
Strategies for Preventing Accidents and Maintaining Industrial Safety in Technical Education Workshops

By

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ABSTRACT

This study determined the strategies for preventing industrial accidents in technical education workshops in technical colleges in Edo and Delta States, Nigeria. Descriptive survey research design was adopted for the study. Two research questions were formulated to guide this study and two null hypotheses were tested at .05 level of significance. The population of the study consisted of 316 respondents from medium scale industries (34), technical teachers (129) and final year students (153) in technical colleges from the colleges of education in the two states. The population was manageable; hence census sampling technique was adopted using the entire population for the study. Ninety (90) items questionnaire derived from literature was the instrument used for data collection. The instrument was face-validated by five experts. The instrument was pilot tested, data collected were subjected into reliability test using Cronbach's alpha, and the analysis gave reliability coefficient of .86. The data collected from this study were analyzed using mean and Analysis of Variance (ANOVA) to test the null hypotheses. The findings from this study revealed among others that the safety practices were required to prevent accidents and maintain safety in the workshops. It was recommended amongst others that the safety practices as identified in this study be practiced and adhered to maintain an accident free workshop.

Keywords: Technical Education, Workshop, Industrial Safety

INTRODUCTION

Accidents in workshops are inevitable but adequate precaution could help to minimize any danger can be harmful to students of workers when discharging their duties. Safety is a fundamental concern for the industrial and health workers and employers in business organization. This probably explained why Macintosh and Gough (2004) earlier posited that the safety and health in the workplace have become an integral component to the viability of business for employers, labour unions, governments, and environmentalists in general. The right to life is the most fundamental right. Workers are fully entitled to safety of their lives and health. To this end, ILO (1985) maintained that every worker has a right of access to occupational health and safety services, irrespective of the sector of the economy, size of the company, or type of assignment and occupation. In some cases, when employees are involved in accidents, they lose their lives and this could impair the economy of their organization. According to ILO (2013) 2.34 million men and women are deprived of that right by occupational accidents and work related diseases. ILO estimated that 2.34 people die globally yearly as a result of their work from occupational accidents

and work-related diseases. This is more than 6,000 victims per day, about twice as many as in the World Trade Centre tragedy – each and every day of the year. Unfortunately, there are no particular reliable records of occupational hazards of victims in developing countries including Nigeria (Okolie & Okoye, 2012 in Anaele, Adelakun & Olumoko, 2014). According to the World Health Organization (WHO) (2006), poor occupational health and reduced working capacity of workers may cause economic loss up to 10-20 percent of the Gross National Product of a country. It therefore becomes imperative that adequate care be taken in Technical Education workshops to avoid hazards as a good training practice for technical education students who subsequently would compose the employees in various industries in Nigeria.

Safety in technical education workshops connotes relative freedom from risks or hazards on students and staff. It includes good preservation of workshop materials, tools and machines. Safe use of tools and machines are also included in safety regulations in the workshops. Ezeji and Onoh (2008) defined safety as planned measures or precautions that are taken to control or prevent situations and acts in an endeavour to prevent injuries to the persons concerned, injuries to others who may be around the working place and damage to workshop equipment and materials. According to Work Accident Helpline (2014), it is better to be careful 100 times than to get killed once. Lack of adequate safety measures in technical education workshops would lead to hazards that would eventually negatively affect practical skill acquisition by students.

Industrial safety is the strategic policies, plans or measures put in place to forestall accidents to workers, people around and break down materials, tools and equipment (Anaele, Adelakun & Olumoko, 2014). Industrial safety is the measure supervised by the personnel in charge of workshops and laboratories to forestall or reduce incidences of hazards to workshops users and prevent the breakdown of tools, equipment and machines. Safety policies include all activities and precautions taken by workshop personnel to ensure occupational safety from injury to health or life. The government and employers of labour are also required to enforce the necessary regulations that would help forestall occupational hazards. These include regular training, regular maintenance, and government regulations, among others which are related to the activities conducted under technical education programmes.

Technical education has been recognized as that education which provides its recipients with practical skills and basic scientific knowledge to practice a chosen occupation in the world of work. It is the education that is designed technically and systematically to accommodate both the trainer and the trainee to enable the trainee acquire the basic knowledge, skills, abilities, understanding and attitudes needed for one's efficient performance in his or her chosen occupational career for self-reliance and national development. It is the education that deals with the acquisition of knowledge, skills, understanding and attitude to perform effectively in the world of work (Oviawe & Adeola, 2017). To Wapmuk (2011), technical education is a study or programmes that skillfully prepare people for effective performance on practical tasks. It involves the acquisition of skills and competencies that can help individuals to function productively in industrial and business occupations. According to UNESCO (2016), technical, vocational education and training is a comprehensive term referring to those aspects of the educational processes involving, in addition to general education, the study of technologies and related science, the acquisition of knowledge, practical skills and attitude relating to occupations in various sectors of economic and

social life. Technical education involves the study of techniques, related sciences, acquisition of practical skills, attitudes and knowledge relating to occupational sector and economic life. The primary aim of technical education is to equip its recipients with manipulative skills for gainful employment. Technical education is a formidable force that will imbue the individual with appropriate skills, knowledge, abilities and competencies that will enable the person become self-employed and self-reliant towards sustainable economic development (Oviawe & Adeola, 2017). Oni (2007) in Anaele, Adelakun and Olumoko, (2014) defined technical education as the education that provides the recipients with the basic knowledge and practical skills needed for entry into the world of work as employees or self-employed. The objectives of Technical education as stated by the Federal Republic of Nigeria (FRN) (2013) are:

- i. provide trained manpower in applied science, technology and commerce particularly at sub-professional level;
- ii. provide the technical knowledge and vocational skills necessary for agricultural, industrial, commercial and economic development;
- iii. produce people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man;
- iv. give an introduction to professional studies in engineering and other technologies;
- v. give training and impart the necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant; and
- vi. enable young men and women have an intelligent understanding of the increasing complexity of technology.

Towards achieving these laudable objectives, adequate workshop properly provided with safety measures is essential in achieving practical skills by students who are future employees to the world of work.

Safety in the workplace or workshop environment is inseparable from economic and social environment for human progress. Hazards in working place causes severe pain, sufferings as well as economic losses to victims, their families, the workplace and society at large. Workshop hazards are many and vary from electricity, use of wrong tools for jobs, unchecked or unguarded machines, and slippery floors, among others. Inadequate training of students on workshop regulations might make the students to continue the wrong attitudes to safety in industries upon graduation. Industrial safety has been a major universal issue in view of the fact that workplaces are innately risky with hazards which can kill, injure, and cause illness and diseases to employees and other people around the industry. Safety and health in the workplace have become an integral component to the viability of business for employers, labour unions, governments, and environmentalists in general (Anaele, Adelakun & Olumoko, 2014). The right to life is the most fundamental right. Yet, it seems that the level of awareness on the issue is still low. To this end, Anaele, et al stated that safety measures and practices in Nigerian appear to fall below expectation. There are a lot of industries currently battling with enormous occupational accidents especially in developing countries including Nigeria. Nations globally are expected to value the lives of her citizens and device measures to reduce incessant cases of industrial accidents and its attendant effects. Adebisi (2006) posited that there is higher incidence of fatal work-related injuries in developing world than in the developed ones despite attempts by succeeding government and administrations to salvage

the situation through the enactment of laws and its enforcement. It is against this background that this study was carried out to determine strategies for maintaining industrial safety in technical education workshops towards enhancing economic development and diversification in Edo and Delta States technical colleges in Nigeria.

Purpose of the Study

The purpose of this study was to determine the strategies for enhancing industrial safety in technical education workshop in technical colleges in Edo and Delta States of Nigeria. Specifically, this study sought to find out the basic:

1. Causes of accidents in the technical education workshop/workplace; and
2. Requirement and strategies to be adopted by school management to prevent workshop accidents in technical education workshops.

METHODOLOGY

This study was conducted using descriptive survey research design on the strategies for enhancing industrial safety in technical education workshop in technical colleges in Edo and Delta States of Nigeria. The population for the study consisted of all the 34 employers in medium scale industries; 129 technical teachers and 153 final year students in technical colleges in Edo and Delta States of Nigeria. Since the population was few, the entire population was used. Therefore, there was no sample. The instrument used for data collection was a 90-item questionnaire derived from literature. The item was structured in five point Likert scale of Strongly Agree (SA), 5 points; Agree (A), 4 points; Undecided (U), 3 points; Disagree (D) 2 points and Strongly Disagree (SD), 1 point. It consisted of two sections. Section A addressed the basic causes of accidents in the workshop while section B dealt with the basic requirements and strategies to be provided by management towards the prevention of workshop accidents.

The instrument was face validated by five experts in technical education and test and measurements. Based on their suggestions, modifications were made which resulted in the final draft used for this study. A pilot study was conducted in Federal College of Education Okene, Kogi state. Data collected from pilot study were subjected to reliability test using Cronbach's alpha. Reliability coefficient of .86 was obtained. Three hundred and sixteen (316) copies of questionnaire were administered to the respondents assisted by five research assistants. The entire 316 questionnaires were duly completed and returned. The data collected for this study were analyzed using mean score to answer the research questions and Analysis of Variance (ANOVA) to test difference among the items responses obtained at .05 level of significance.

RESULTS

Research Question 1: What are the basic causes of accidents in the workshop?

Table 1: Mean and Analysis of Variance (ANOVA) used to answer research question one

S/No.	Items	X	SD	P-value	Remarks
Personality Traits					
1.	Lack of required skills	4.56	0.75	0.61	Agreed/NS
2.	Being mentally unfit in form of nervousness, mental derangement and intolerance	4.78	0.71	0.71	Agreed/NS
3.	Lack of concentration	4.65	0.76	0.67	Agreed/NS
4.	Disobedience through defiance of safety rules and Regulations	4.35	0.64	0.96	Agreed/NS
5.	Being physically unfit in age, health or illness	4.63	0.74	0.81	Agreed/NS
6.	Exhibiting over confidence, hastiness, or laziness	4.50	0.72	0.58	Agreed/NS
Unsafe Acts					
7.	Operating equipment without authority	4.51	0.76	0.67	Agreed/NS
8.	Operating machines without guards	4.38	0.71	0.87	Agreed/NS
9.	Non-availability of protective equipment	4.64	0.78	0.72	Agreed/NS
10.	Making adjustment while operating tools and Equipment	4.31	0.70	0.91	Agreed/NS
11.	Inadequate application of protective gargets	4.73	0.75	0.64	Agreed/NS
12.	Wrong body posture when lifting	4.29	0.71	0.78	Agreed/NS
13.	Wrong posture during practical work	4.36	0.57	0.99	Agreed/NS
14.	Improper dressing (wearing of loose clothing, long hair, large earrings) while operating machines	4.71	0.73	0.51	Agreed/NS
15.	Engaging in shortcut activities	4.56	0.70	0.47	Agreed/NS
16.	Engaging in horse play activities around working areas	4.76	0.75	0.57	Agreed/NS
17.	Distracting, teasing, abusing and startling others during work	4.44	0.57	0.26	Agreed/NS
18.	Working ay unsafe speed such as speeding up motors	4.59	0.72	0.80	Agreed/NS
Work Environment Factor					
19.	Poorly designed and constructed building	4.67	0.74	0.74	Agreed/NS
20.	Poorly installed equipment	4.64	0.68	0.90	Agreed/NS
21.	Utilization of malfunctioning equipment	4.64	0.74	0.64	Agreed/NS
22.	Poor layout of workshop	4.59	0.76	0.79	Agreed/NS
23.	Improper location of emergency exit	4.71	0.73	0.43	Agreed/NS
24.	Lack of illumination	4.66	0.72	0.83	Agreed/NS

25.	Defective materials, tools, equipment and machines	4.59	0.65	0.96	Agreed/NS
26.	Improper housekeeping	4.64	0.74	0.64	Agreed/NS
27.	Non-availability of fire extinguisher	4.54	0.88	0.99	Agreed/NS
28.	Poor management of waste	4.63	0.85	0.68	Agreed/NS
29.	Use of obsolete tools, equipment and machines	4.38	0.90	0.54	Agreed/NS
30.	Inadequate ventilation	4.59	0.76	0.79	Agreed/NS
31.	Lack of rests and breaks between working hours	4.58	0.76	0.79	Agreed/NS

In response to research question 1, Table 1 reveals that all the 31 items stated as causes of accidents in technical education workshops were rated by the respondents as agreed with mean ratings ranging from 4.28 to 4.78; with their standard deviation ranging from 0.54 to 0.90 which are positive indicating that the respondents were not far from the mean and were close to each other in their perceptions. This help to add value to the mean. Table 1 also reveals that the 31 items had their P-value ranging from 0.26 to 0.99 which are greater than .05 implying that there was no significant difference in the mean ratings of the respondents on their perception on the basic causes of accidents in the school workshop.

Research Question 2: What are the basic requirements and strategies to be provided by management towards the prevention of workshop accidents?

Table 2: Mean and Analysis of Variance (ANOVA) used to answer research question two

S/No.	Items	X	SD	P-value	Remarks
1.	Report any accident immediately it occurs	4.66	0.88	0.55	Agreed/NS
2.	Ensure tools are properly sharpened before use	4.51	0.67	0.99	Agreed/NS
3.	All tools and equipment must be maintained in good condition	4.63	0.71	0.83	Agreed/NS
4.	Arrange tools in tool racks and boxes when not in use	4.55	0.78	0.63	Agreed/NS
5.	Only appropriate tools should be used for given tasks	4.37	0.81	0.53	Agreed/NS
6.	Do not operate tools, equipment and machines unless you are authorized to do so	4.64	0.74	0.44	Agreed/NS
7.	Do not operate tools, equipment and machines when under the influence of drugs	4.69	0.75	0.98	Agreed/NS
8.	Do not operate machines when tired	4.58	0.72	0.66	Agreed/NS
9.	Examine machine blades and belts for crack before Use	4.71	0.63	0.99	Agreed/NS
10.	Do not leave machines running unattended to	4.63	0.64	0.81	Agreed/NS
11.	Wear insulated gloves when working on electrical Gadgets	4.69	0.75	0.98	Agreed/NS

S/No.	Items	X	SD	P-value	Remarks
12.	Put on welding gloves during welding operations	4.73	0.70	0.98	Agreed/NS
13.	Put on safety boots to prevent crushed toes when working around heavy equipment or falling objects	4.59	0.71	0.81	Agreed/NS
14.	Do not leave machines until they come to a complete Stop	4.32	0.98	0.91	Agreed/NS
15.	Put on other personal protective equipment during operations	4.60	0.85	0.58	Agreed/NS
16.	Do not operate equipment and machines you are not trained to use	4.55	0.65	0.70	Agreed/NS
17.	Do not use tools (screw drivers, files, scrapers) without handles	4.54	0.72	0.71	Agreed/NS
18.	Ensure good housekeeping	4.56	0.69	0.64	Agreed/NS
19.	Do not wear loose clothing and large jewelries while operating machines	4.62	0.85	0.69	Agreed/NS
20.	Ensure proper lock out from power source before cleaning, repairing or making any adjustment on machines	4.33	0.79	0.68	Agreed/NS
21.	Properly wear (button) workshop coats	4.61	0.78	0.69	Agreed/NS
22.	Ensure other people are out of danger zone before switching on machines	4.58	0.87	0.81	Agreed/NS
23.	Ensure machine guards are in place before starting any operation	4.58	0.76	0.90	Agreed/NS
24.	Check machine oil levels before attempting to use them	4.62	0.79	0.78	Agreed/NS
25.	Do not lift heavy equipment manually	4.63	0.87	0.73	Agreed/NS
26.	Clamp down and secure all work pieces when drilling or milling	4.67	0.87	0.88	Agreed/NS
27.	Do not allow any spliced electrical cords or wiring	4.65	0.80	0.56	Agreed/NS
28.	Provide safe work environment	4.64	0.68	0.90	Agreed/NS
29.	Ensure danger notices are placed at strategic areas	4.71	0.63	0.99	Agreed/NS
30.	Always conduct regular inspection in the workshop	4.63	0.71	0.83	Agreed/NS
31.	Ensure management commitment to safety	4.64	0.74	0.44	Agreed/NS
32.	Develop and implement safe work rules and procedures	4.60	0.85	0.58	Agreed/NS
33.	Enforce safety rules and appropriate discipline	4.67	0.74	0.73	Agreed/NS

S/No.	Items	X	SD	P-value	Remarks
	where necessary				
34.	Provision of adequate safety equipment (safety boots, goggles) in the workshops	4.73	0.75	0.64	Agreed/NS
35.	Ensure workshop users put on their safety equipment in relation to hazards	4.78	0.71	0.70	Agreed/NS
36.	Provide on-going safety training	4.64	0.73	0.81	Agreed/NS
37.	Provide machine start and stop button within easy and convenient reach of operator	4.65	0.76	0.67	Agreed/NS
38.	Tools and equipment must be maintained in good Condition	4.76	0.75	0.57	Agreed/NS
39.	Provide adequate space around machines	4.66	0.72	0.83	Agreed/NS
40.	Horse play, alcohol or drugs should not be allowed in the workshop	4.58	0.72	0.66	Agreed/NS
41.	Ensure cleanliness of workshop	4.55	0.78	0.63	Agreed/NS
42.	Provide adequate lighting				
43.	Ensure safety devices are put in place or worn before carrying out any operation	4.51	0.67	0.99	Agreed/NS
44.	Ensure prime movers such as flywheel are fenced from workshop users	4.37	0.81	0.53	Agreed/NS
45.	Ensure transmission machinery are fenced	4.54	0.72	0.71	Agreed/NS
46.	Provide safe access and safe exit in the workshop	4.56	0.69	0.64	Agreed/NS
47.	Provide respirators and nose masks for workers in high dusty work zones	4.62	0.85	0.69	Agreed/NS
48.	Ensure cranes and other lifting equipment are checked at least once in every six months	4.58	0.76	0.90	Agreed/NS
49.	Make safety provisions in case of fire	4.32	0.98	0.91	Agreed/NS
50.	Provide first aids facilities in case of accident	4.63	0.64	0.81	Agreed/NS
51.	Ensure adequate ventilation in the workshop	4.59	0.71	0.81	Agreed/NS
52.	Provide good drinking water	4.32	0.98	0.90	Agreed/NS
53.	Provide washing facilities	4.33	0.79	0.68	Agreed/NS
54.	Provide accommodation for clothing	4.37	0.81	0.53	Agreed/NS
55.	Provide facility for removal of dust and fume	4.59	0.65	0.96	Agreed/NS
56.	Provide adequate emergency exit	4.63	0.85	0.68	Agreed/NS
57.	Ensure adequate maintenance of equipment to prevent defects	4.64	0.74	0.64	Agreed/NS
58.	Enlighten workshop users of the inherent dangers of a machine and the way out	4.63	0.85	0.68	Agreed/NS
59.	Ensure adequate communication between management and workshop users	4.71	0.63	0.99	Agreed/NS

In response to research question 2, Table 2 reveals that the respondents rated all the 59 items stated as basic requirements and strategies to be provided by management towards the prevention of workshop accidents as agreed with mean ratings ranging from 4.3 to 4.78 with their standard deviation ranging from 0.63 to 0.98 which are positive indicating that the respondents were not far from the mean and were close to each other in their perceptions. This help to add value to the mean. Table 2 also reveals that the 59 items had their P-value ranging from 0.44 to 0.99 which are greater than .05 implying that there was no significant difference in the mean ratings of the respondents on their perception on the basic requirements and strategies to be provided by management towards the prevention of workshop accidents.

DISCUSSION OF FINDINGS

The findings from Table 1 indicates that all the 31 items stated as causes of accidents in technical education workshops were rated by the respondents as agreed with mean ratings ranging from 4.28 to 4.78. This finding is in line with the assertion of Ezeji and Onoh (2008) that the causes of accidents are personality traits such as being physically fit in age, health or illness; exhibiting over confidence, hastiness, laziness; unsafe acts or practices such as operating an equipment without authority, operating machine without guards and work environment factor like poorly designed and constructed building with slippery floors and poorly installed equipment. Table 1 also reveals that the 31 items had their P-value ranging from 0.26 to 0.99 which are greater than. This implies that there was no significant difference in the mean ratings of the respondents on their perception on the basic causes of accidents in the school workshop.

The findings in Table 2 reveals that the respondents rated all the 59 items stated as basic requirements and strategies to be provided by management towards the prevention of workshop accidents as agreed with mean ratings ranging from 4.32 to 4.78. This finding corroborates the assertion of Frankenmuth Safety Programme (2014), Anaele, Adelakun and Olumoko (2014), Canadian Center for Occupational Health and Safety (2012) that all injuries must be reported as soon as possible, personal protective equipment must be worn as prescribed by management, all tools/equipment must be maintained in good condition, only appropriate tools shall be used for specific jobs and guards must be kept in place before operations. Also in line with the finding of this study, Occupational Safety and Health Act (2013) posited that employers are to provide workers with a safe work environment, ensure good lighting, ventilation, good house-keeping, protection of prime movers, precautions in places where dangerous fumes are likely to be present and safety provisions in case of fire. Table 2 also reveals that the 59 items had their P-value ranging from 0.44 to 0.99 which are greater than .05. This implies that there was no significant difference in the mean ratings of the respondents on their perception on the basic requirements and strategies to be provided by management towards the prevention of workshop accidents.

CONCLUSION AND RECOMMENDATIONS

Occupational accidents cause dreadful human pain and suffering, as well as economic losses to the victims, family members, the industries and the society at large. This makes the issue and of industrial safety fundamental to be taken and given priority attention it deserves in order to save lives, the industries and society. Based on the findings from this study, the following recommendations are made:

1. It was recommended amongst others that the safety practices as identified in this study be practiced to maintain an accident free workshop.
2. Government should ensure that all safety gadgets required against exposure to accidents and other hazards for operation in the workshops are made available

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