some possible sources of physical or psychological stress include heavy work, immobilization, heat and cold, noise, danger, loose or tight situation, uncomfortable chairs, poor lighting and ventilation, continuous bending and standing, overcrowding etc (Sanders & McCormick, 1993; and Jain & Rao 2006).

There are underpinning theories with regard to stress and its effect on an individual's performance. How and why this happens varies from one theory to another. Of relevance to this study are the environmental stress, arousal theory and adaptation level theories. The environmental stress theory viewed environmental elements such as noise, vibration, etc as stressors. Stressors are aversive circumstances that threaten the well-being of a person and impose stress in the person (Bell *et al.* 2005). Stress is the reaction to these environmental circumstances. The reaction to environmental circumstances includes behavioural and physiological components. The behavioural component proposed by (Lazarus, 1983) is called psychological stress, and the physiological component called systemic stress was proposed by (Selye 1980). The two stress reactions are interrelated and do not occur alone; are combined into one theory known as environmental stress theory (Baum, Singer & Baum, 1981; Lazarus & Folkman 1984; Evans & Cohen, 1987).

An appraisal of stressors helps one to determine response to them because persons react to stress positively or negatively. The types of stressor appraisals are the primary appraisal, which involves assessment of threat, and the secondary appraisal, which involves assessment of coping strategies. If an appraisal is 'negative' and an event is seen as being dangerous, responses that prepare a person to cope with it will ensue. The behavioural (psychological and physiological) changes are responses to stress. These changes are in three stages namely alarm reaction, resistance and exhaustion. An alarm reaction to a stressor causes autonomic process (heart rate, adrenaline secretion etc.) to speed up. The resistance occurs when the stress process begins with some autonomic mechanism for coping with the stressor. That is, if heat is the stressor, sweating occurs; if indoor air pollution is the stressor, sneezing, irritation occurs. If these homeostatic (process of body reaction to changes in order to keep the body conditions the same) mechanisms do not restore equilibrium, signs of exhaustion will be observed as the organism enters the state of exhaustion. In addition, environmental stress elements also affect performance. Some tasks carried out following stress can improve performance in simple psychomotor tasks and can also impaired performance in complex tasks (Evans 1978). In a summary, when a person responds to stress, there will be decrease in problem solving abilities, increase in general negativity, impatience, irritability, feeling of worthlessness and emotionality which may lead to negative task performance.

The arousal theory advocated by Duffy (1951) and Scott (1966) has very important consequences for stress and performance of people and the theory suggests that exposure to environmental stimulation increases arousal. The theory stated that arousal is the central state of the activation of the nervous system which underpins preparedness for action and is controlled by the reticular activation system of the brain (Bridger 2003). Hebb & Daneri (1994) defined arousal as the heightening of the brain activity by the arousal centre of the brain known as the reticular formation. That is, when an individual is exposed to environmental elements (noise, vibration, temperature etc), these elements activate the nervous system of the brain and the individual becomes prepared for action. This is physiologically characterized by heightened autonomic (heart rate, adrenaline secretion etc) activity and observed as stress indicators such as increased heart rate, blood pressure, respiratory rate, adrenaline secretion etc; or behaviourally by increased motor activity and self-reported arousal. Therefore, a number of environmental scientists have turned to this concept to explain many of the influences of environmental elements such as vibration, temperature and noise etc on behavioural effects (Broadbent, 1971; Bell, 1981; and Keith & Beith, 1985). Arousal is one of the dimensions on which any environment can be evaluated (Russell & Snodgrass, 1991) such as making distinct predictions about the effects of environment on behaviour of lowered arousal and heightened arousal.

Pleasant and unpleasant stimuli heighten or lower arousal. For example, a good school workshop equipped with relevant machines and tools, and adequately illuminated can just be arousing as a noxious noise or polluted indoor space. Arousal is therefore interpreted according to the emotions displayed by others around us (Schacter & Singer, 1962; Scheier *et al.* 1979; and Reisenzein 1983). When noise increases arousal, it may cause annoyance, irritation or distraction (Geen & O'Neal 1969) which is stress indicators caused by environmental stress factors.

Arousal can also have important consequences for performance. Yerkes-Dodson Law states that performance is maximal at intermediate levels of arousal and gets progressively worse as either arousal falls below or rise above the optimum point. For complex tasks, the optimum level of performance occurs at slightly lower level of arousal than simple tasks (Bell *et al*. 2005). From environment-human behaviour perspective, it is expected that as environmental stimulation from vibration, noise, air pollution, heat or any other sources increases arousal, performance will either improve or deteriorate, depending on whether the affected person's response is below, at or above the optimum arousal level for a particular task (Broadbent 1971; Kahneman 1973; and Hebb & Daneri 1994). Apparently, low arousal is not conducive for maximum performance and extremely high arousal prevents humans from concentrating on the task ahead.

The adaptation level theory which is also known as Wohwill's adaptation level theory of environmental stimulation (Wohwill 1974) suggests that adaptation levels differ from one individual to another and it is a function of experience. Thus, how one evaluates and reacts to a given environment along a particular dimension is in part determined by how much that environment deviates from one's adaptation level on that dimension. The adaptation levels changes with time and depends on exposure to different levels of stimulation. The more the environment deviates from the adaptation level; the more intense the reaction to that environment would be (Belt *et al.* 2005).

Another theory relevant to stress and performance of individuals is the behaviour constraints theory which suggests that the consequence of environmental constraints is the loss of perceived control over environmental stimuli causing the stimulation (Prohansky *et al.* 1970; Rodin & Baum 1982; Stokols 1982, and Zlutnick & Altman 1972). The term 'constraints' means something about the environment that is limiting or interfering with the things an individual intends to do (Bell *et al* 2005). The constraint could be impairment from the environment or our belief that the environment is placing a constraint on us. When a person perceives that environmental events are constraining or restricting the person's behaviour, the person will experience discomfort or negative effect and the individual will try to reassert some control over the situation. This phenomenon is known as reactance (Brehm 1972; Wortman & Brehm 1975). If a person feel that freedom of action is being constrained; psychological reactance will lead an individual to try to regain freedom (Strube &Werner, 1984). But, if a persons' effort to reassert control is unsuccessful in regaining freedom of action, the consequence of loss of control is learned helplessness (Seligman 1975 and Garber & Seligman 1981).

Thus, perceived loss of control has adverse effect on behaviour and that restoring control enhances performance and mental outlook. Simply perceiving that one could have control over the negative effects of vibration, noise, air pollution etc; could reduce the adaptive costs of that stress while perceived loss of control over the presence of air pollution, noise etc reduces efforts to do anything about the problem (Evans & Jacobs 1981). These theories are therefore relevant to this study because it tries to find out whether environmental factors (noise, vibration, etc) which causes stress could affect task performance in a school workshop.

The effect of stress on an individual depends on their frame of reference and attitude, which develops from their inner intuition. One can only react to stressors in form of stress by identifying and recognizing an external stimulus when the stressor impinges on an organism resulting in the feeling of sensation that will give rise to an inner experience. The extent to which stressors affect a person also depends on the stimulus and the impinging energy of the stimulus which must exceed the physiological thresholds (Bridger 2003).

Vibration occurs due to oscillatory motion of a system around an equilibrium position. The system can be in a solid, liquid or gaseous state (Kavianian & Wentz 1996) or the oscillation of a body about a reference position (Bridger 1995). If the energy is sufficient, vibration could be heard as noise or sound (Jones 2002). Vibration is transmitted more easily through solid materials than air. A heavy piece of equipment can transmit vibration through a structure such as frame and flooring of a building to other equipment. Operators in contact with any vibrating equipment may become aware of and be affected by the transmitted vibration (Hammer & Price 2001). Depending on the frequency and amplitude, vibration may be imperceptible or painful and can be detected by human occupants at certain frequencies of amplitude as small as 0.001 mm, even though it is inaudible (Jones 2002).

Sources of vibration in industrial buildings occurs where there is rotation of unbalanced loads or bent shafts; misalignment of driving or driven equipment; impacts of a moving part against another part that is moving or stationary; water hammer in hydraulic systems or due to lack of adequate snubbing devices in pneumatically operated equipment. Vibration can also emanate from high velocity air ducts; looseness of equipment parts, which causes them to rattle; flat spots on bearings or steel wheels; worn and separated treads or nails; or other objects embedded in tyres and belt on gear slippage (Hammers & Price 2002).

Human beings can experience vibration stress through injurious vibration of the skull and other bones, and internal organs. Vibration can lead to annoying muffled sensations in the ears and perceptible chest vibration (Hammer & Price 2002). Vibration causes annoyance to individuals especially when they try to do some fine work while their arms rest on a work table and one becomes extremely annoyed and uncomfortable in trying to control the vibration. Raynaud Syndrome or disease also known as “dead fingers”, or “vibration white finger (VWF) or hand-arm vibration syndrome (HAVS) is another vibration induced stress malady. Raynaud Syndrome is a disease of the blood vessels and nerves of the hand or feet (Kavianian & Wentz 1996; and Bridger 2003). Raynaud’s Syndrome occurs in occupations involving the use of fairly high vibrating operating hand tools such as paving breakers, power sanders, hand-held rotary grinding tools, pneumatic chipping hammers and chisels, and power wrenches that are used for scraping and chipping mental tracks; stone cutting, lumbering and in cleaning departments of foundries. Raynaud’s Syndrome causes pain, numbness and paleness of the skin mainly the fingers due to deficiency in oxygen or reduction of blood flow in the blood vessel and nerve contraction. When deficiency in blood flow occurs, the hands feel cold, often with decreased sensation but if detected early, the disease is reversible and if not, it can cause permanent disability in the use of the hand (Kavianian &Wentz 1996; Hammer & Price 2002). Raynaud’s disease while not being caused by vibrating hand tools (Wentz 1999), can certainly be aggravate by holding vibrating tools for extended periods of time.

Vibration causes blurred vision by affecting the movement of images on the retina of the eye and degrades the coordination of visual capabilities substantially when the critical resonance frequency of the eye balls is approached (Kavianian & Wentz 1996; and Hammer & Price 2002). This affects reading time of meters, and errors become greater when only the display is vibrated. That is, characters of the material being viewed have significant effects on performance in a vibrating situation (Sanders & McCormick 1993). In addition, vibration can cause spinal and nervous systems dislocation, and muscle weakness of individuals in certain occupations, especially when workers are exposed to intense, long-term whole body vibration. The postural stress of sitting drivers or operators occur because they are often exposed to vibration in the vertical plane (trunk) while muscular weakness of individuals can leading to loss of motor control (Sanders & McCormick 1993; Kavianian & Wentz 1996; Bridger 2003; and Blum & Naylor, 2004). Seat designs to minimize the transmission of vibration can reduce the risk of back injury.

The reaction of individuals to vibration stresses can bring about performance decrement especially when visual, motor and neural processes are involved. In this regard Blum & Naylor (2004) reported that, under high vibration conditions, the visual and motor processes of man are affected and this could cause large performance decrement. Bridger (2003) also opined that, vibration affects performance by causing parts of the body essential to the task to resonate such as shoulder girdle, the head, followed by the eyes which can degrade manual and visual actions. Vibration also affects productivity and accuracy because the muscles used for moving parts of the body (hands and legs) in task performance are impaired by vibrating machines. Vibration affects tasks in terms of motor or manual control, visual control reaction time, monitoring, and pattern recognition, speed and accuracy of job production; and thus performance decrement (Sanders & McCormick 1993; Miller 2005; and Heerwagen 2004).

However, no two individuals react in the same way to vibration induced stresses in the same workshop space due to variation in age, state of health, physical activities, type and the physique of the individual and the degree of acclimatization. Further, vibration sensation in terms of comfort or discomfort is subjective and since it is a state of feeling, it depends in part on the person being affected by the vibration situation. Thus, degree to which vibration induced stresses affect the individuals’ performance also varies according to the intensity and ability of the individual to withstand stresses induced by vibration. In addition, an individual can perceive the effect of vibration induced stresses by sensing the stimuli and interprets that which is sensed. Perception therefore involves the detection, identification and the recognition of the stimuli and comparing it with previous experience (Sanders & McCormick 1993; and Bridger 2003).

Literature on related studies have indicated that vibration induced stresses were found to have affected an individual’s task performance. Thus, the consequences of users of a school workshop exhibiting stress related behaviours will be lack of adequate and effective workshop practice, and appropriate manipulative skills. It therefore became necessary to find out whether vibration induced stresses in the school workshop during workshop activities is a factor affecting students’ task performance in workshop practice.

The specific objectives of the study are to find out:

1. The extent to which vibration induced stresses from equipment/tools in a school workshop as a factor affects students’ task performance in workshop practice.
2. Whether the responses of students on the extent vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice will differ.
3. Whether the students will show significance preference for any of the vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice.

In addition, a null hypothesis derived from the research question was postulated thus:

1. The responses of students’ from the Federal Colleges of Education (Technical), South-South, Nigeria on the extent to which vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice will not differ

significantly.

2. Students will show no significance preference for any of the vibration induced stresses from equipment/tools in a school workshop as a factor affect students' task performance in workshop practice.

4. Method and Materials

The two Federal Colleges of Education (Technical) in South-South Nigeria located at Asaba, Delta State and Omoku, Rivers State, Nigeria was used for the study. The study population was 185 NCE Technical Education students in their 300 Levels which comprised 73 and 112 students from Asaba and Omoku respectively during the 2008/2009 academic session. The NCE Technical programme is a three year programme that leads to the award of the Nigerian Certificate in Education (NCE); and the 300 Level students were chosen for the study because they offer the entire courses listed in the first and second years of the programme before choosing specializing in an area in their 300 Level (NCCE, 2008). 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 had reasonable knowledge of workshop practice. No sample was taken because the population was manageable.

The Vibration Stress and Performance Questionnaire (VSPQ) instrument was used to collect data It was a structured questionnaire designed to elicit students' perception responses of vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice. The questionnaire items in the VSPQ were five and each question item in form of statements had five response options of very great extent (VGE), great extent (GE), moderate extent (ME), Low extent (LE), and Very low extent (VLE) in a 5-point scale. The students were expected to choose from any of the options according to how they perceive the effect of the vibration induced stresses on their task performance in workshop practice.

The VSPQ) instrument was face-validated by three professional colleagues in Measurement and Evaluation from the Federal College of Education (Technical), Omoku to ensure that they addressed the purpose of the study. The reliability of the instrument was tested by using 30 NCE Technical students in their 300 Levels 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 runs the same NCE Technical Education programme; and the students were expected to have reasonable knowledge of workshop practice and the use of various machines, equipment and power tools. The Cronbach Alpha Coefficient test result for the VSPQ instrument was 0.56, indicating the reliability of the instrument.

The Vibration Stresses and Performance Questionnaire (ESPQ) were administered to the 300 Level NCE Technical students 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 was offered by all NCE 300 Level students who were expected to be in the lecture when the questionnaire was administered. 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 retrieval; and 97 copies from students at Omoku out of 112 copies administered, and representing 86.60 percent retrieval.

The data was analyzed using arithmetic mean and standard deviation to establish the students responses on the extent to which induced stresses from equipment/tools in a school workshop as a factor affected their students' task performance in workshop practice. Using a 5-point scale, the decision rule assigned on the response scale students' 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).

For the calculation of Standard Deviation (SD), the following formula was used:

$$SD = \{\sum (X - \overline{X})^2/n-1\}^{0.5} \quad (1)$$

Where, X is the scores; $\underline{X}$, the mean and n is the population.

The hypothesis was tested using Z-test of two independent group means at a significance level of 0.05 for two tailed test to establish the responses of students' from the Federal Colleges of Education (Technical), Asaba and Omoku on the extent to which vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice will differ significantly.

The equation for the Z-test (Z) was:

$$\frac{(\overline{X_1} - \overline{X_2})}{\{SD_1/n_1 + SD_2/n_2\}^{0.5}} \quad (2)$$

In addition, the Chi-square (X^2) was also to establish whether the students' responses will show no significance preference for any of the vibration induced stresses from equipment/tools in a school workshop as a factor affect students' task performance in workshop practice.

The formula used for computing the Chi-square (X^2) was: $\{\sum_i \{(O_i – E_i)2/E_i\}$ (3)

Where, $\sum_i$ is summation of all items to i term; O_i is the observed frequencies, and E_i the expected frequencies.

5. Results

The results in Table 1 determined the students responses on vibration induced stresses from equipment/tools in a school workshop such as annoyance (anger), numbness (lack of sense of touch), blurred vision, spinal and nervous system dislocation, and muscle weakness as factors affecting students' task performance in workshop practice.

Table 1: Students' responses on vibration induced stresses on task performance in workshop practice

Assessed vibration stress indicators	Asaba		Omoku		Decision
	X_A	SD_A	X_B	SD_B	
1. Vibration from machines/ power tools causes annoyance which affects accuracy in precision tasks.	3.86	1.16	3.98	1.15	Great extent
2. Vibration from machines/ power tools causes numbness which affects reaction time and manual/motor control performance.	3.53	1.24	3.73	1.20	Great extent
3. Vibration from machines/ power tools causes blurred vision which affects visual control and pattern recognition.	3.83	1.12	3.99	1.04	Great extent
4. Vibration from machines/ power tools causes spinal and nervous system dislocation which affects manual/motor control performance.	3.69	1.37	3.92	1.25	Great extent
5. Vibration from machines/ power tools causes muscle weakness from complete shaking of body which affects productivity and accuracy in precision tasks	3.79	1.19	4.16	1.03	Great extent
Grand mean (X_G)	3.74	1.22	3.96	1.13	Great extent

From the results, the students' Grand Perception Mean (**x_G**) scores of 3.74 and 3.96 for Federal College of Education (Technical), Asaba and Omoku respectively revealed that, vibration induced stresses from equipment/power tools in a school workshop as a factor affected their task performance in workshop practice to a great extent. The Grand Mean Standard Deviations (**x_G**) of 1.22 and 1.13 for the students' response scores from Asaba and Omoku were small; not widely dispersed but clustered and close to the mean. This showed that, the students' perception scores had a small variability and therefore homogeneous.

Hypothesis 1 was to determine whether the responses of students' from the Federal Colleges of Education (Technical), South-South, Nigeria on the extent to which vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice will not differ significantly.

From the result in Table 2, the Z-calculated of 1.18 was less than the Z-table value of 1.65. Therefore, the null hypothesis was not rejected at $P \leq 0.05$. That is, the responses of students from Asaba and Omoku on the extent to which vibration induced stresses from equipment/tools in a school workshop as a factor affecting their task performance in workshop practice did not differ significantly.

Table 2: Z-test for students' responses on vibration induced stresses on task performance in workshop practice

Colleges	N	X	SD	Df	P ≤	Z-calculated	Z-critical	Decision
Asaba	70	3.74	3.74	165	0.05	1.18	1.65	Not significant Ho: not rejected
Omoku	97	3.96	3.96					

Hypothesis 2 was to determine whether the students will show no significance preference for any of the vibration induced stresses from equipment/tools in a school workshop as a factor affect students' task performance in workshop practice.

Table 3: Chi-square (X^2) test for students' responses on vibration induced stresses on task performance in workshop practice

Assessed vibration stress indicators	Asaba	Omoku	Decision
	(X_A^2) Calculated	(X_B^2) Calculated	
1. Vibration from machines/ power tools causes annoyance which affects accuracy in precision tasks.	1.77	0.17	Not significant
2. Vibration from machines/ power tools causes numbness which affects reaction time and manual/motor control performance.	3.47	5.21	
3. Vibration from machines/ power tools causes blurred vision which affects visual control and pattern recognition.	1.99	3.37	
4. Vibration from machines/ power tools causes spinal and nervous system dislocation which affects manual/motor control performance.	3.21	9.67	
5. Vibration from machines/ power tools causes muscle weakness from complete shaking of body which affects productivity and accuracy in precision tasks	0.58	6.63	
Total	11.02	25.05	
$P \leq 0.05$, df=16	(X^2) Table= 26.30		

The resulted presented in table 3 revealed that with (X_A^2) Calculated of 11.02 and 25.05 for students responses from Asaba and Omoku less than the critical table-value of 26.03, the null hypothesis was not rejected. At $P \leq 0.05$ and df of 16, the students did not show significant preference for any of vibration induced stresses such as annoyance (anger), numbness (lack of sense of touch), blurred vision, spinal and nervous system dislocation, and muscle weakness as factors affecting students' task performance in workshop practice. that is all the assessed stress indicators affected workshop practice.

6. Discussion of Findings

The findings revealed that vibration induced stresses affected students' task performance in workshop practice. Thus, it was of the students that vibration from machines, equipment, and power hand tools in the school workshop which caused the vibration induced stresses such as annoyance, numbness (lack of sense of touch), blurred vision spinal and nervous system dislocation, and muscle weakness affected their task performance in reaction time and manual/motor control performance, visual control and pattern recognition and accuracy in precision tasks. This finding agreed with Wentz (999); and Hammer & Price (2002) and Bridger (2003); who observed that vibration stresses which causes numbness, blurred vision, muscle weakness, and whole body vibration reduces motor performance of individuals and increases errors and makes complex tasks difficult to perform.

It was also the response of the students that vibration from machines/ power tools caused annoyance, and this affected their accuracy in precision tasks. In this regard, Hammer & Price (2002) opined that, vibration can lead to annoying muffled sensations in the ears and perceptible chest vibration and that, vibration caused annoyance to individuals especially when they try to do some fine work while their arms rest on a work table and one becomes extremely annoyed and uncomfortable in trying to control the vibration. From the findings, vibration from machines/ power tools caused numbness which affected students' reaction time and manual/motor control performance during workshop practice. In a related study on vibration aspects: operator safety defined by new directives, Deboli & Calvo (2004) reported that power tools not professionally suitable caused Vibration White Finger (VWF) or Hand-arm Vibration Syndrome (HAVS) and a consequent high economic and social cost.

Further, it was the response of the students that, vibration from machines/ power tools caused blurred vision which affected visual control and pattern recognition. This finding was in agreement with Chao (2003) who in a study on the effects of motions on visual and manual control observed that, visual performance of subjects reading from a navigation screen installed aboard a ship in motion due to the effect of sea waves was affected when certain character size, display type and screen background colour combination was used as the ship rolled.

In addition, vibration from machines/ power tools caused spinal and nervous system dislocation and it affected manual/motor control performance as perceived by the students. In the same vein, Ismail, Haniff, Kim, Deros & Makhtar (2010) in a survey on environmental factors and job satisfaction among operators in automotive industry reported that, operators assembling automotive components agreed that, vibration from vibrating tools hurt their body and that, there was a significant link between vibration from vibrating tools and job satisfaction. Also, it was the perception of the students that, vibration from machines/ power tools caused muscle weakness from complete shaking of body and it affected productivity and accuracy in precision tasks. The finding is consistent with Zinck (1989) who tried to quantify the levels of both whole-body and hand-arm vibration that employees are exposed to on the job; and to determine if certain jobs/employees are at risk of developing vibration-related disorder. The study established that, vibrations from power hand tools or operating vibrating machinery with the operators seated inside them affected operators personal comfort and decreased proficiency in tasks.

There was no significant difference in the students' response scores on the extent to which vibration induced stresses in a school workshop as a factor affecting the task performance their performance in workshop practice from Federal Colleges of Education (Technical), Asaba and Omoku respectively. In addition, the students did not show a significant preference for any of the vibration induced stresses in the school workshop as factors affecting their task performance in workshop practice. Thus, annoyance, numbness, blurred vision and muscle weakness which are vibration induced stresses affect students' task performance in workshop practice in terms of reaction time and manual/motor control performance, visual control, pattern recognition and accuracy in precision tasks.

7. Conclusion/Recommendations

The findings of the study indicated that vibration induced stresses in the school workshop as responded by the students affected their task performance in workshop practice. Further, the response scores of the students from the Federal College of Education (Technical), Asaba and their counterparts from Omoku did not differ significantly on whether vibration induced stresses as a factor affected their task performance in workshop practice. Also, the students did not show a significant preference for any of the vibration induced stresses in the school workshop as factors affecting their task performance in workshop practice. The significance of the study was that, a school workshop characterized by vibration induced stresses from machines and power tools can assure effective workshop practice.

It is expected that through scholarly publication of the findings, stakeholders concerned with the use of workshop for teaching/learning shall become aware that even when where students are taught by qualified and competent instructors, workshop can still be affected negatively if the deleterious effects of vibration induced stresses are not reduced to desirable levels.

Based on the findings of the study, it was recommended that vibration levels from machines, equipment and other power tools should be mitigated to enhance students' task performance in workshop practice. This can be achieved by keeping the machines free from chatter, impact and vibration-generating motion through periodic and regular maintenance. 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. In addition, equipment that might vibrate should be rigidly mounted with tightly kept foundation bolts on firm solid foundations or blocks of concrete that are isolated from the building structure by large wooden blocks and thin pads of cork.

In addition, to improve on the present study, a pilot study where students will carry out task performance while exposed to the present vibration 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 gender groups to establish whether their perceptions of vibration from machines/power tools as a stressor affecting workshop practice shall differ.

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