CHAPTER ONE

INTRODUCTION

Background to the Study

The fundamental emphasis of technical and vocational education programme is skills development. Technical education borders on acquisition of knowledge and skills in trades like woodwork, metalwork, electrical installations, electronics, block/bricklaying and concreting, welding and fabrication, fitting and machining and auto-mechanics. Other trades are carpentry and furniture crafts, painting and decorating; and plumbing works. The skills are necessary for employment and help workers to update and upgrade their job performance so as to retain their jobs in both the private and public sectors of the economy. Such skills include fitting, machining, milling, jointing and cutting skill among others. This is consistent with the National Policy on Education (Federal Republic of Nigeria, 2013), which provides that one of the prime objectives of vocational and technical education is to give training and impart the necessary skills leading to the production of craftsmen, technicians and skilled personnel who will be enterprising and self-reliant.

Ogalanya (2000) stated that technology education helps to provide adequate skills, knowledge and practical experiences to individuals with a wide range of abilities. On the other hand, Yayirus (2003) observed that practical skills are not just acquired in the open field; rather they are developed in the workshops or

laboratories replete with appropriate tools, equipment and other necessary facilities. Ogwa (2009) reported that skills acquisition is most successful when adequate practical work is employed in the implementation of technical and vocational training. That is to say, to give training and impart the required skills to people; tools and equipment must be utilized. Nwankwo (2011) affirmed that the availability of various machine tools, even the most up-to-date ones, in sufficient quantities does not itself ensure efficient and highly productive operation of an industrial enterprise without the appropriate use of those machine tools and equipment. The utilization of workshop facilities like tools, equipment, safety devices, consumable and non-consumable materials are of paramount importance to teaching and learning in vocational and technical education for the development of practical skills of the students.

Odu (2011) stated that hand tools, machines and instructional material facilities may be available in abundance but without well trained technical teachers to manage these facilities, learning cannot take place. Technical teachers consist of trained teachers in different areas of technology such as electrical/electronic, building, woodwork, plumbing, carpentry and joinery, auto mechanics and metalwork. Technical teachers, males and females alike, are those that give the training and transmit the facts, knowledge, skills, and attitudes, and to the learners within the instructional system and as may be applied to the world of work. Some

of the technical teachers in Kwara and Kogi States are old on the job and are experienced having spent more than six years, while some of them are young on the job with less than six years teaching experience. For anybody to assume the duty of a technical teacher, such a person is expected to possess the needed competencies for imparting technical knowledge and skills, especially when a desirable emphasis is on competency-based learning (Davies, 2001). According to Ekpenyong (2008), technical teachers must be versatile in their areas of specialization and in science education courses as well as in workshop organization and management. Technical teachers transmit the relevant practical skills by demonstrating before the students the tasks to be performed, while the students in turn are expected to acquire the skills by practising the skills in a workshop as soon as the demonstration is over.

The workshop is where the interactions take place. Okorie (2001) explained that technical college workshop is a place where the learner may experiment, test, construct, dismantle, repair, design, create, imagine, and study. Going by this, a workshop is an essential facility for the study and practice of technical and vocational education. Normally, the workshops should be equipped with tools, machines and raw materials similar to those in the industrial workshops. Umunadi (2010) indicated that technical college workshops should have the same equipment, tools and materials in terms of types, designs, and specifications with

the industry where the students will eventually work after training. Workshops are expected to be equipped with a variety of tools and machines that range from simple hand-operated machines to complex computer-controlled machines capable of great precision for teaching and learning processes. Technical college equipment include lathe machines, shaping machines, rolling machines, drilling machines, cutting machines, welding machines, circular saw, guillotine and various hand tools such as hacksaws, files, pincers, pliers, drills, soldering iron, and spanners that are required for imparting practical knowledge and skills to the students. Workshops also contain a wide variety of toxics, inflammables, corrosive or reactive compounds such as sulphuric acids and oxyacetylene. In the process of trying to use these machines and materials, accident could occur; therefore workshop users (both technical personnel and students) are prone to accidents.

It is stated in the National Policy on Education (FRN, 2013) that the Federal government of Nigeria has adopted education as an instrument of effecting national development. This was the desire behind the establishment of technical colleges in both urban and rural areas. The idea therefore is aimed at bringing education to the door post of all Nigerians. The system seems to have contributed immensely towards balancing educational between the urban and rural dwellers. However, the types of equipment and tools avoidable in the urban and rural workshops could

vary in accordance with the environment. Perhaps what is not clear yet is the effect of localization of technical college workshops in these areas.

In human settlements urban stands for an area that is characterized by human population and vast human built-up infrastructures while rural areas have a low population and small settlement with scanty infrastructures. Health, education, employment, and development facilities are thousands times better in urban as compared to rural areas. This wholesome situation seems to have not attracted qualified teachers from working in rural areas. Obasi (2011) reported that urban schools have more concentration of qualified graduate teachers; students of the same subjects in rural schools are compelled to make do with either unqualified teachers or none at all. Perhaps the differences in opportunities offered for imparting and acquiring of skills in both urban and rural environment could affect workshop accidents

Okeke and Oranu (2006) noted that wherever tools and machines are used, accidents will likely occur despite the best efforts. Similarly Uwaifo (2009) observed that it is an indisputable fact that wherever work is done with machines or hand tools, there is likelihood of accident occurring, causing injuries to people, damage to machines, tools and materials in such a workplace. Accident may be defined as an undesirable, unplanned, un-controlled event or a sudden miss-hap which interrupts an activity or function and could result in physical harm to

person(s) or damage to property or equipment. Kadiri (2006), and Okeke and Oranu (2006) variously reported that an accident may be the result of an unsafe act or unsafe condition. Unsafe acts are human factors that cause accidents, while unsafe conditions are environmental factors that cause accidents. These situations can be related, since an individual's unsafe act can result in an unsafe condition for someone else. Kadiri (2006) defined an unsafe act as any act on the part of a person, which will increase the chances of having an accident. Kadiri further defined unsafe condition as that condition within the work environment which increases the worker's chances of having an accident.

Offonmbuk and Ekereobong (2012) reported that accidents are common in technical college workshops. This supported Olateju (2005) who revealed that accidents often occur in vocational and technical education workshops. Olateju listed such accidents to include electric-shock, cuts from sharp objects, eye injury, burns of various degrees, and fall from heights, slips, and fire incidence. There were instances where technical teachers and students were reported to be disabled as a result of workshop accidents. Typology of accidents is the systematic study and classification of types of accidents according to their characteristics and traits.

Accidents interfere with lessons and decimate manpower and material resources; thus disorganizing the workshop activities. From economic view point, accidents are costly events which seriously hamper production. Often machineries

and equipment involved in an accident are damaged resulting in expensive cost for replacement or improvisation. Not only are repairs and replacements costly, the time taken for them to be effected is wasteful. This is a great burden to the school management. The effects of accident on its victims are even more serious than its effects on the economy. Not only does it affect the victim's job, it affects the family and colleagues. It becomes more painful when the accident is obviously avoidable and the cause traced to someone's laissez-faire attitude to safety or poor supervision.

In order to prevent workshop accidents, safety instructions and safety devices are required. Olateju (2005) reported that students are often exposed to hazards when the necessary safety instructions to guide them during practical exercises are not observed. The author further stated that provision of safety devices in technical college workshops has been over-looked. Teachers often fail to demonstrate good safety practices and attitudes due to the fact that instructional aides such as safety posters, tips and films are not provided by the authorities concerned. Where they are available, the teacher may lack the knowledge to apply and administer the safety devices. Safety devices are devices such as fire extinguishers, first aid boxes, and hand gloves that help to secure the safety of anyone who is using workshop machines and equipment. Safety devices could also

be obstacles that prevent workers from entering or touching dangerous area of any system.

Safety in a technical workshop is an art of inculcating the necessity of taking precautions for the avoidance or reduction of accidents in order to protect people/students and property. Safety is a relative freedom from danger, risk, or threat of harm, injury, or loss to personnel and/or property, whether caused deliberately or by accident (Health and Safety Executive, 1982). It is the preventive measure taken by a person to preserve lives, properties and the environment against accidents. Accident prevention activities enable workers to perform to the peak of their ability, and ensure the safety of humans, machines and materials.

The realities of globalization and technological advancement earnestly call for turning out skilled workers who can flexibly acquire, apply and transfer their knowledge to varying technological conditions (Ogwo, 2005). Occurrence of accidents in technical college workshop could hinder the achievement of this worthwhile objective. Hence, there is the need to determine the types of accidents, causative factors and strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi states.

Statement of the Problem

Technical and vocational educational programmes involve practical training in workshops, which call for the use of tools, equipment, machines and materials. This training is expected to take place in a workshop that is free of hazards. Practical activities in technical college workshops such as; welding, drilling, battery charging, spraying, and forging expose users to possible unsafe situations. In addition, by acts of omission or commission, users jeopardize the entire working environment. As a result, accidents do occur and cause injuries to technical teachers, students and workshop assistants (Olateju, 2005). These turn the workshop from a work-friendly environment to an unfriendly and hazardous environment.

Accident occurrence could also lead to equipment damage, waste of materials and time, thereby frustrating training plans at the workshops from coming to fulfilment at the record time. The injury sustained could result in pain and suffering to the victims or could cause permanent disability, loss of job to technical teachers or fear and anxiety to technical teachers and students. It could lead to loss of morale to students, unbearable agony to their families and enormous expenditure by the college when suits from wounded victims and replacement of damaged equipment are involved.

Accident occurrence could also disrupt lessons or could even shutdown a workshop depending on the degree of injury sustained by the victims when it occurred. Usually where lessons are disrupted, make up lessons may be hard to organize and the syllabi may not be covered. The issue of frequent occurrence of accident in technical college workshops that sometimes cause permanent injury to students, demotion or loss of job to technical teachers and litigation brought about the need to seek opinions of successful technical teachers on typology, causative factors and preventive strategies of accidents in technical college workshops.

Purpose of the Study

The main purpose of this study was to determine the typology, causative factors and strategies for preventing accidents in technical college workshops in Kwara and Kogi States. Specifically, the study was designed establish the:

1 Types of accidents that could occur in technical college workshops in urban areas of Kwara and Kogi States.

2 Types of accidents that could occur in technical college workshops in rural areas of Kwara and Kogi States.

3 Human factors that could cause accidents in technical college workshops in urban areas of Kwara and Kogi States.

4 Human factors that could cause accidents in technical college workshops in rural areas of Kwara and Kogi States.

5 Environmental factors that could cause accidents in technical college workshops in urban areas of Kwara and Kogi States.

6 Environmental factors that could cause accidents in technical college workshops in rural areas of Kwara and Kogi States.

7 Strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi States.

Significance of the Study

The findings of this study will be beneficial to technical college teachers, students, educational planners, administrators and vocational and technical training institutions. The findings of this study will be of benefit to technical teachers because they will be more sensitive to the organization and management of workshops in technical colleges. The findings will help technical college teachers discover areas of workshop activities to improve upon to minimize the occurrence of accidents.

The findings of this study will create awareness of causes of accidents in technical college workshops. Awareness, thus created will lead to increase in workshop discipline among students, cause them to develop good work behaviour and make-them acquire safe machine operation skills. Findings of this study will assist educational planners and administrators in identifying and taking appropriate decisions towards training and re-training needs of technical college staff. Such

training needs could therefore be met through approval of study leave, organizing conferences, seminars and field-trips for staff and students.

The findings of this study will also draw the attention of the administrators and teachers to ensure good housekeeping and effectively supervise the activities in the workshops in other to avoid unauthorized operations and horse play. The findings will also further enlightened government to always recruit highly skilled and experienced technical teachers to teach technical subjects in technical colleges.

Finally, in research and development, the quest is on adding new knowledge to the existing ones. The findings of this study will add new knowledge to the teaching and learning in technical colleges and provide future relevant research materials.

Scope of the Study

This study focused on typology, causes and preventive strategies of accidents in technical college workshops in Kwara and Kogi States of Nigeria. The study is delimited to accidents that are caused by human and environmental factors and excludes domestic, road traffic and other accidents caused by unforeseen factors.

Research Questions

In pursuance of the purpose of this study, answers were sought for the following research questions.

1 What types of accidents could occur in technical college workshops in urban areas of Kwara and Kogi States?

2 What types of accidents could occur in technical college workshops in rural areas of Kwara and Kogi States?

3 What human factors could cause accidents in technical college workshops in urban areas of Kwara and Kogi States?

4 What human factors could cause accidents in technical college workshops in rural areas of Kwara and Kogi States?

5 What environmental factors could cause accidents in technical college workshops in urban areas of Kwara and Kogi States?

6 What environmental factors could cause accidents in technical college workshops in rural areas of Kwara and Kogi States?

7 What are the strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi States?

Hypotheses

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

1. There is no significant difference in the mean ratings of more experienced and less experienced technical teachers on the types of accidents that could occur in technical college workshops in Kwara and Kogi States.

2. Male and female technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops in Kwara and Kogi States.

3 Technical teachers in urban and rural areas do not differ significantly in their mean ratings of environmental factors that could cause accidents in technical college workshops in Kwara and Kogi States.

4 More experienced and less experienced technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops in Kwara and Kogi States.

5 There is no significant difference in the mean ratings of more experienced and less experienced technical teachers of strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi States.

6 There is no significant difference in the mean ratings of male and female technical teachers of the strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi States.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter reviewed literature related to the study. The review was organized under the following sub-headings:

Conceptual Framework

Technical Education

Technical College Workshops

Strategy

Accident

Typology of Accidents

Safety and Accident Prevention

Theoretical Framework

Domino Theory of Accident Causation

Human Factor Theory of Accident Causation

Theoretical Studies

Types of accidents in technical college workshops

Causes of accident in Technical College Workshops

Accident Prevention in Technical College Workshops

Technical Teachers Responsibilities in Workshop Accident Prevention

Need for Accident Prevention Activities in Technical College Workshops.

Empirical Studies

Summary of Literature Review

Conceptual Framework

Technical Education

Ezeagu (2005) defined technical education as an education that has the specific or definite role of preparing and equipping students with skills, that increase their chances of finding a job, and the skills they need to create their own employment. The National Policy on Education (NPE) defined technical education as that aspect of education which leads to the acquisition of practical and applied skills as well as basic scientific knowledge (Federal Republic of Nigeria, 2013). Oke, (2003) viewed Technical Education as a form and level of specialized education aimed at developing the recipient's knowledge and abilities in the practical (industrial) arts courses, applied science and mathematics. In other words, technical education is a necessary tool for training skilled manpower and total societal transformation.

Technical education is offered in technical colleges in diverse industry-related fields. In Kwara and Kogi States, the followings are offered: Motor Mechanics, Fitting and Machining, Carpentry and Joinery, Electrical Installation and Maintenance, Radio and Television Repair and Furniture Craft. Others are Welding and Fabrication, Painting and Decoration,

Block/Bricklaying and Concreting and Plumbing Work. The main aim of technical education is to give training and impart necessary skills leading to the production of craftsmen, technicians and other skilled personnel who will be enterprising and self-reliant (Federal Republic of Nigeria, 2013).

Technical College Workshops

Uwaifo (2009) explained that a workshop is a building or a room where skills, machines, parts, tools, furniture and repair work are acquired or made for our own use and convenience. Technical college workshop in this context means a building or room where machines, tools and materials are installed and utilized for the purpose of imparting and acquiring skills. Various types of workshops are in use today, some of which are the single unit, general unit and the mobile workshop (Ofonmbuk & Ekereobong, 2012).

The list of workshops in technical college would include motor mechanics, fitting and machining, carpentry and joinery, electrical installation, radio and television, welding and fabrication, painting and decoration, block-laying and concreting. These workshops can be called technical laboratories and that of motor mechanics, the garage. Most technical college workshops contain the same kinds of tools, equipment, working areas, storage facilities and materials. As there are similarities, some general rules can be made about keeping these environments safe.

Strategy

Strategy according to Okwuanaso and Nwazor (2000) is an act or way of planning operation especially of troops, so as to fight successfully and win. It entails skills in managing an affair or matters in hand; it is the tactics for achieving an objective. It consists of various parts, methods, designs and techniques -all of which join together to help achieve the goal. Also, Chandler (1962) defined strategy as the determination of the basic long term goals and objectives in an enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out their goals.

Strategies impact on resources (input) in some positive or negative way and they are executed in a tactical manner so as to link goals and objectives for day- to-day operations. Chandler (1962) further stated that those strategies link upward to goals and objectives and also link directly to output/efficiency. Objectives are targets but strategies provide the way or guidance to these targets.

In this study however, the goal is on how to identify types of accident, their causes and the strategies that can be adopted to prevent them in technical college workshops in Kwara and Kogi States. Therefore all the methods, procedures and techniques adopted from the opinions of technical teachers will amount to strategies for the attainment of the goal.

Accident

Accident is defined as an unplanned occurrence which results in injuries, fatalities, loss of production or damage to properties and assets. Accidents are of different types such as domestic accidents, traffic accidents, and industrial accidents. Bhanderi and Choudhary (2008) explained that domestic accidents take place at home or in its immediate surroundings. Traffic accident on the other hand is the accident which occurs on the road or in the place to which the public has access. The industrial accident is a sudden and unforeseen event, which happens to a person(s) and is attributed to any cause, arising out of or in the course of work and resulting in an employment injury to the person(s), colleagues or damage to the tools, materials and equipment.

Heinrich (1959) said that the person who suffers a disabling injury caused by an unsafe act, in the average case, had over 300 narrow escapes (near-misses) from serious injury as a result of committing the very same unsafe act. Bird and Germain (1992) later explained that ‘near-miss’ (narrow escape) are undesired events, which under slightly different circumstances could have resulted in harm to people, damage to property or loss of process. Traditionally, most near-misses are ignored because nothing happened or so it seems. It is obvious that there are numerous near-miss incidents for every serious injury. It would therefore be logical that all these incidents be treated as seriously as loss-producing accidents.

Typology of Accidents

Typology of accidents is the systematic study and classification of types of accidents according to their characteristics and traits. There are various types of workshop accidents among which are injury from sharp objects, body injury from damaged or unguarded equipment/tools, contact of acidic or corrosive chemicals on the physical body, toxic gas emitting and inhalation, electrocution, electric shock, suffocation and fall from height.

Safety and Accident Prevention

Traditionally, safety has been perceived to be the absence of accidents. However, the absence of accidents may not reflect the absence of risks. Anderson cited by Eneogwe (1991), said that safety does not imply conversion of physical environment into an accident proof situation, rather it extends the scope of human experience by anticipating and preventing conditions that would otherwise be injurious or even fatal.

Safety is a situation of relative freedom from danger, risk, or threat of harm, injury, or loss to personnel and/or property, whether caused deliberately or by accident. Encyclopaedia of Arab World (2010) viewed safety as the preservation of the lives, property, and the environment by taking preventive actions to avoid accidents, pollution and destruction. To Kadiri (2006) safety is the condition of being protected against physical, social, spiritual, financial, emotional,

occupational, psychological or other types or consequences of failure, damage, error, accidents, harm, or any other event.

No human activity or human-made system can be guaranteed to be absolutely safe. The concept of safety carries many different notions such as:

(a) zero accidents;

(b) a freedom from danger or risk: i.e. those factors which cause or likely to cause harm;

(c) an healthy attitude towards unsafe acts and unsafe conditions by employees;

(d) the acceptable degree to which the inherent risks are preventable;

(e) the deliberate process of hazard identification and risk management and;

(f) the control of accidental loss (of persons, property) or damage to the environment.

Safety is a concept we need to apply to work. It must be proactive, as opposed to reactive. When properly applied, accidents can be greatly reduced and in some cases prevented altogether. Safety should always be given priority in whatever we do. It is an integral part of the planning process and should never become an after-thought. Opara (2003) stressed that if safety is not carefully observed in the use and handling of tools and equipment, serious injuries could result. Opara revealed further that the use of the ladder that has damaged, missing

or loose rungs should be avoided. Such ladder must be positioned on a firm base and at correct angle and that it is advisable that the ladder be held firmly on the ground by another person in order to prevent slip.

Yakubu (2004) observed that practising safety skills in tools' usage during training can often reduce accident, injury to persons, damage to tools , wastage to materials, and cumulative effect of traumas. In their opinion, Jenne and Green (1979) believed that safety programmes are designed to provide safety education, assist in controlling or minimizing accidents, severity of injuries and possible death. The authors stressed further that safety consciousness implies alertness to danger which controls every action of an individual with the desire to remain alive and safe.

Wiegmann, Zhang, Thaden, and Mitchell (2002) identified four essential elements or organizational indicators of safety culture. These include the organization's commitment to safety, the involvement of operational supervisors in safety- related activities, the formal safety system of the organization, and the organization's informal safety system.

Organizational commitment to safety according to the authors referred to the degree to which an organization's senior management prioritizes safety in decision-making and allocates adequate resources to safety. In particular, an organization's commitment to safety is reflected by three major components,

including (1) Safety values– Attitudes and values expressed (in words and actions) by the upper management regarding safety, (2) Safety fundamentals- Compliance with regulated aspects of safety, such as training requirements, manuals and procedures, and equipment maintenance, and (3) Going Beyond Compliance- Priority is given to safety in the allocation of company resources (e.g. equipment, personnel, time) even though they may not be required by regulation. The formal safety system refers to processes for reporting and addressing both occupational and process safety hazards. On the other hand, the informal safety system refers to the unwritten rules pertaining to safety behaviour, including rewards and punishments for safe and unsafe actions and the manner in which rewards and punishments are instituted in a just and fair manner.

Baird (1972) observed that a safety attitude must be developed in students to focus their attention on the prevention of possible accidents. The author emphasized both the physical and human elements that cause accidents. Physical elements of safe work practices involve the use of good judgment, protective equipment, and knowledge of how the equipment operates. Emphasis is also placed on instruction in the physical use of materials, dangerous solutions or chemicals, heating devices, electrical devices, mechanical equipment, and testing equipment in order to prevent accident. Baird concluded that materials and equipment can be used safely if proper instruction is presented in a positive manner.

Safety devices are items designed to prevent, control or mitigate undesirable events or accidents. They could be worn by the worker, as guards on machine or equipment. Those that are worn by the worker are often called personal protective equipment (PPE). Depending on the operations, personal protective equipment is used to protect the following notable human parts:

a) Head: headgear, hard hat, Helmet.

b) Eyes: safety goggles, safety glasses, face shield.

c) Nose: gas or dust mask.

d) Ear: ear muffler, ear mug.

e) Body: apron, overall, safety apparel, rain coat, safety belt.

f) Hand: hand gloves.

g) Legs: safety boots, rain boots.

Those used as machine guards are gear/chain/ belt covers, caution/danger tag, Circuit breakers, fuses and earth-wire. There are wide ranges of tools that are used to prevent accidents and injuries such as fire extinguishers/sand buckets and mates found in first aid boxes.

Theoretical Framework

The framework of the study was based on domino theory of accident causation developed by Heinrich and human factors theory of accident causation developed by Ferrel.

Domino Theory of Accident Causation

Domino theory states that accidents result from chain of sequential events, and that an "accident" is one factor in a sequence that may lead to injury. Heinrich said that these factors can be visualized metaphorically like a line of dominoes falling over. When one of the dominoes falls, it triggers the next one, and each successive domino topples the one next to it. Heinrich posited that five factors are in the sequence of events leading to injury/damage. These can be summarized as follows:

1) Ancestry and social environment: Negative character traits that may lead people to behave in an unsafe manner can be inherited (ancestry) or acquired as a result of the social environment. e.g. greed, recklessness

2) Fault of person: Negative character traits, whether inherited or acquired, are why people behave in an unsafe manner and why hazardous conditions exist. e.g. ignorance, lack of skill or knowledge

3) Unsafe act or unsafe condition: Unsafe acts committed by people and mechanical or physical hazards are the direct causes of accidents. e.g. unsafe performance of person or unsafe condition of the environment

4) Accident**.** Typically, accidents that result in injury are caused by falling or being hit by moving objects. e.g. striking of person by falling objects.

5) Injury (result of accident). Typical injuries resulting from accidents include lacerations and fractures. e.g. cut or broken bones

Heinrich stated further that 88 percent of all accidents are caused by unsafe acts of people, 10 percent by unsafe conditions of environment and 2 percent are caused by unforeseen circumstances. Heinrich's theory has two central points: (1) injuries are caused by the action of preceding factors and (2) removal of the central factor (unsafe act/hazardous condition) negates the action of the preceding factors and, in so doing, prevents accidents and injuries.

Human Factors Theory of Accident Causation

Human factors model is based on the idea that the human errors are the major cause of accidents. It was developed by Ferrel in 1977. Ferrel developed the theory of accidents based on a chain of events ultimately caused by human errors. According to Seyyed and Zahra (2012) the author believed that human errors are the main causes of accidents occurrence and that they are caused by three broad factors: overload, inappropriate response, and inappropriate activities. These factors are explained in the following paragraphs.

Overload

Overload amounts to an imbalance between a person's capacity at any given time and the load that person is carrying in a given state. A person's capacity is the product of such factors as his or her natural ability, training, and state of mind,

fatigue, stress, and physical condition. The load that a person is carrying consists of tasks for which he or she is responsible and added burdens resulting from environmental factors (noise, distractions, and so on), internal factors (personal problems, emotional stress, and worry), and situational factors (level of risk, unclear instructions, and so on). The state in which a person is acting is the product of his or her motivational and arousal levels.

Inappropriate Response and Incompatibility

How a person responds in a given situation can cause or prevent an accident. If a person detects a hazardous condition but does nothing to correct it, he or she has responded inappropriately. If a person removes a safeguard from a machine in an effort to increase output, he or she has responded inappropriately. If a person disregards an established safety procedure, he or she has responded inappropriately. Such responses can lead to accidents. In addition to inappropriate responses, this component includes workstation incompatibility. The incompatibility of a person's workstation with regard to size, force, reach, feel, and similar factors can lead to accidents and injuries.

Inappropriate Activities

Human error can be the result of inappropriate activities. An example of an inappropriate activity is a person who undertakes a task that he or she doesn't know how to do. Another example is a person who misjudges the degree of risk

involved in a given task and proceeds based on that misjudgment. Such inappropriate activities can lead to accidents and injuries.

The implication of theories of accident causation among others is that accident prevention in technical college workshop often depends on how well technical teachers can organize and manage the workshop for training. Good workshop keeping or housekeeping as it is sometimes called simply means an educational environment that is conducive for effective learning.

Yayirus (2003) quoting Giachino & Gallington expressed that:

> *The physical condition of the classroom, workshop or laboratory has a strong effect on the amount and the quality of learning. Well planned and well managed facilities tend to develop good students' attitudes, without which effective and creative learning is impossible. Dirty, disorganized surroundings have a negative effect on education*.

The technical teacher's first responsibility in the workshop is to remove as many of the contributing causes of accident as possible. Okeke and Oranu (2006) affirmed that one of the contributions, which our school workshops can make to accident prevention, is the development of satisfactory attitude towards the guarding of equipment, tools and processes for eliminating hazards from a job. Chemicals, acids and other inflammable substances not properly kept in safe containers are accidents ready to happen. There should be sufficient space to

provide for safe working arena, easy access and storage of tools and materials without obstruction.

Technical college administrators, head of departments and other supervisors should know that prolong activities that can lead to boredom should be avoided. The work load of technical teachers should be minimal and teacher-students ratio regulated. Each time hazard is identified on equipment, the appropriate quarters should be informed, with caution tag (e.g. Do Not Operate) placed on such equipment.

From the discussion of the theories so far, several significant implications for accident researches could be inferred. All theories produce evidence of accident occurrence and that accident is caused. Furthermore all accidents directly relate to unsafe acts, unsafe conditions or both. The cause theory requires the investigator to search for the cause aspect of the accident phenomenon.

Elimination of the causes of accidents through accident prevention strategies could reduce accident to the barest minimum. Furthermore, the knowledge of the possibility of accident occurring during workshop operations with the likely causes will instil safety consciousness in the users of technical college workshops. Each different theory affects the purpose, scope, and method of investigation of accidents. Also, each theory produces different data at the end of the investigation

and the subsequent formulation of hypotheses, thus its experimentation is based on scientific method.

Accident theories provide a conceptualization of the characteristics of the accident, which typically show the relationship between causes and effects. They explain why accidents occur, and are used as techniques for risk assessment during system development. For post-accident analysis they could be used to study the causes of the accident occurrence and as further measures to control the accidents and techniques to prevent their occurrences. Technical teachers should ensure that accident occurrence in the workshop is duly recorded, properly investigated and analysed to effectively prevent future occurrences of similar accidents in the workshop.

The researcher believes that accidents do occur, and that every accident has a cause. The cause could be from the unsafe acts of personnel or from the unsafe condition of the environment. Some strategies could be adopted to prevent accidents. The knowledge of these facts could instil safety consciousness in the workers.

Theoretical Studies

Types of Accidents in technical college workshops

Accidents are common in technical college workshops (Offonmbuk & Ekerobong, 2012). Perhaps the fear of punishments could be one of the leading

causes of under-reporting. Yet, accidents are lessons technical teachers can learn from. Through workshop experiments and practices, students observe the interaction of chemicals and draw important conclusions and acquire the necessary skills require of them to self-reliant. However, these processes are often hampered by workshop accidents. These accidents range from minor cut and burn to fatal injuries. Understanding what those accidents are, their causes and how to prevent them from occurring in the first place is the first step towards reducing their frequency and making workshop practice more enjoyable.

Schools should keep a record of all accidents (including minor accidents) in each college workshop, and report all serious workshop accidents (e.g. an accident in which medical advice has been sought) to the respective Regional or Zonal Education Offices without delay. School should also make use of the accidents records to improve the effectiveness of the preventive measures for minimizing the occurrence of workshop accidents. The list of common workshop accidents in technical colleges include: cut, fire, struck by falling objects, and fall from height. Other types of accidents include; Electric shock, stress, gas inhalation, slip and fall, trip and fall and burns from hot metals

Cut

One of the most common workshop accidents is getting cut (Olateju, 2005). Cuts occur when students break glass apparatus or mishandle sharply edged tools

like hacksaw, guillotine, circular saw, cutter, knife and even razor blade. The health consequences of cuts can range from haemorrhages to severe bacterial infections. Technical teachers and workshop instructors can reduce cuts by teaching their students how to carefully use, and store sharp edge workshop tools. Any tool showing signs of break or crack should not be used. Also, broken blades, needles, bottles, should be properly disposed.

Burns

The second most common type of accidents in technical workshop is burns. An electrical accident can result in an electrical burn, arc burn, thermal contact burn, or a combination of burns.

Electrical burns are among the most serious burns and require immediate medical attention. They occur when electric current flows through tissues or bone, generating heat that causes tissue damage.

Arc or flash burns result from high temperatures caused by an electric arc or explosion near the body. These burns should be treated promptly. *Thermal contact burns* are caused when the skin touches hot surfaces of overheated oven, forge, mould, electric conductors, conduits, or other energized equipment. Thermal burns also can be caused when clothing catches on fire, as may occur when an electric arc is produced.

Fire Incidence

Fire could be caused by naked flame, small sparks or arcing from electricity. For example, arcs that result from short circuits can cause injury or start a fire. Extremely high-energy arcs can damage equipment, causing fragmented metal to fly in all directions. Even low-energy arcs can cause violent explosions in atmospheres that contain flammable gases, vapours, or combustible dusts. Fire may cause skin burns or even raze down the entire building

Chemical Accidents

Gas inhalation: accidental inhalation of gases caused by leaking gas tap and gas emissions from chemical reactions is another dangerous accident in the technical college workshop. Many of the common solvents are extremely toxic if inhaled in any quantity or over a period of time. Do not evaporate excess solvents in the laboratory; use the hood or a suitable distillation apparatus with a condenser. Some compounds, such as acetyl chloride, will severely irritate membranes in your eyes, nose, throat, and lungs, while others, such as benzyl chloride, are severe lachrymators, i.e. they induce eye irritation and tears.

Chemical contact with skin: Chemical on skin could occur as a result of chemical spillage, during washing up of chemical containers. Many organic substances are also not corrosive, do not burn the skin, or seem to have any serious

effect. They are, however, absorbed through the skin, sometimes with dire consequences. Others will give serious allergic reaction upon repeated exposure, as evidenced by severe dermatitis. Students should be cautioned against mischievous behaviour of pouring chemicals to others.

Chemical ingestion: The common ways of accidentally ingesting harmful chemicals are: (1) by pipet, (2) from dirty hands, (3) contaminated food or drink and (4) food use of chemicals taken from the laboratory.

Causes of Accidents in Technical College Workshops

Preventing accidents is extremely difficult in the absence of an understanding of the likely causes of accidents. Kadiri (2006) stated that the causes of accidents are either environmental or behaviouristic: unsafe conditions or unsafe acts. Kadiri said further that most of the accidents may be the combination of both factors. Okeke and Oranu (2006) attempted to discuss accident causes in technical and vocational workshops under ancestral and social environment, behaviouristic and physical/or mechanical hazards.

Ancestry and Social Environment: These are inherited characteristics of individuals that are very important elements in accident causes and prevention. Such undesirable characteristics are nervous tendencies, stubbornness, avarice, chance-taking, and showing-off.

Behaviouristics: These are mental, bodily and environmental circumstances that constitute faults. They include disregard of danger, resentment of authority, inattention to instruction, indifference, over confidence, absent-mindedness and intolerance. Others are undue haste, obsession, impatient, playful, fatigue and boredom.

Physical/or Mechanical Hazard: This is the condition of the selected agency, which could have been guarded or corrected. The hazardous conditions on these agencies that result directly to accidents can be classified under one of the following:

1. Improperly guarded agencies (unguarded or inadequately guarded);
2. Defective agencies (rough, slippery, sharp, inferior in composition);
3. Hazardous arrangements or procedures in, on, or and around the selected agency (unsafe storage, congestion, over loading);
4. Improper Illumination (insufficient light, glare);
5. Improper ventilation (insufficient air change, improper air source);
6. Unsafe apparel (lack of or defective gloves, aprons, shoes, respiration, loose clothing);
7. Unsafe mechanical or physical conditions not elsewhere classified

Strategies for Preventing Accidents in Technical College Workshops

Most of the teaching and learning processes in technical colleges take place in technical workshops, where there is a vast assortment of men, machines and materials. The slogan ‘safety begins at the top’ clearly states one of the essential conditions for accident prevention in a technical workshop. Ogundare (2008) pointed out that a safe place to work and a safe procedure are a management responsibility and cannot be shifted.

According to Simons (1993), ‘a bad accident record should be against the supervisor, while a good accident record should be credited to the supervisor’. A company with high accident record may find it difficult to hire and retain workers, while frequent accidents imply that operations are out of control and may suggest that management is either incompetent or cares little about its workers and work. This shows that management at various levels including the government, school administrators and the workshop managers/supervisors should be committed to accident prevention programmes.

Management commitment to safety is a concept nearly synonymous with safety success. Real commitment has to begin with top management and be communicated downward to other leaders so that they aggressively find ways to establish, demonstrate, and perpetuate a pledge to a genuinely safe workplace. Establishing commitment means creating (or revising) a safety programme that

relates to workshop users. Technical college administrators and workshop supervisors should set an example by following established rules and regulations, which ultimately set tone for workshop safety. Ogundare (2008) advised management to always follow a good operative safety policy in order to prevent accidents in technical college workshops. Ogundare later defined the policy to include, protective measures in accident prevention, planning layout and design operation techniques, good housekeeping, and accident investigation and reporting.

Protective Measures in Accident Prevention.

Majority of the accidents have been attributed to the unsafe act of workers (human factors). However, the importance of physical condition (environmental factors) cannot be overlooked. Injuries caused by mechanical hazard may result in permanent or partial disability, that is, amputation, or loss of a part of the body. Therefore to control this mechanical and physical hazards involve the four engineering concepts; design, construction, operation and maintenance. These concepts are interdependent. Good design can reduce the hazards of construction and operation and will minimize maintenance. Effective maintenance, in turn, is necessary in order to maintain a high safe operation.

Planning Layout and Design

Good planning is as essential in safety as it is in production. If a new factory is to be built or an existing factory reconstructed, there are many things affected by

both safety and production that should be taken into account at the planning stage. It is important that consideration be given to the time of the actual planning and not as an afterthought when the factory has been built, a good plan makes economy as well as safety. According to Okeke and Oranu (2006), the following principles should be adopted during planning to ensure safe and efficient production.

a. Aisle: adequate provision should be made in order to minimize material handling hazards and facilitate the passage of large number of moving personnel.

b. Floors, stairs, platforms and gangways should be non-skid; preferably it should be semi adhesive.

c. Adequate space for machinery and equipment should be provided, crowding of machinery should be avoided.

d. Provide enough space for the safety of maintenance and repair personnel.

e. Provide adequate means of escape in time of emergency.

f. Dangerous processes such as spraying, painting, and processes with high fire or explosion risk must be isolated.

g. Noisy processes, such as generating plant should be located far from work area to reduce exhaust fumes and noise.

h. Fuse and switch panels should be positioned where the machines control can be seen.

i. Machines with in-built safety devices should be recommended or used.

j. The quick means of stopping machines should be clearly indicated.

l. Allowance for possible expansion must be made.

Good Housekeeping

The essential of good housekeeping are generally reduced to the principle of 'a proper place for everything and everything to its proper place' (Ajisafe & Adeoye, 1997). Good housekeeping eliminates physical risk and also contributes to safety psychological effect. When good housekeeping is in place, every worker will, most likely, behave more carefully than where disorderliness prevails and housekeeping is neglected. The saying "safety pays" is true in every sense when applied to maintaining good order in a workplace. Jeffery (1993) pointed out a number of necessary ideas in good housekeeping that must be observed. They are:

- No object should be allowed to obstruct the gangway. This is to prevent collision or stumbling and to facilitate escape in case of emergency.
- Gangways should be clearly marked off with white lines.
- Gangways should not be used for storage of materials.
- Materials must be properly stored.
- Waste materials must be removed promptly; cotton waste should be placed in closed metal containers.
- Oil spillage on the floor should be mopped up instantly. The floor must be kept dry always.

- Suitable racks, hooks, grips, cabinets and panels should be provided for hand tools and electrical tools.

All these are not only to save lives but to curtail unnecessary expenses. All tools, equipment, machines and the work arena should always be prepared for safe job and safe physical environment.

Accident Investigation and Reporting

The main aim of accident investigation is to determine the true cause of the accident with a view to taking remedial action to prevent a recurrence. It is an established fact that accidents do not just happen, they are caused. In order to obtain an accurate picture of what occurred, investigation should be carried out without delay. Delay often results in failure to detect the true basic cause of the accident. Immediate investigations allow for first-hand information on the condition of the work area and tools. Most importantly, they help in eliminating coloured stories told by many witnesses.

The supervisors are best qualified to investigate accidents because they know the situation that resulted into accident. They are closest to all job conditions, such as purpose of the job, correct job procedures, equipment and materials used and the working condition (Ajisafe & Adeoye, 1997).

Accident investigation procedures

The accident investigation procedures stipulated by Taylow (1993) are:

Care of the injured: The accident victim must be given quick first aid treatment and medical attention.

Interview the injured: The injured person is asked series of questions about the accident occurrence to confirm if the individual is physically and mentally okay.

Interview the witnesses: Those that witness the occurrence of the accident should be interviewed one by one.

Notice the details of the work area: The unusual conditions that cause the accident should be examined and methods of the housekeeping should be recorded as observed.

Make detailed sketches if necessary: Chalk may be used to mark-out lines on the floor of the incident area.

Draw conclusion: From the detailed information provided by the investigation, conclusions are to be drawn.

Make recommendations: Recommendations are made in order to correct re-occurrence.

Submit written report: Brief of the report are made and kept for management decision.

Accident Reporting

The Federal Ministry of Labour and Productivity (1974) requires employers of labour to report any form of accident in line with the prescribed form in the factories Act 1958. The report is expected to be submitted by chief inspector of factories whenever an accident occurs.

Compensation

Employer of labour is expected to make provision for claims by employees involved in an accident in the course of their duty. The fact remains that, there is no amount of compensation paid to an injured employee who becomes partially or totally incapacitated that will remove the incapacitation. Oguniyi (1991) emphasized the role of governments in enforcing the law on the safety of workers in the industry. They include:

- Maintain standard health, safety and welfare of people at work.
- Protect other people against risk to health and safety arising out of work activities.
- Control the storage and use of dangerous substance.
- Enjoin the employees to take reasonable care, to ensue that they do not endanger themselves or anyone else affected by their activities at work.

- Placed duties upon employees to ensure that the health, safety and welfare at work of their employees and premises, tools and even information are assured.

Oguniyi (1991) added further that aims of health and safety of workers as contained in the work Act are:

1. The promotion and maintenance of the highest degrees of physical, mental and social well-being of workers in all occupations.
2. The prevention among workers, ill-health caused by their working conditions.
3. The protection of workers in their employment from risks resulting from factors adverse to health.t
4. The planning and maintenance of workers' occupational environment.
5. The adaptation of work to worker and each worker to his job.

Technical Teachers' Responsibility in Preventing Workshop Accidents

The immediate job of preventing accidents in school workshops and laboratories falls upon the technical teachers. According to Okeke and Oranu (2006), the teacher is the keystone of an effective workshop accident prevention programme. Teachers are the key elements in the change process involved in science, vocational, and technical education curriculum reform and productivity. The efficiency with which any school organization can be operated depends on the

competence and interest of the teachers on the job both as individual and collectively as a team. The performance of teachers on the job is a function of three different variables; the quality of the teachers, the quantity of the teachers and the attitude of the teachers.

The Quality of Technical Teachers

One of the variables that can determine the success of accident prevention programme in technical college workshop is the ability or competence of the teacher. Ikpe (2009) revealed that most technical colleges are filled with unqualified teachers and supporting staff who are inefficient. Fafunwa (2008) stated that the education system require well- trained technical and commercial teachers that can operate equipment for carpentry, brick-laying, technical drawing, electronics, electrical installation, automobile, home economics, secretariat equipment and computers.

Accidents will continue to occur in technical college workshops if the teachers lack the necessary skills and competencies as well as awareness and the demand of a task. It is essential therefore, to put in place a technical curriculum programme designed to train would-be-teachers in the methodology and principle of teaching for effective transmission of knowledge to the students. The programme designed for the teachers should be planned so that methodology of the uses of equipment and tools is incorporated. Technical teachers will therefore use

the knowledge, skills and competencies acquired to enhance the performance of students and this will consequently lead to the promotion of technical education. It is important to note at this juncture that technical teachers need to update their knowledge, skills and competencies on new equipment, tools different from obsolete machines in the workshops,

The Adequacy of Technical Teachers

The objectives of technical education are such that no meaningful achievement can be made without adequate provision of qualified technical teachers. Also, one of the greatest handicaps in the prevention of accidents in the vocational and technical education workshops is the acute shortage of qualified technical teachers. Ike (2007) stated that it has never been possible at any time to produce adequate technical and vocational education manpower needs before or during implementation in Nigeria. The inadequate supply of technical–vocational teachers with in their right specialisations and numbers for the different technical and vocational programmes has continued to stand out as a major impediment to the smooth implementation of government policy on technical-vocational education.

Nwachukwu (2001) revealed that there is a noticeable lack of teacher preparation and in-service programmes, and also difficulty in recruiting well-trained teachers with skills and competencies in technical education. The

availability of adequate technical teachers in quantity and quality will influence the implementation and success of technical and vocational education.

Ekpenyong (2008) advised government to adopt the following measures in order to increase the numbers of technical teachers in technical colleges in Nigeria. The measures are:

1. Ensuring equitable distribution of technical teachers nationwide

2. Ensuring speedy and immediate employment of qualified technical teachers as observation shows that a good number of qualified technical teachers leave college and stay for over a year without employment.

3. Improving the career prospects of technical teachers.

The Attitude of Technical Teachers

Okeke and Oranu (2006) rightly observed that the wrong attitude of the students is always a reflection of the teacher. The most important objective of workshop instruction is the development of a safety consciousness in the students. The image created in the mind of the students by the attitudes of a teacher can have a major effect upon their contributions to accidents prevention in the workshop. The technical teacher therefore must be an example and or worthy of emulation.

In order to convince the students of the importance of safe working methods and procedures, the teacher must shun all improper attitudes like; disregard of danger, resentment of authority, undue haste, absent-mindedness, and most

importantly, disobedient to safety rules and regulation. The development of safety consciousness as well as the prevention of accidents requires that technical teachers be equipped with a wide knowledge of safety fundamental. They must be well informed on the latest developments of industrial accident prevention. The teacher should therefore develop in the students safe work habits and an awareness of the dangers that exist when handling equipment, tools and machines (Baird, 1972).

The awareness should come in the form of safety rules and regulations guiding every bit of operations taking place in the workshop. Walton (1974) emphasized that the act of safety in the workshop is simply in its definition. The author explained that safety measures are planned events or precautions that are taken to control situations and acts in an endeavour to prevent (i) injury to the person concerned, (ii) injury to others in the workshop and (iii) damage to the workshop, or its equipment and materials. This means that a dangerous situation created by one person in the workshop could create damage that could affect so many other people and the entire workshop building.

Akinsehinde (1998) enumerated some methods of preventing and reducing workshop accidents as: (1) inspection for hazards (2) provision of latest information on safe working methods, protective equipment and clothing (3) promotion of safety and first aid training (4) investigation of accidents, injuries and

illness; and (5) motivation of students/workers interests. Okeke and Oranu (2006) emphasized that a good accident prevention programme should incorporate the following elements:

1. Supervision of instructional activities
2. Proper instruction on the use of tools and equipment
3. Enforcement of safety practices
4. Safe working arena

The authors stated further that the teacher should not be out of the workshop when a class is in session, must be sure that students are taught how to correctly use all of the tools and equipment required for the course, enforce safety practices and ensure safe keeping of the physical facilities (tools, machines, safety devices and building). Accident prevention programmes in technical college workshops must take into consideration the inexperience of the students. Students may possess very positive attitudes toward safety but still lack the manual dexterity of experienced workers. To compensate for this, the technical college teacher must try to reduce unsafe conditions to the minimum.

Storm (1987) compared school safety education and problems with those of business and industrial training programmes. The author listed the following ten elements as important for safety in school workshop:

1. Safe regular apparel plus special protective apparel in specific workshops should be worn.
2. Buildings should be fire proof and have at least two exits in each room, skid proof floor, an adequate number of electrical out lets and pleasant colour scheme.
3. Equipment, tools and instruments should be clean, in proper working order, and painted in appropriate colours.
4. Housekeeping practices should keep the workshop clean and orderly and provide adequate space for all materials and supplies.
5. Sufficient illumination should be placed where it is needed, without direct or reflected glare.
6. Ventilation system should supply an adequate quantity of fresh air with optimum humidity temperature (65-68F), and should remove odours, dust and fumes.
7. Instructional methods should take into consideration students' abilities and capabilities.
8. General working conditions should include adequate work space and work stations, low noise level, and constant supervision. Enrolment should not exceed the number of work stations.

9. Safe storage should be provided for all materials, especially acids and combustibles, sharp tools and equipment.
10. Emergency provisions should include strategically located fire extinguishers, first aid kits and posted disaster information.

Need for Accident Prevention Activities in Technical College Workshops.

When accident happens, it is always painful and can be life changing. Most work slows down on a job site after an accident and a severe incident can short down the work completely. The injured staff or students have to be taken to the clinic, someone picks up their tools, another has to finish up what they were doing before the accident, another reports the incident to the supervisor or the management, also to the family of the victim. So an accident not only affects the persons injured but everybody in the technical college and every member of the family. Therefore nobody wants injuries or illness to happen in the workplace or industries. Injuries and deaths are no-win situation. The bottom line is that fewer injuries mean less worker pain and suffering and increased productivity and profitability.

No company can insure against all the costs arising from accidents and they can have a dramatic impact on the business (Health and Safety Executive, 1982). What this mean is that insurance policies do not cover everything and they can only pay for serious injuries, ill-health and damage. The amount of these uninsured

costs varies between businesses and the types of incident, but is several times more than the insured costs. In addition to losing your best worker, the machine will be off line for weeks. The compliance officer who investigated the incident could say that the accident could have been avoided had the equipment been inspected and maintained regularly. The investigating officer could go ahead to fine the company for serious violation of safety rules and regulation.

Health and Safety Executive (1982) identified two types of costs in an accident. The insured costs and the uninsured costs or direct costs and indirect costs. The insured or direct costs are defined as those costs that are covered by insurance policies. They are medical expenses on serious injuries, ill health and indemnity payments for the injured worker. On the other hand, the uninsured or the indirect costs are those costs that are not covered by insurance policies. They are hidden costs on: lost of time by workers and supervisors, loss of production, damage to equipment, damage to product, reduced morale, cost to train replacement; and legal expenses. According to Olateju (2005), to enhance the productivity of workers, every establishment needs to guard against the occurrence of accidents by creating a safe working environment for their workers for the accomplishment of their duties.

Empirical Studies

Olateju (2005) conducted a study on Accident Occurrence and Prevention in Vocational and Technical Education Workshop for Sustainable Skill Development. The study was carried out in technical colleges in Lagos State. The purpose of the study was to investigate occurrences and prevention of accidents in vocational and technical education workshop. The researcher used 97 vocational technical teachers in Lagos State. The researcher sought answers to three research questions which are 1). What are the common types of accidents in vocational technical colleges in Lagos State? 2). What are the major causes of accidents in vocational technical colleges in Lagos State? 3). What are the various accidents prevention measures taken in vocational technical colleges in Lagos State? A survey design was used with structured questionnaire to obtain the required data for the study. The data obtained were analysed using the mean. The result of the study revealed that accidents do occur when management fails to provide adequate safety devices, when equipment is not regularly maintained and when lighting conditions are inappropriate. The implication of Olateju's study to this present work is that the findings revealed that accidents are occurring in technical college workshops. Olateju went on to list the following as some of the common accidents in the workshops;

1. Slips and falls

2. Eye injury
3. Burns
4. Electric shock

Omotayo (1996) conducted a study on relationship between safety instructions and accident prevention in Technical college laboratories in Edo state. The purpose of the study was to assess the extent to which safety instructions are given during workshop practice and training. A survey design was used with structured questionnaires to obtain the required data for the study. The result of the study revealed that the degree of safety instructions depend on the extent of effort the workshop supervisor put in to enforce safety practices in the workshop and that if safety instructions are well implemented accidents in the workshops would drastically reduce. Omotayo's work is relevant to the present work in that it revealed that accidents prevention and reduction in technical college workshop are possible if necessary facilities and safety strategies are put in place. These are in tune with the purposes of the current study.

Furthermore William (1995) conducted a research on the legal aspects of training in the work place-safety training programmes at Chapmann University, Pennsylvania. William used a survey design with structured questionnaire for the study. The purpose of the study was to assess the importance of safety training programme and the safety training procedures. The major findings of the work

include that failure to train, or inadequate training can have a far reaching moral and legal impact on the company, the managers and employees. It can also lead to litigation and liability situations for many individuals, including the managers, trainers and employers. It also found out that the training process is a vital tool that an organization has at its disposal to prevent injuries, damage, liabilities and lawsuits. The implication of William's study is that the technical teacher or the school management could be liable if accident occurs carelessly in technical college workshop. This underpins the problem of the present study.

Finally, Njoku (2007) conducted a research on assessment of the observance of safety precautions in electrical installation workshops in Imo State technical colleges. The purpose of the study was to assess the extent of observance of safety precautions in electrical installation workshops with a view to improving students' safety consciousness. The research questions were how often students observe safety practices needed in the use of electrical hand tools in technical college electrical workshops and that what is the level of availability of safety devices provided by the management for minimizing accidents in technical college electrical workshops? The hypotheses among others included: There is no significant difference between electrical teachers/instructors and electrical workshop supervisors/attendants on their mean ratings on the extent to which students observed safety practices needed in the use of electrical tools in technical

college electrical workshops and there is no significant difference between electrical teachers/instructors and electrical workshop supervisors/attendants on their mean ratings on the extent of availability of safety devices provided by the management for minimizing accidents in technical college electrical workshops.

The design of the study was a survey design with structured questionnaire used as the instrument. Data collected from respondents were analysed using the mean and the t-test statistics. The findings revealed that students did not always observe safety precautions and that management of technical colleges in Imo State did not provide all the safety devices required in the workshop. It was recommended that more qualified electrical teachers and supervisors should be recruited. This is also relevant to the present work in that it sought to ascertain whether management commitment could be a strategy that could be used to prevent accidents in technical college workshops in Kwara and Kogi States.

Summary of Literature Review

In the review of related literature, major operational definitions used in the study like technical education, technical college workshop, accident, typology of accidents and causes of accidents among others were reviewed. For example, workshop accident was defined as a sudden and unforeseen event, attributed to any cause, which happens to a person, arising out of or in the course of the work in the workshop. Each concept was distinguished and explained to the reader. The

review went on by discussing two theories of accident causation upon which the study's framework was based upon; they are domino and human factor theories of accident causation.

The review also examined theoretical studies where types of accidents in technical college workshops were discussed. Such accidents among others include cut, burn, fire incidence, and fall from height. Also examined were the causes of these accidents like behaviouristic (human factors) and physical hazards (environmental factors). By the review, strategies that could be adopted to prevent accidents in technical college workshops were discussed. The researcher enumerated strategies like good housekeeping, compliance with safety rules and regulations, management commitment, provision of adequate safety devices, tools and materials. The review, through empirical studies revealed that accidents do occur while working with tools and equipment in the workshops; they are under-reported though.

Finally, the review of literature indicated that while the previous studies conducted by other researchers and authors have been helpful in the organization of this researcher, none has focused on typology, causative factors and preventive strategies of accidents in technical college workshops in Kwara and Kogi States. None has sampled the chosen respondents. These gaps therefore have further strengthened the rationale for the present study.

CHAPTER THREE

METHOD

In this chapter, the method used in carrying out the study is presented and discussed under the followings sub-headings: research design, area of the study, population of the study, sample and sampling technique, and instrument for data collection. Others are validation of the instrument, reliability of the instrument, method of data collection and method of data analysis.

Research Design

The design used for this study is the descriptive survey design. Akuezuilo and Agu (2003) submitted that a survey research design is one in which a group of people or items is studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. Descriptive survey design is appropriate, especially for seeking individuals' opinions, attitudes and perception in their natural setting. The design is considered suitable for this study because it falls under this category. The researcher is seeking the opinions of technical college teachers in Kwara and Kogi States.

Area of the Study

This study was carried out in Kwara and Kogi States in the North-Central geo-political zone of Nigeria. Kwara State has boundaries with Oyo and Osun States to the West, Kogi State to the East, Niger State and Benin Republic to the

North and Ekiti State to the South. Kogi State on the other hand has boundaries with Benue, Enugu and Anambra States to the East, Nasarawa and FCT to the North, Edo, Ondo and Ekiti States to the South and Kwara State to the West. The two states, which now have ten technical colleges, were together as one state before the creation of Kogi State in 1991. Some of the technical colleges found in Kwara and Kogi states today were established when the two states were together. Similar technical trades are offered in these technical colleges. Also, some of the technical teachers in Kwara state at present have taught in technical colleges now found in Kogi state and vice versa. The area covers all the six senatorial districts of the two states which are Kwara South, Kwara Central, Kwara North, Kogi West, Kogi Central and Kogi East. The River Niger, which is one of the two major rivers in Nigeria transverses the two States. The technical colleges are sited in the urban and in the rural areas. The inhabitants are mainly civil servants, traders and farmers. They are culturally homogeneous, possessing similar research characteristics and have common languages like Yoruba and Nupe.

Population of the Study

The population of this study consisted of the 793 teachers in all the technical colleges in the area of study. Data collected from the bulletins of the statistics departments of the Ministry of Education, Science and Technology at Ilorin and Lokoja in November, 2014 showed that there were 393 and 400 technical college teachers in Kwara and Kogi States respectively.

Sample and Sampling Techniques

The sample for the study was 397 technical teachers. Proportionate stratified random sampling technique was used to obtain the sample. All the 10 technical colleges in the two states were used. The colleges were stratified into urban and rural areas and 50 percent of the population of technical teachers in each college were randomly selected. A total of 197 technical teachers in Kwara State and 200 technical teachers in Kogi State were used for the study, making it 397 respondents.

Instrument for Data Collection

The researcher developed the questionnaire named 'Questionnaire on Typology, Causative Factors and Preventive Strategies of Accidents in Technical College Workshops (QTCFPSATCW) which was the instrument used for data collection. A synthesis of the views and positions gathered from the review of related literature guided the construction of the questionnaire. The instrument-(Appendix B) has five sections; A, B, C, D, and E. Section A elicited personal data from the respondents. Section B contained items of types of accidents that could occur in technical college workshops. It has 20 items. Section C collected data of human factors that could cause accidents in technical college workshops. It has 26 items. On the other hand, Section D contained items on environmental factors that could cause accidents in technical college workshops. It has 13 items. Section E

contained items on strategies that could be used to prevent accidents in technical college workshops. It has 14 items. The Likert scale was adopted for the instrument with five response options of: Strongly Agree (SA) = 5; Agree (A) = 4; Undecided (UD) = 3; Disagree (D) = 2; and Strongly Disagree (SD) = 1. A sample of the instrument is attached as Appendix B on page 102.

Validation of the Instrument

To validate the instrument, copies of the research topic, purpose of study, research questions and hypotheses together with the draft instrument were given to two experts in technical education and one expert in measurement and evaluation all from the Faculty of Education, Nnamdi Azikiwe University, Awka. The experts carried out face validity of the instrument. All comments and suggestions that were made through the validation process by the experts were incorporated and reflected in the instrument as appropriate after approval by the project supervisor. The experts' comments are attached as Appendix C on page 110.

Reliability of the Instrument

The reliability of the instrument was determined by distributing it to 20 randomly selected technical teachers from Federal Government Science and Technical College, Awka and Government Technical College, Utuh in Anambra State. The data collected were anaylized with Cronbach Alpha statistics and reliability co-efficient values obtained were 0.93, 0.93, 0.91and 0.93 for sections

B, C, D and E of the instrument respectively. On the whole, the instrument yielded reliability co-efficient of 0.92 which was considered high and acceptable for the study. The reliability calculation is attached as Appendix D on page 112.

Method of Data Collection

The researcher prepared 10 research assistants who helped him to personally distribute 397 copies of the instrument to the respondents in the two states, with accompanying letters of transmittal. Some respondents completed the questionnaire on the spot and they were retrieved but in most cases where on the spot completion or retrieval were not possible, therefore, the researcher and assistants re-visited the concerned respondents on agreed dates for retrieval. In all, 385 copies of the questionnaire (representing 97 percent) were retrieved and used for the study. The distribution of the questionnaire is attached as Appendix E on page 113.

Method of Data Analysis

The data collected from the respondents were collated and analysed using the percentage, the mean, the standard deviation and the z-test. The percentage was used to analysed the background information. The mean was used to analysed the data related to the research questions. The level of agreement and disagreement of each item of the questionnaire was determined based on mean rating of the item

interpreted relative to real limits of numbers on a five points Likert rating scale and assigned values as shown thus:

Responses	**Response Code**	**Ratings**	**Real Limits**
Strongly Agree	SA	5	4.50-5.00
Agree	A	4	3.50-4.49
Undecided	UD	3	2.50-3.49
Disagree	D	2	1.50-2.49
Strongly Disagree	SD	1	0.50-1.49

The decision rule for the research questions was based on the mean rating value of 3.50. Therefore, any item with mean rating value of 3.50and above was accepted, while any item with mean rating value less than 3.50 was rejected. Standard deviation was applied to measure dispersion of respondents' responses on the mean values of their responses. The smaller the standard deviation, the more homogeneous their responses are. The z-test for independent samples was used to test the hypotheses at 0.05 level of significance. A hypothesis was accepted where the calculated z-test value is less than the critical table value and it was rejected where the calculated z-value is equal to or greater than critical z-value.

CHAPTER FOUR

PRESENTATION AND ANALYSIS OF DATA

This chapter presents the data and the statistical analysis of the study. The presentation of data was based on the questionnaire returned. Out of 397, a total of 385 were returned. This represents 97 percent return. Presentation of data analysis and results were ordered according to research questions raised and hypotheses postulated in chapter one.

Background Information

Table 1: Distribution of Respondents by Personal Data

School Location			**Gender**			**Experience**		
	No	**%**		**No**	**%**		**No**	**%**
Urban	154	40	Male	300	77.9	≥6yrs	317	82.3
Rural	231	60	Female	85	22.1	<6yrs	68	17.7
Total	**385**	**100**		**385**	**100**		**385**	**100**

Data in Table 1show that 154 of the respondents are in urban area while majority (231) of them are in rural schools. The data further show that more than three quarters of the respondents (300) are males while only one quarter (85) are females. In addition, the data show that respondents with at least six years' experience are in the majority (more than four fifths- 317) while only one fifth (68) have less than six years of experience. In summary, data in the table show that

there are more technical teachers in rural areas in Kwara and Kogi States and they are dominantly males and experienced.

Research Question 1

What types of accidents could occur in technical college workshops in urban areas of Kwara and Kogi States? Questionnaire items 1-20 were used to analyse this research question and the results obtained were shown in Table 2.

Table 2: Respondents' Mean Ratings and Standard Deviations on Types of Accidents that could occur in Technical College Workshops in Urban Areas of Kwara and Kogi States (N=385)

S/N	Type of Accidents	$\overline{X}$	S.D.	Remark
1	Struck by falling objects	3.75	1.19	A
2	Fall from height	3.21	1.35	UD
3	Electric shock	4.19	1.09	A
4	Trips and fall	3.16	1.43	UD
5	Slips and fall	4.27	0.09	A
6	Burns from chemical splash	3.03	1.64	UD
7	Burns from electric flash	3.90	1.14	A
8	Burns from hot object (e.g oven, forge)	4.19	0.99	A
9	Cuts from sharp object	4.23	1.07	A
10	Scratches	3.65	1.26	A
11	Crushing of the toe or heel by objects	4.16	0.89	A
12	Piercing of foot or hand by sharp object	4.44	0.77	A
13	Fracture of the limbs	3.25	1.34	UD
14	Fire incidence	3.51	1.38	A
15	Eye injury	3.82	1.21	A
16	Inhalation of fumes/gas	3.49	1.18	UD
17	Electrocution	3.03	1.17	UD
18	Contact with rotating/revolving parts	3.52	1.25	A
19	Amputation	2.14	1.13	D
20	Hitting/cutting of finger with tools	3.64	1.19	A
	Mean of Mean/S.D.	**3.63**	**1.14**	**A**

The results of data presented in Table 2 show data of technical teachers' rating of types of accidents that could occur in technical college workshops in urban areas. Items 1, 3, 5, 7, 8, 9 and 10 were rated above 3.50. Other items rated above 3.50 were items 11, 12, 14, 15, 18 and 20. This means that the respondents agreed that the listed types of accidents could occur in technical college workshops in urban areas.

On the other hand the respondents were undecided on their mean ratings of items 2, 4, 6, 13, 16 and 17 while they disagreed with item 19. The mean ratings of these items were less than the cut off mean of 3.50. This means that the technical teachers do not agree that the listed types of accidents could occur in technical college workshops in urban areas.

Research Question 2

What types of accidents could occur in technical college workshops in rural areas of Kwara and Kogi States? Questionnaire items 1-20 were used to analyse this research question and the results obtained were shown in Table 3.

Table 3: Respondents' Mean Ratings and Standard Deviations on Types of Accidents that could occur in Technical College Workshops in Rural Areas of Kwara and Kogi States (N=385)

S/N	Type of Accidents	$\overline{X}$	S.D	Remark
1	Struck by falling objects	3.74	0.97	A
2	Fall from height	3.66	1.07	A
3	Electric shock	4.19	1.09	A
4	Trips and fall	3.00	1.43	UD
5	Slips and fall	3.31	1.45	UD
6	Burns from chemical splash	3.48	1.37	UD

Table 3 cont.

S/N	Type of Accidents	$\overline{X}$	S.D	Remark
7	Burns from electric flash	3.51	1.57	A
8	Burns from hot object (e.g oven, forge)	3.75	1.13	A
9	Cuts from sharp object	4.04	1.09	A
10	Scratches	3.47	1.00	UD
11	Crushing of the toe or heel by objects	3.54	0.96	A
12	Piercing of foot or hand by sharp object	4.01	0.72	A
13	Fracture of the limbs	3.27	1.02	UD
14	Fire incidence	3.60	1.38	A
15	Eye injury	3.44	1.35	UD
16	Inhalation of fumes/gas	3.41	1.15	UD
17	Electrocution	3.05	1.40	UD
18	Contact with rotating/revolving parts	3.32	1.05	UD
19	Amputation	2.46	1.15	D
20	Hitting/cutting of finger with tools	3.44	1.28	UD
	Mean of Mean/SD	**3.48**	**1.18**	**UD**

The results of data presented in Table 3 show data of technical teachers' rating of types of accidents that could occur in technical college workshops in rural areas. Items 1, 2, 3, 7, 8, 9, 11, 12 and 14 were rated above 3.50. This means that the respondents agreed that the listed types of accidents could occur in technical college workshops in rural areas.

On the other hand the respondents were undecided on their mean ratings of items 4, 5 6, 10, 13, 15, 16, 17, 18 and 20 while they disagreed with item 19. The mean rating values of these items were less than the cut off mean of 3.50. This means that the technical teachers do not agree that the listed types of accidents could occur in technical college workshops in rural areas.

Research Question 3

What human factors could cause accidents in technical college workshops in urban areas of Kwara and Kogi States? Questionnaire items 21-46 were used to analyse this research question and the results obtained were shown in Table 4.

Table 4: Respondents' Mean Ratings and Standard Deviations on Human Factors that could cause Accidents in Technical College Workshops in Urban Areas of Kwara and Kogi States (N=385).

S/N	Human Factors	$\overline{X}$	S.D.	Remark
21	Unauthorized operations of machines	3.98	1.18	A
22	Using defective tools and equipment	3.49	1.38	UD
23	Engaging in horse play	3.82	1.28	A
24	Improper use of personal protective equipment	3.96	1.10	A
25	Answering phone call during operation	3.33	1.58	UD
26	Failure to adhere to safety rules and regulations	4.07	1.16	A
27	Failure to tag-out/lock-out	3.91	0.77	A
28	Working on an unearthed electrical equipment	3.50	1.12	A
29	Trying to catch a falling tool	3.28	1.12	UD
30	Drinking alcohol/taking drug on duty	3.29	1.53	UD
31	Using lift jack without chocking the vehicle	3.58	1.18	A
32	Carrying many materials at a time	3.55	1.14	A
33	Using strained ropes/chain/slings	3.38	1.14	UD
34	Using generator in an enclosed space	3.46	1.45	UD
35	Trying to stop revolving/rotating parts with hand	3.58	1.59	A
36	Welding in a confined space	3.37	1.33	UD
37	Working on a suspended scaffold/ladder	2.98	1.37	D
38	Using arc welding machine to weld a part of vehicle without removing battery terminals	3.17	1.38	UD
39	Stretching oneself on a ladder	3.17	1.13	UD
40	Using water to quench electric fire	3.59	1.39	A
41	Improper planning	3.69	1.23	A
42	Inexperienced and untrained staff	3.74	1.23	A

S/N	Human Factors	S.D	Remark				
43	Lack of safety consciousness	4.09	1.09		A		
44	Bad lifting techniques	3.88	1.04		A		
45	Over confidence	3.88	1.16		A		
46	Prolong activities			3.64	1.23		A
Mean of Mean/SD		**3.59**	**1.25**		**A**		

The results of data presented in Table 4 show data of human factors that could cause accidents in technical college workshops in urban areas. Items 21, 23, 24, 26, 27, and 28, were rated above 3.50. Other items with mean rating values above 3.50 were 31, 32, 35, 40, 41, 42, 43, 44, 45 and 46. This means that the respondents agreed that the listed human factors could cause accidents in technical college workshops in urban areas.

On the other hand the respondents were undecided on their mean ratings of items 22, 25, 29, and 30. Others were undecided with are items 33, 34, 36, 38, and 39, while they disagreed with item 37. The mean rating values of these items were less than the cut off mean value of 3.50. This means that the technical teachers do not agree that the listed human factors could cause accidents in technical college workshops in urban areas.

Research Question 4

What human factors could cause accidents in technical college workshops in rural areas of Kwara and Kogi States? Questionnaire items 21-46 were used to analyse this research question and the results obtained are shown in Table 5.

Table 5: Respondents' Mean Ratings and Standard Deviations on Human Factors that could cause Accidents in Technical College Workshops in Rural Areas of Kwara and Kogi States (N=385)

S/N	Human Factors	$\overline{X}$	S.D	Remark
21	Unauthorized operations of machines	3.74	1.25	A
22	Using defective tools and equipment	3.70	0.82	A
23	Engaging in horse play	4.00	0.74	A
24	Improper use of personal protective equipment	4.22	0.83	A
25	Answering phone call during operation	3.89	1.23	A
26	Failure to adhere to safety rules and regulations	4.39	0.49	A
27	Failure to tag-out/lock-out	4.17	0.37	A
28	Working on an unearthed electrical equipment	3.87	0.67	A
29	Trying to catch a falling tool	3.65	1.08	A
30	Drinking alcohol/taking drug on duty	3.40	1.61	UD
31	Using lift jack without chocking the vehicle	4.12	0.67	A
32	Carrying many materials at a time	4.20	0.77	A
33	Using strained ropes/chain/slings	3.60	0.86	A
34	Using generator in an enclosed space	3.55	1.10	A
35	Trying to stop revolving/rotating parts	4.27	0.70	A
36	Welding in a confined space	3.90	0.80	A
37	Working on a suspended scaffold/ladder	3.90	0.66	A
38	Using arc welding machine to weld a part of vehicle without removing battery terminals	3.77	1.33	A
39	Stretching oneself on a ladder	3.37	0.96	UD
40	Using water to quench electrical fire	3.59	1.18	A
41	Improper planning	3.66	0.81	A
42	Inexperienced and untrained staff	3.63	1.00	A
43	Lack of safety consciousness	3.74	0.91	A
44	Bad lifting techniques	3.58	0.85	A
45	Over confidence	3.55	1.31	A
46	Prolong activities	3.42	1.18	UD
	Mean of Mean/S.D.	**3.80**	**0.90**	**A**

The results of data presented in Table 4 show data of human factors that could cause accidents in technical college workshops in rural areas. Items 21, 22,

23, 24, 25, 26, 27, 28, 31, 33 and 34 were rated above 3.50. Other items with mean rating values above 3.50 were 35, 36, 37, 38, 40, 41, 42, 43, 44, and 45. This means that the respondents agreed that the listed human factors could cause accidents in technical college workshops in rural areas.

On the other hand the respondents were undecided on their mean ratings of items 30, 39, and 46. The mean rating values of these items were less than the cut off mean value of 3.50. This means that the technical teachers do not agree that the listed human factors could cause accidents in technical college workshops in rural areas.

Research Question 5

What environmental factors could cause accidents in technical college workshops in urban areas of Kwara and Kogi States? Questionnaire items 47-59 were used to analyse this research question and the results obtained are shown in Table 6.

Table 6: Respondents' Mean Ratings and Standard Deviations on Environmental Factors that could cause Accidents in Technical College Workshops in Urban Areas of Kwara and Kogi States (N=385)

S/N	Environmental Factors	$\overline{X}$	S.D	Remark
47	Inadequate supports or guards	3.84	1.09	A
48	Poor housekeeping	3.66	1.21	A
49	Inadequate tools and materials	4.12	0.83	A
50	Distraction from other people	3.91	1.03	A
51	Slippery floor	3.84	1.42	A
52	Substandard materials equipment	3.69	1.30	A
53	Lack of regular insp./maintenance	3.73	1.39	A
54	Ineffective earthing system	3.74	1.00	A
55	Inadequate lighting/illumination	3.73	1.36	A

Table 6 cont.

S/N	Environmental Factors	$\bar{X}$	S.D	Remark
56	Lack of personal protective equipment	4.05	1.20	A
57	Overloading equipment above its rating	3.97	1.23	A
58	Leaking gas cylinder	3.55	1.50	A
59	Congestion in work place	3.58	1.42	A
	Mean of Mean/S.D	**3.76**	**1.22**	**A**

The result of data analysis presented in Table 6 show that all the 13 items had mean range of 3.55 to 4.12. This range was above the cut off mean of 3.50. This implies that the items are environmental factors that could cause accidents in technical college workshops in urban areas.

Research Question 6

What environmental factors could cause accidents in technical college workshops in rural areas of Kwara and Kogi States? Questionnaire items 47-59 were used to analyse this research question and the results obtained are shown in Table 7.

Table 7: Respondents' Mean Ratings and Standard Deviations on Environmental Factors that could cause Accidents in Technical College Workshops in Rural Areas of Kwara and Kogi States (N=385)

S/N	Environmental Factors	$\bar{X}$	S.D	Remark
47	Inadequate supports or guards	4.10	0.58	A
48	Poor housekeeping	3.93	0.46	A
49	Inadequate tools and materials	4.20	0 .53	A
50	Distraction from other people	3.61	1.00	A
51	Slippery floor	3.81	0.98	A
52	Substandard materials/equipment	3.61	0.98	A
53	Lack of regular insp. /maintenance	4.07	0.58	A
54	Ineffective earthing system	3.87	0.46	A
55	Inadequate lighting/illumination	3.97	0.34	A
56	Lack of personal protective equipment	4.13	0.41	A
57	Overloading equipment above its rating	3.65	1.15	A

Table 7 cont.

S/N	Environmental Factors	$\bar{X}$	S.D.	Remark
58	Leaking gas cylinder	4.08	0.61	A
59	Congestion in work place	3.99	0.60	A
	Mean of Mean/S.D.	**3.92**	**0.66**	**A**

The results of data analysis presented in Table 7 show that all the 13 items had their mean rating higher than the cut off mean of 3.50. Item 49, inadequate tools and materials was rated highest with a mean score of 4.20, while item 52, substandard materials/equipment was rated lowest with a mean score of 3.61. This means that the respondents agreed that the listed environmental factors could cause accidents in technical college workshops in rural areas.

Research Question 7

What are the strategies that could be adopted to prevent accidents in technical college workshops in Kwara and Kogi States?

To answer this question, the relevant data were analysed and results obtained are shown in Table 8.

Table 8: Strategies that could be adopted to Prevent Accidents in Technical College Workshops (N=385)

S/N	Strategies	$\bar{X}$	S.D	Remark
60	Hazard identification and reporting	4.18	0.98	A
61	Effective supervision	4.11	0.89	A
62	Compliance with safety rules and regulation	4.32	0.93	A
63	Management Commitment	4.09	0.81	A
64	Routine inspection and maintenance	4.32	0.81	A
65	Use of safety tips and flyers	4.09	0.90	A
66	Accident investigation and reporting	4.10	0.98	A
67	Regular safety meetings	4.08	0.78	A

Table 8 cont.

S/N	Strategies	$\bar{x}$	S.D	Remark
68	Fortified first aid box	3.99	1.04	A
69	Adequate waste disposal unit	4.05	0.85	A
70	Provision of accident statistic board	4.02	0.90	A
71	Good housekeeping	4. 21	0.72	A
72	Provision of adequate tools and materials	4.16	0.84	A
73	Provision of standard safety devices	4.24	0.87	A
	Mean of Mean/S.D	**4.14**	**0.88**	**A**

The results of data presented in Table 8 show the mean scores and standard deviation of respondents' rating of strategies that could be adopted to prevent accidents in technical college workshops. All the items have their mean rating values above 3.50 with highest mean rating value of 4.32 and least mean rating value of 3.99. They are therefore accepted. This was further confirmed by the grand mean and standard deviation of 4.14 and 0.88 respectively.

Test of Hypothesis

The hypotheses formulated for the study were tested in this section. The z-test statistical was used for analysing data the relating to the hypotheses at 0.05 level of significance.

1: There is no significant difference in the mean ratings of more experienced and less experienced technical teachers on the types of accidents that could occur in technical college workshops.

The test of hypothesis 1 is presented in table 9.

Table 9: z-test Summary of Mean Ratings of More Experienced and Less Experienced Technical Teachers of Types of Accidents that could occur in Technical College Workshops

Group	N	$\overline{X}$	SD	df	z-cal	z-critical	Remark
More Experienced Technical Teachers	317	3.49	1.19				
				383	1.56	1.96	Accepted
Less experienced Technical Teachers	68	3.73	1.14				

Table 9 presented the z-test summary of the mean rating values of more experienced and less experienced technical teachers on types of accidents that could occur in technical college workshops. From the analysis, it can be observed that the mean for the more experienced technical teacher was 3.49 and that of the less experienced technical teachers was 3.73. The standard deviations were 1.19 and 1.14 respectively.

The calculated z-value was 1.56 and the critical z-value was 1.96. Since the calculated z-value of 1.56 is less than the critical z-value of 1.96 at 0.05 level of significance. This indicates that more experienced and less experienced technical teachers did not differ significantly on the types of accidents that could occur in technical college workshops. The hypothesis is accepted.

2: Male and female technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops.

The test of hypothesis 2 is presented in table 10.

Table 10: z-test Summary of Mean Rating of Male and Female Technical Teachers of Human Factors that could cause Accidents in Technical College Workshops

Group	N	$\overline{X}$	SD	df	z-cal	z-critical	Remark
Male Technical Teachers	300	3.70	2.80				
				383	0.23	1.96	Accepted
Female Technical Teachers	65	3.78	0.99				

Table 10 presented the z-test summary of the mean rating values of male and female technical teachers on human factors that could cause accidents in technical college workshops. The mean for male technical teacher was 3.70 and that of female technical teachers was 3.78. The standard deviations were 2.80 and 0.99 respectively. The calculated z-value was 0.23 and the critical z-value was 1.96.

Since the calculated z-value of 0.23 is less than the critical z-value of 1.96 at 0.05level of significance, the hypothesis is therefore accepted. This means that there exists no significance difference in the mean ratings of male and female technical teachers of human factors that could cause accidents in technical college workshops.

3: Technical teachers in urban and rural areas do not differ significantly in their mean ratings of environmental factors that could cause accidents in technical college workshops.

The test of hypothesis 3 is presented in table 11.

Table 11: z-test summary of Mean Ratings of Urban and Rural Technical Teachers of Environmental Factors that could cause Accidents in Technical College Workshops

Group	N	$\overline{X}$	SD	dF	z-cal	z-critical	Remark
Urban Technical Teachers	154	3.79	1.22				
				383	1.11	1.96	Accepted
Rural Technical Teachers	231	3.91	0.66				

Table 11 presented the z-test analysis of the mean rating values of urban and rural technical teachers of environmental factors that could cause accidents in technical college workshops. From the analysis, it can be observed that the mean for technical teacher in urban areas was 3.79 and that of technical teachers in rural areas was 3.91. The standard deviations were 1.22 and 0.66 respectively.

The calculated z-value was 1.11 and the critical z-value was 1.96. It can be inferred that the calculated z-value of 1.11 is less than the critical z-value of 1.96, hence; the null hypothesis is accepted. This means that there is no significance difference in the environmental factors that could cause accidents in technical college workshops in the urban and rural areas.

4: More experienced and less experienced technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops.

The test of hypothesis 4 is presented in table 12.

Table 12: z-test Summary of Mean Rating of More Experienced and Less Experienced Technical Teachers of Human Factors that could cause Accidents in Technical College Workshops

Group	N	$\overline{X}$	SD	dF	z-cal	z-critical	Remark
More Experienced Technical Teachers	317	3.69	1.06				
				383	1.02	1.96	Accepted
Less Experienced Technical Teachers	68	3.84	1.11				

Table 12 presented the z-test summary of the mean rating values of more experienced and less experienced technical teachers on human factors that could cause accidents in technical college workshops. The mean for more experienced technical teacher was 3.69 and that of less experienced technical teachers was 3.84. The standard deviations were 1.06 and 1.11 respectively.

The calculated z-value was 1.02 and the critical z-value was 1.96. Since the calculated z-value of 1.02 is less than the critical z-value of 1.96 at 0.05 level of significance, the hypothesis is therefore accepted. This means that there exists no significant difference in the mean ratings of more experienced technical teachers and less experienced technical teachers on human factors that could cause accidents in technical college workshops.

5: There is no significant difference in the mean ratings of more experienced and less experienced technical teachers of strategies that could be adopted to prevent accidents in technical college workshops.

The test of hypothesis 5 is presented in table 13.

Table 13: z-test summary of Mean Ratings of More Experienced and Less Experienced Technical Teachers of Strategies that could be adopted to Prevent Accidents in Technical College Workshops

Group	N	$\overline{X}$	SD	dF	z-cal	z-critical	Remark
More Experienced Technical Teachers	317	4.09	0.90				
				383	1.02	2.77	Rejected
Less Experienced Technical Teachers	68	4.36	0.60				

Table 13 presented the z-test summary of the mean rating values of more experienced and less experienced technical teachers of strategies that could be adopted to prevent accidents in technical college workshops. From the analysis, it can be observed that the mean for more experienced technical teachers was 4.09 and that of less experienced technical teachers was 4.36. The standard deviations were 0.90 and 0.60 respectively.

The calculated z-value was 2.77 and the critical z-value was 1.96. Since the calculated z-value of 2.77 is greater than the critical z-value of 1.96 at 0.05 level of significance, the hypothesis is rejected. This shows that there is a significant difference in the mean ratings of more experienced and less experienced technical teachers of the strategies that could be adopted to prevent accidents in technical college workshops.

6: There is no significant difference in the mean ratings of male and female technical teachers of strategies that could be adopted to prevent accidents in technical college workshops.

The test of hypothesis 6 is presented in table 14.

Table 14: z-test Summary of Mean Rating of Male and Female Technical Teachers of Strategies that could be adopted to Prevent Accidents in Technical College Workshops

Group	N	$\overline{X}$	SD	dF	z-cal	z-critical	Remark
Male Technical Teachers	300	4.10	0.89				
				383	1.69	1.96	Accepted
Female Technical Teachers	85	4.26	0.73				

Table 14 presented the z-test analysis of the mean rating values of male and female technical teachers of strategies that could be adopted to prevent accidents in technical college workshops. From the analysis, it can be observed that the mean for the male technical teacher was 4.10 and that of the female technical teachers was 4.26. The standard deviations were 0.89 and 0.73respectively.

The calculated z-value was 1.69 and the critical z-value was 1.96. Since the calculated z-value of 1.69 is less than the critical z-value of 1.96 at 0.05 level of significance, the null hypothesis is accepted and the alternative rejected. This means that there exists no significant difference in the mean ratings of male technical teachers and female technical teachers of strategies that could be adopted to prevent accidents in technical college workshops.

Summary of the Findings

The following findings were made:

1. That the types of accidents that could occur in technical college workshops among others include: cuts from sharp objects, scratches, crushing of the toe or heel by objects, piercing of foot or hand by sharp objects, eye injury, hitting/cutting of the finger with tools, burns from hot objects (e.g. oven, forge), fall from height and electric shock.
2. That amputation, trips and fall, burns from chemical splash, fracture of the limbs, inhalation of fumes/gas and electrocution could not occur in technical college workshops.
3. That human factors including failure to adhere to safety rules and regulations, using defective tools and equipment, engaging in horse play, improper use of personal protective equipment, inexperienced and untrained staff and unauthorized operations of machines among others could cause accidents in technical college workshops.
4. That stretching oneself on a ladder could not cause accidents in technical college workshops.
5. That environmental factors that could cause accidents in technical college workshops among others are inadequate tools and materials, lack of regular

inspection/maintenance, substandard materials/equipment, poor housing keeping and lack of safety devices.

6. That among the strategies that could be adopted to prevent accidents in the technical college workshops are Compliance with safety rules and regulations, provision of standard safety devices, provision of adequate tools and materials, routine inspection and maintenance, good housekeeping and management commitment.
7. More experienced and less experienced technical teachers do not differ significantly in their mean ratings of types of accidents that could occur in technical college workshops.
8. There exists no significant difference in the mean ratings of male and female technical teachers of human factors that could cause accidents in technical college workshops.
9. Technical teachers in urban and rural areas do not differ significantly in their mean ratings of environmental factors that could cause accidents in technical college workshops.
10. There exists no significant difference in the mean ratings of more experienced technical teachers and less experienced technical teachers on human factors that could cause accidents in technical college workshops.

11. There is a significant difference in mean ratings of more experienced and less experienced technical teachers of strategies that could be adopted to prevent accidents in technical college workshops.
12. There exists no significant difference in the mean ratings of male technical teachers and female technical teachers of strategies that could be adopted to prevent accidents in technical college workshops.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This chapter presents the discussion of the findings, conclusion, implication of the findings, limitations of the study, recommendations and suggestions for further studies.

Discussion

Findings of the study are discussed under:

1 Types of accidents that could occur in technical college workshops.

2 Human factors that could cause accidents in technical college workshops.

3 Environmental factors that could cause accidents in technical college workshops.

4 Strategies that could be adopted to prevent accidents in technical college workshops.

Types of accidents that could occur in technical college workshops

With respect to research question 1 and 2 which were presented in Tables 2 and 3 which sought to identify the types of accidents that could occur in technical college workshops in urban and rural areas, findings indicated that cuts from sharp objects, scratches, crushing of the toe or heel by objects, piercing of foot or hand by sharp objects, eye injury, hitting/cutting of the finger with tools, burns from hot objects (e.g. oven, forge) and electric shock could occur. These findings corresponded to those of Olateju (2005); Kadiri (2006); Okeke and Oranu (2006);

Uwaifo (2009) and Offomnbuk and Ekereobong (2012). The authors listed electric shock, slips and fall, burn from hot metals, cuts and eye injury as accidents that do occur in technical college workshops.

It was also found out that amputation, trips and fall, burns from chemical splash, fracture of the limbs, inhalation of fumes/gas and electrocution could not occur in technical college workshops. This is in disagreement with Olateju (2005), Kadiri (2006) and Okeke and Oranu (2006). The authors listed amputation, trips and fall, burns from chemical splash, fracture of the limbs, inhalation of fumes/gas and electrocution as part of accidents in vocational technical education workshops. Apart from trips and fall, other accidents listed here are major accidents that could leave permanent deformation to their victims or even death as in the case of electrocution. It is just possible that technical teachers are more careful when activities that could lead to these types of accidents are involved.

Finding of hypothesis 1 which was presented in Table 9 revealed that there was no significant difference in the mean ratings of more experienced and less experienced technical teachers on the types of accidents that could occur in technical college workshops. The mean ratings are 3.49 and 3.73 for more experienced and less experienced technical teachers respectively. This suggests that experience has no significant role to play in the types of accidents that could occur in technical college workshops. It is in the opinion of this researcher that

equipment and tools have no human leniency and that they have no respect for years of experience only that the rules and precautions guarding them must be obeyed by their users.

Human factors that could cause accidents in technical college workshops

Table 3 and Table 4 present the results on human factors that could cause accidents in technical college workshops in urban and rural areas. The results from the analyses showed that technical teachers agreed that failure to adhere to safety rules and regulations could lead to accident in the workshop. This is in consonant with Dolan (2000) who observed that non-compliance with safety rules and regulations is a common cause of accidents in technical workshops.

This finding also agreed with Okeke and Oranu (2006) who lamented that accidents occurred in the workshop as a result of violation of the common law as disrespect to safety precaution or procedure. Nwaifo (2009) advised that the only way to safeguard against accidents in technical college workshop is to be disciplined while in the workshop or by strict compliance with rules and regulations peculiar to that workshop. This researcher is convinced that students could be exposed to hazards if not properly guided with necessary safety instruction during practical exercises. Technical college administrators and workshop supervisors therefore should set examples by following established rules and regulations, which ultimately sets the tone for workshop safety.

Findings also indicate that inexperienced and untrained staff could cause serious accidents in technical college workshops. This is in consonant with Fafunwa (2008) who declared that the educational system requires well-trained technical and commercial teachers that can operate equipment for carpentry, brick-laying, technical drawing, electronics, electrical, automobile, and home economics. Nwachukwu (2001) lamented that there is a noticeable lack of teacher preparation and difficulty in recruiting well-educated teachers with skills and competencies in technical education. Programmes designed for technical teachers should be planned to include the methodology of the use of equipment and tools.

There were disparities in the mean ratings of urban and rural technical teachers of some items of human factors that could cause accidents. Technical teachers in urban areas were undecided in their mean ratings of items 22, 25, 29, 30, 33, 36, 38 and 39, while technical teachers in rural areas were undecided in their mean ratings of item 46. Could it be that there exists a disparity in the standard of urban and rural technical colleges or that there is a lack of commitment in the technical teachers in urban and rural technical colleges? Umunadi (2009) revealed that equipment utilization is greater in the urban technical colleges relative to rural technical colleges. It is possible that this is because technical teachers in rural areas do not make use of the available equipment and materials due to lack of motivation to cope with life in isolated and remote areas. It is the

opinion of this researcher that equal access to technology is a great asset to urban and rural technology integration.

Finding of hypothesis 2 which was presented in Table 10 of chapter four revealed that male and female technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops. Also, finding of hypothesis four which was presented in Table 12 revealed that more experienced and less experienced technical teachers do not differ significantly in their mean ratings of human factors that could cause accidents in technical college workshops. These show that male and female technical teachers irrespective of their experiences agreed that there are human factors that could cause accidents in technical college workshops.

Environmental factors that could cause accidents in technical college workshops

The results of the analysis presented in Table 6 and Table 7 which sought to establish environmental factors that could cause accidents in technical college workshops in urban and rural areas revealed that inadequate tools and materials, substandard materials/equipment, and lack of safety devices are environmental factors that could lead to accidents in technical college workshops. These are in line with Osuala (2004) who lamented that major problems facing vocational and technical education were inadequate quantities of equipment, machines, tools, and instructional materials. Moses (2011) corroborated Osuala (2004) when he asserted

that inadequate school facilities constitute one of the major sources of frustration and disillusionment in technical and vocational education and training. Odu, (2011) lamented that some technical teachers were either trained on obsolete equipment or have worked with such equipment for a long time that their skills need to be updated through training and re-training programme. Chukwurah (2013) concluded that most vocational institutions in Nigeria are ill-equipped.

It is the opinion of this researcher that inadequate tools, equipment and materials could cause accidents especially in the urban areas where students' enrolment is high. A situation where 100 or more students besiege a machine during practical activity is practically impossible without accident occurrence. It is even more difficult for a technical teacher to supervise an overcrowded work arena. This cannot make for a true and accident-free acquisition of skills. Government must provide sufficient facilities in technical college workshops if accidents are to reduce in technical college workshops.

Finding of hypothesis 3 which was presented in Table 11 of chapter four revealed that there was no significance difference on environmental factors that could cause accidents in technical college workshops in urban and rural areas. This implies that similar environmental factors could cause accidents in both urban and rural areas. It is the opinion of this researcher that inadequate tools, equipment, safety devices, materials and/or poor maintenance of them could cause avoidable

accidents in technical college workshops irrespective of the geographical location. Poor housekeeping and congestion in work area will also cause accident whether in the urban or rural area.

Strategies that could be adopted to prevent accidents in technical college workshops

The results in Table 8 present strategies that could be adopted to prevent accidents in technical college workshops. The findings of this study had shown that good strategies could help in accidents prevention. This is in agreement with Omotayo (1996) who revealed that accidents prevention and reduction in technical college workshop are possible if necessary facilities and safety strategies are put in place. This researcher believes that provision of adequate tools and materials, standard safety devices; accidents statistic board and safety flyers are good strategies to prevent accidents. An automatic circuit breaker if installed on a machine could help prevent electric shock or fire outbreak when fault occurs in the machine. Also, a safety guard on a machine will serve as an obstacle that prevents a worker from touching dangerous areas of the machine (like rotating shaft, gear or belt).

The findings of the study also revealed that hazard identification, routine inspection and maintenance and management commitment could be adopted as good strategies to prevent accidents. This is in agreement with Ojelade (2008) who pointed out that proper maintenance of school facilities ensures safety. Also,

Ogundare (2008) pointed out that a safe place to work and a safe procedure are a management responsibility and cannot be shifted. Effective maintenance culture, which combines resources and activity, is vital to accident prevention in technical college workshops. On a day- to - day level, routine inspection must be carried out on all the equipment and tools before use. Any hazard identified must be reported and a caution tag placed on such machine to stop further use until the hazard is removed.

Technical teachers also agreed that good housekeeping is one strategy that could be adopted to prevent accidents in technical college workshops. This finding agreed with the findings of Ajisafe and Adeoye (1997) and Ogundare (2008). The authors observed that good housekeeping eliminates physical risk and also contributes to safety psychological effect. The finding of the study also supported Okeke and Oranu (2006) who stated that physical facilities of a school workshop have a tremendous significance in preventing accidents. Good housekeeping is the practice of maintaining a clean, clutter-free and organized workplace that eliminates or greatly reduces the risk of slip, trip or fall. It means having no unnecessary items about and keeping all necessary items in their proper place. This researcher believes that effective housekeeping can eliminate some workplace hazards and help get a job done safely and properly, while poor housekeeping can frequently contribute to accidents by hiding hazards that cause injuries.

The testing of hypothesis 6 in Table 14 revealed that the null hypothesis was accepted. This means that there exist no significance difference in the mean ratings of male technical teachers and female technical teachers on strategies that could be used to prevent accidents in technical college workshops. This finding shows clearly that these strategies are not gender biased. What this implies is that the strategy a male teacher would use to prevent accident in technical college workshop could also be used for the same purpose by a female teacher. This finding has provided hope against some reports that some occupations and technological subjects are seen by the society to be of men's domain (Okeke, 2005).

Conclusion

Based on the findings of this study, it was concluded that the types of accident that could occur in technical college workshops among others are cuts from sharp objects, scratches, eye injury, burns, fall from height and electric shock. Human factors like failure to adhere to safety rules and regulations and environmental factors such as inadequate quantities of tools, and poor housekeeping are some of the causes of various kinds of accident in technical college workshops. Some strategies such as provision of adequate tools and materials, routine inspection, good housekeeping, recruitment of quality and quantity technical teachers could be adopted to prevent accident in technical college workshops.

Implication of the Study

The findings of this study have some important educational implications. The types of accidents that could occur in technical college workshops had been established, the implication therefore is that technical teachers should guard against human and environmental factors that could cause these accidents. If not it could derail the aims and objectives of setting up technical education programme.

From the study, it was found out that unauthorized operations and horseplay by the students could cause accidents. This implies that technical teachers and workshop attendants should not allow the students to be left alone in the workshop. They should adequately supervise every activity of the students while in the workshop.

Good housekeeping was also found out to be a strategy that could be adopted to prevent accidents in technical college workshops. This implies that good workshop management is required to reduce accident occurrence in the workshop. Technical teachers should achieve safety in the keeping and issuance of tools, equipment and materials, ensure that the workshop is cleaned up after use, as well as in a good interpersonal relationship among all users of the workshop.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. Implementation of technical education curriculum requires good manipulating skill-oriented instructional facilities in a conducive learning environment. Government should therefore ensure availability of training equipment/tools in adequate quantity and quality to commensurate with students' ratio in each technical college to ensure students proper participation in an accidents-free workshop.
2. Management of technical colleges should ensure that teacher/students' ratio is reduced. They should also ensure that technical teachers constantly update their knowledge/skills through seminars, and educational advancement in order to keep abreast of new technologies.
3. Technical teachers should organize the workshop activities with good housekeeping in the issuance and use of materials, tools and equipment, maintenance of the workshops.
4. Technical teachers should present safety instructions and demonstrate the use of each equipment to student before workshop practice is allowed.
5. The findings of this study also revealed that students need proper supervision when on workshop practice. It is therefore recommended that

technical teachers should never be out of workshop during workshop practice to avoid unauthorized operations and horseplay.

Limitations of the Study

The study was limited by factors. In the first instance, some of the respondents were overtly antagonistic towards some of the questionnaire items. Such persons wanted to influence their co-respondents towards their line of thought save for quick intervention of the researcher and his research assistants. Finally, the study was limited to the accuracy of the information gathered from the respondents as indicated by their objectivity in completing the questionnaire items.

Suggestions for Further Research

Further research which could be undertaken as a result of this study includes:

1. Replication of the present study to cover a wider geographical area; if possible the whole of North Central geo-political zone of Nigeria.
2. Typology, causative factors and preventive strategies of accidents in factory workshops in Kwara and Kogi States could be carried out.

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APPENDENCES

Appendix A:

LETTER OF TRANSMITTAL

Nnamdi Azikiwe University,

P. M. B. 5025,

Awka.

12th May, 2014

Dear Sir/Madam,

REQUEST TO RESPOND TO A QUESTIONNAIRE

A research is being carried out on Typology, Causative Factors and Preventive Strategies of Accidents in Technical College Workshops in Kwara and Kogi States. Your opinion is very important in this case. You are required to rate the questionnaire items as objectively as possible.

All information you give will be treated with strict confidence and used strictly for the research. Thanks for your assistance.

Yours faithfully,

Ogunmola, Abiodun Emmanuel

Post-graduate Student.

Appendix B

QUESTIONNAIRE ON TYPOLOGY, CAUSATIVE FACTORS AND PREVENTIVE STRATEGIES OF ACCIDENTS IN TECHNICAL COLLEGE WORKSHOPS (QTCFPSATCW)

SECTION A: Background information of the respondents.

Instruction: Please, provide the required information by ticking (√) as appropriate.

1. Location of your College: Urban ---------- Rural----------

2. Your Gender: Male---------- Female----------

3. Working Experience: Six years and above----- Less than Six years -----

SECTION B: Types of accidents that could occur in technical college workshops

Instruction: Below are items on the types of accidents that could occur in technical college workshops.

Please, rate by ticking (√) in the appropriate column, your opinion on the types of accidents that could occur in your technical college workshops.

Use the following:

SA = Strongly Agree (5)

A = Agree (4)

UD = Undecided (3)

D = Disagree (2)

SD = Strongly Disagree (1)

Types of Accidents

S/N	Items on types of accidents that could occur in your college workshops	SA 5	A 4	UD 3	D 2	SD 1
1	Struck by falling objects					
2	Fall from height					
3	Electric shock					
4	Trips and fall					
5	Slips and fall					
6	Burns from chemical splash					
7	Burns from electric flash					
8	Burns from hot object(e.g. oven, forge)					
9	Cuts from sharp objects					
10	Scratches					
11	Crushing of the toe or heel by objects					
12	Piercing of foot or hand by sharp objects					
13	Fracture of the limbs					
14	Fire incidence					
15	Eye injury					
16	Inhalation of fumes/gas					
17	Electrocution					
18	Contact with rotating/revolving parts					

S/N	Items on types of accidents that could occur in your college workshops	SA 5	A 4	UD 3	D 2	SD 1
19	Amputation					
20	Hitting/cutting of the finger with tools					

Section C: Human factors that could cause accident in technical college workshops.

Instruction: Below are items on human factors that could cause accident in technical college workshops. Please, rate by ticking (√) in the appropriate column, your opinion on the human factors that could cause accident in your college workshops.

Use the following:

SA = Strongly Agree (5)

A = Agree (4)

UD = Undecided (3)

D = Disagree (2)

SD = Strongly Disagree (1)

Human factors

S/N	Items on human factors that could cause accidents in your college workshops	SA 5	A 4	UD 3	D 2	SD 1
21	Unauthorized operations of Machines					
22	Using defective tools and equipment					
23	Engaging in horse play					
24	Improper use of Personal Protective Equipment					
25	Answering phone call during operations					
26	Failure to adhere to safety rules regulations					
27	Failure to tag- out/lock-out					
28	Working on an unearthed electrical equipment					
29	Trying to catch a falling tool					
30	Drinking alcohol/taking drugs on duty					
31	Using lift jack without chocking the vehicle					
32	Carrying many materials at a time					
33	Using strained ropes, chains or slings					
34	Using generator in an enclosed space					
35	Trying to stop a revolving/rotating part with hands					
36	Welding in a confined space					
37	Working on suspended scaffold/ladder					

S/N	Items on human factors that could cause accident in your college workshops	SA 5	A 4	UD 3	D 2	SD 1
38	Using arc welding machine to weld a part of vehicle without removing the battery terminals					
39	Overstretching oneself on a ladder					
40	Using water to quench electrical fire					
41	Improper planning					
42	Inexperienced and untrained staff					
43	Lack of safety consciousness					
44	Bad lifting techniques					
45	Over confidence					
46	Prolong activities					

Section C: Environmental factors that could cause accidents in technical college workshops.

Instruction: Below are items on environmental factors could cause accidents in technical college workshops. Please, rate by ticking (√) in the appropriate column, your opinion on the environmental factors that could cause accidents in your college workshops.

Use the following:

SA = Strongly Agree (5)

A = Agree (4)

UD = Undecided (3)

D = Disagree (2)

SD = Strongly Disagree (1)

Environmental factors

S/N	**Items on environmental factors that could cause accidents in your college workshops**	**SA 5**	**A 4**	**UD 3**	**D 2**	**SD 1**
47	Inadequate supports or guards					
48	Poor housekeeping					
49	Inadequate tools and materials					
50	Distraction from other people					
51	Slippery floor					
52	Substandard materials/equipment					
53	Lack of regular inspection/maintenance					
54	Ineffective earthing system					
55	Inadequate lighting/ illumination					
56	Lack of personal protective equipment					
57	Overloading equipment above its rated capacity					
58	Leaking gas cylinder					
59	Congestion in workplace					

Section E: Strategies that could be adopted to prevent accidents in technical college workshops.

Instruction: Below are items on strategies that could be adopted to prevent accidents in technical college workshops. Please, rate by ticking (√) in the appropriate column, your opinion on the strategies that could be adopted to prevent accidents in your college workshops.

Use the following:

SA = Strongly Agree (5)

A = Agree (4)

UD = Undecided (3)

D = Disagree (2)

SD = Strongly Disagree (1)

Strategies that could be adopted to prevent accidents in workshops

S/N	**Items on strategies that could be adopted to prevent accidents in your college workshops**	**SA 5**	**A 4**	**UD 3**	**D 2**	**SD 1**
60	Hazard identification and reporting					
61	Effective supervision					
62	Compliance with safety rules and regulation					
63	Management commitment					
64	Routine inspection and preventive maintenance					

S/N	Items on strategies that could be adopted to prevent accidents in your college workshops	SA 5	A 4	UD 3	D 2	SD 1
65	Use of safety tips and flyers					
66	Accident investigation and reporting					
67	Regular safety meetings					
68	Fortified first aid box					
69	Adequate waste disposal unit					
70	Provision of accident statistic board					
71	Good house keeping					
72	Provision of adequate tools and equipment					
73	Provision of standard safety devices					

Appendix C

COMMENTS AND SUGGESTIONS OF EXPERTS ON THE INSTRUMENT

Appendix D

RELIABILITY INDEX OF THE INSTRUMENT

Scale: Types of Accidents

Reliability Statistics

Cronbach's Alpha	N of Items
.926	20

Scale: Human Factors that could cause Accidents

Reliability Statistics

Cronbach's Alpha	N of Items
.929	26

Scale: Enviromental Factors that could cause Accidents

Reliability Statistics

Cronbach's Alpha	N of Items
.910	13

Scale: Strategies that could prevent Accidents

Reliability Statistics

Cronbach's Alpha	N of Items
.928	14

Appendix E:

Distribution of the questionnaire

State	Location	Questionnaire		%
		Administered	returned	
Kwara	GTC Amodu-Asungbolu	32	31	
	GTC Erin-Ile	32	32	
	GTCEsie-Iludun	41	40	
	GTC Ilorin	47	47	
	GTC Patigi	53	51	
Kogi	GTC Ankpa	37	45	
	GTC Idah	44	43	
	GTC Oboroke	43	40	
	GTC Odu	29	27	
	GTC Mopa	39	39	
Total	**10**	**397**	**385**	**97**

Appendix F:

STATISTICAL ANALYSIS WITH SPSS

All data were analyzed using the Statistical Package for the Social Sciences, Personal Computer Version (SPSS/PC+) version 22. Appropriate statistical procedures for description (means, standard deviations, t-test)

Demographic Information

Location of your college

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Urban	154	40.0	40.0	40.0
	Rural	231	60.0	60.0	100.0
	Total	385	100.0	100.0	

Your Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	300	77.9	77.9	77.9
	Female	85	22.1	22.1	100.0
	Total	385	100.0	100.0	

Working Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Six years and above	317	82.3	82.3	82.3
	Less than six years	68	17.7	17.7	100.0
	Total	385	100.0	100.0	

RESEARCH QUESTIONS, MEAN AND STANDARD DEVIATION

Research Question one and two

Descriptive Statistics

Location		N	Minimum	Maximum	Mean	Std. Deviation
Urban	Struck by falling objects	154	1.00	5.00	3.7468	1.18576
	Fall from height	154	1.00	5.00	3.2143	1.35263
	Electric shock	154	1.00	5.00	4.1948	1.08512
	Trips and fall	154	1.00	5.00	3.1623	1.43473
	Slips and fall	154	2.00	5.00	4.2662	.90056
	Burns from chemical splash	154	1.00	5.00	3.0390	1.64051
	Burns from electric flash	154	1.00	5.00	3.9026	1.14201
	Burns from hot object (e.g. Oven, forge)	154	2.00	5.00	4.1948	.99066
	Cuts from sharp object	154	1.00	5.00	4.2273	1.07571
	Scratches	154	1.00	5.00	3.6558	1.26996
	Crushing of the toe or heel by objects	154	2.00	5.00	4.1558	.89391
	Piercing of foot or hand by sharp object	154	2.00	5.00	4.4416	.77533
	Fracture of the limbs	154	1.00	5.00	3.2468	1.33975
	Fire incidence	154	1.00	5.00	3.5130	1.37787
	Eye injury	154	1.00	5.00	3.8247	1.21609
	Inhalation of fumes/gas	154	1.00	5.00	3.4935	1.18403
	Electrocution	154	1.00	5.00	3.0325	1.17945
	Contact with rotating/revolving parts	154	1.00	5.00	3.5260	1.24826
	Amputation	154	1.00	5.00	2.1494	1.13058
	Hitting/cutting of the finger with tools	154	1.00	5.00	3.6364	1.19267
	Valid N (listwise)	154				
Rural	Struck by falling objects	231	2.00	5.00	3.7403	.97002
	Fall from height	231	2.00	5.00	3.8139	.96232
	Electric shock	231	1.00	5.00	3.6623	1.07473
	Trips and fall	231	1.00	5.00	2.9957	1.42797
	Slips and fall	231	1.00	5.00	3.3117	1.44697

	Burns from chemical splash	231	1.00	5.00	3.4848	1.36684
	Burns from electric flash	231	1.00	5.00	3.5108	1.57110
	Burns from hot object (e.g. Oven, forge)	231	2.00	5.00	3.7489	1.12952
	Cuts from sharp object	231	1.00	5.00	4.0433	1.09061
	Scratches	231	2.00	5.00	3.4719	1.00772
	Crushing of the toe or heel by objects	231	2.00	5.00	3.5455	.96295
	Piercing of foot or hand by sharp object	231	2.00	5.00	4.0087	.72826
	Fracture of the limbs	231	2.00	5.00	3.2727	1.02960
	Fire incidence	231	1.00	5.00	3.6017	1.38526
	Eye injury	231	1.00	5.00	3.4416	1.34643
	Inhalation of fumes/gas	231	2.00	5.00	3.4113	1.15331
	Electrocution	231	1.00	5.00	3.0563	1.40228
	Contact with rotating/revolving parts	231	1.00	4.00	3.3203	1.04735
	Amputation	231	1.00	5.00	2.4675	1.15251
	Hitting/cutting of the finger with tools	231	1.00	5.00	3.4416	1.28022
	Valid N (listwise)	231				

Research Question three and four

Descriptive Statistics

Location		N	Minimum	Maximum	Mean	Std. Deviation
Urban	Unauthorized operations of Machines	154	1.00	5.00	3.9805	1.17974
	Using defective tools and equipment	154	1.00	5.00	3.4935	1.37792
	Engaging in horse play	154	1.00	5.00	3.8182	1.27548
	Improper use of Personal Protective Equipment	154	2.00	5.00	3.9610	1.10189
	Answering phone call during operations	154	1.00	5.00	3.3312	1.58033
	Failure to adhere to safety rules regulations	154	1.00	5.00	4.0714	1.16095
	Failure to tag-out/lock-out	154	2.00	5.00	3.9091	.77006

	Working on an unearthed electrical equipment	154	1.00	5.00	3.5000	1.12749
	Trying to catch a falling tool	154	1.00	5.00	3.2792	1.12312
	Drinking alcohol/taking drugs on duty	154	1.00	5.00	3.2987	1.53448
	Using lift jack without chocking the vehicle	154	1.00	5.00	3.5779	1.17592
	Carrying many materials at a time	154	1.00	5.00	3.5584	1.13752
	Using strained ropes, chains or slings	154	1.00	5.00	3.3766	1.14947
	Using generator in an enclosed space	154	1.00	5.00	3.4610	1.44680
	Trying to stop a revolving /rotating part with hands	154	1.00	5.00	3.5779	1.58746
	Welding in a confined space	154	1.00	5.00	3.3766	1.33861
	Working on suspended scaffold/ladder	154	1.00	5.00	2.9805	1.37423
	Using are welding machine to weld a part of vehicle without removing the battery terminals	154	1.00	5.00	3.1688	1.38056
	Overstretching oneself on a ladder	154	1.00	5.00	3.1753	1.31424
	Using water to quench electrical fire	154	1.00	5.00	3.5974	1.39335
	Improper planning	154	1.00	5.00	3.7403	1.23036
	Inexperienced and untrained staff	154	1.00	5.00	3.8117	1.03387
	Lack of safety consciousness	154	1.00	5.00	4.0974	1.08928
	Bad lifting techniques	154	1.00	5.00	3.8896	1.04514
	Over confidence	154	1.00	5.00	3.8896	1.16911
	Prolong activities	154	1.00	5.00	3.6494	1.23422
	Valid N (listwise)	154				
	Unauthorized operations of Machines	231	1.00	5.00	3.7446	1.25790
Rural	Using defective tools and equipment	231	2.00	5.00	3.7013	.82459
	Engaging in horse play	231	2.00	5.00	4.0043	.74307

Improper use of Personal Protective Equipment	231	2.00	5.00	4.2251	.83482
Answering phone call during operations	231	1.00	5.00	3.8918	1.23411
Failure to adhere to safety rules regulations	231	4.00	5.00	4.3896	.48872
Failure to tag-out/lock-out	231	4.00	5.00	4.1688	.37542
Working on an unearthed electrical equipment	231	2.00	5.00	3.8701	.67277
Trying to catch a falling tool	231	2.00	5.00	3.6494	1.07662
Drinking alcohol/taking drugs on duty	231	1.00	5.00	3.3983	1.61428
Using lift jack without chocking the vehicle	231	1.00	5.00	4.1299	.67277
Carrying many materials at a time	231	1.00	5.00	4.1991	.77695
Using strained ropes, chains or slings	231	2.00	5.00	3.6017	.86316
Using generator in an enclosed space	231	2.00	5.00	3.5541	1.09757
Trying to stop a revolving /rotating part with hands	231	2.00	5.00	4.2727	.70346
Welding in a confined space	231	1.00	5.00	3.9004	.80409
Working on suspended scaffold/ladder	231	1.00	5.00	3.9091	.66949
Using are welding machine to weld a part of vehicle without removing the battery terminals	231	1.00	5.00	3.7792	1.13394
Overstretching oneself on a ladder	231	1.00	5.00	3.3723	.96455
Using water to quench electrical fire	231	1.00	5.00	3.5887	1.18309
Improper planning	231	2.00	5.00	3.6580	.81289
Inexperienced and untrained staff	231	2.00	5.00	3.6320	1.00374
Lack of safety consciousness	231	2.00	5.00	3.7403	.91939
Bad lifting techniques	231	1.00	5.00	3.5844	.85999
Over confidence	231	1.00	5.00	3.5498	1.31079

	Prolong activities	231	1.00	5.00	3.4286	1.18059
	Valid N (listwise)	231				

Research Question Five and six

Descriptive Statistics

Location		N	Minimum	Maximum	Mean	Std. Deviation
Urban	Inadequate supports on guards	154	1.00	5.00	3.8442	1.09144
	Poor house keeping	154	1.00	5.00	3.6558	1.21203
	Inadequate tools and materials	154	2.00	5.00	4.1169	.83194
	Distraction from other people	154	2.00	5.00	3.9091	1.03130
	Slippery floor	154	1.00	5.00	3.8442	1.41943
	Substandard materials/equipment	154	1.00	5.00	3.6948	1.29518
	Lack of regular inspection/maintenance	154	1.00	5.00	3.7273	1.38749
	Ineffective earthling system	154	1.00	5.00	3.7403	1.00199
	Inadequate lighting/illumination	154	1.00	5.00	3.7273	1.35893
	Lack of personal protective equipment	154	1.00	5.00	4.0455	1.19553
	Overloading equipment above its rated capacity.	154	1.00	5.00	3.9740	1.22580
	Leaking gas cylinder	154	1.00	5.00	3.5455	1.49549
	Congestion in work place	154	1.00	5.00	3.5779	1.42243
	Valid N (listwise)	154				
Rural	Inadequate supports on guards	231	2.00	5.00	4.1039	.58050
	Poor house keeping	231	2.00	5.00	3.9307	.46106
	Inadequate tools and materials	231	3.00	5.00	4.2035	.52518
	Distraction from other people	231	1.00	5.00	3.6104	.99768
	Slippery floor	231	1.00	5.00	3.8095	.97717
	Substandard materials/equipment	231	2.00	5.00	3.6061	.98500
	Lack of regular inspection/maintenance	231	2.00	5.00	4.0736	.58141
	Ineffective earthling system	231	1.00	4.00	3.8745	.46326
	Inadequate lighting/illumination	231	2.00	5.00	3.9740	.33521

Lack of personal protective equipment	231	3.00	5.00	4.1255	.41368
Overloading equipment above its rated capacity.	231	1.00	5.00	3.6450	1.15135
Leaking gas cylinder	231	1.00	5.00	4.0779	.60648
Congestion in work place	231	1.00	5.00	3.9913	.60427
Valid N (listwise)	231				

RESEARCH QUESTION 7

Descriptive Statistics

	N	Mean	Std. Deviation
Hazard identification and reporting	385	4.18	.98
Effective supervision	385	4.11	.89
Compliance with safety rules and regulation	385	4.32	.93
Management commitment	385	4.09	.81
Routine inspection and preventive maintenance	385	4.32	.81
Use of safety tips and flyers	385	4.09	.90
Accident investigation and reporting	385	4.10	.98
Regular safety meetings	385	4.08	.78
Fortified aid box	385	3.99	1.04
Adequate waste disposal unit	385	4.05	.85
Provision of accident statistic board	385	4.02	.90
Good house keeping	385	4.21	.72
Provision of adequate tools and equipment	385	4.16	.84
Provision of standard safety devices	385	4.24	.87
Valid N (listwise)	385		

COMPUTATION OF z-test STATISTICS

Hypothesis one

Group Statistics

	Working Experience	N	Mean	Std. Deviation	Std. Error Mean
Struck by falling objects	More experienced	317	3.7192	1.05244	.05911
	Less experienced	68	3.8529	1.09633	.13295
Fall from height	More experienced	317	3.5931	1.13977	.06402
	Less experienced	68	3.4853	1.31004	.15887
Electric shock	More experienced	317	3.8738	1.00466	.05643
	Less experienced	68	3.8824	1.51144	.18329
Trips and fall	More experienced	317	2.9590	1.48672	.08350
	Less experienced	68	3.5441	1.01384	.12295
Slips and fall	More experienced	317	3.5552	1.40330	.07882
	Less experienced	68	4.3382	.70415	.08539
Burns from chemical splash	More experienced	317	3.1830	1.52343	.08556
	Less experienced	68	3.8824	1.21593	.14745
Burns from electric flash	More experienced	317	3.7256	1.46599	.08234
	Less experienced	68	3.3971	1.19875	.14537
Burns from hot object (e.g.	More experienced	317	3.8927	1.12558	.06322
Oven, forge)	Less experienced	68	4.0882	.94214	.11425
Cuts from sharp object	More experienced	317	4.0442	1.08701	.06105
	Less experienced	68	4.4559	1.02846	.12472
Scratches	More experienced	317	3.4984	1.12965	.06345
	Less experienced	68	3.7647	1.06670	.12936
Crushing of the toe or heel by	More experienced	317	3.7729	.97703	.05488
objects	Less experienced	68	3.8676	1.00602	.12200
Piercing of foot or hand by	More experienced	317	4.0946	.79786	.04481
sharp object	Less experienced	68	4.5882	.49581	.06013
Fracture of the limbs	More experienced	317	3.1009	1.08903	.06117
	Less experienced	68	4.0147	1.20314	.14590
Fire incidence	More experienced	317	3.5363	1.38577	.07783
	Less experienced	68	3.7059	1.36107	.16505
Eye injury	More experienced	317	3.5710	1.29709	.07285
	Less experienced	68	3.7059	1.36107	.16505
Inhalation of fumes/gas	More experienced	317	3.3470	1.16628	.06551
	Less experienced	68	3.8971	1.05292	.12769
Electrocution	More experienced	317	3.1136	1.30955	.07355
	Less experienced	68	2.7353	1.31146	.15904
Contact with rotating/revolving	More experienced	317	3.3912	1.09587	.06155
parts	Less experienced	68	3.4559	1.30937	.15878

Amputation	More experienced	317	2.3281	1.11928	.06286
	Less experienced	68	2.3971	1.30601	.15838
Hitting/cutting of the finger with tools	More experienced	317	3.4953	1.22377	.06873
	Less experienced	68	3.6324	1.35937	.16485

Hypothesis two

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Unauthorized operations of Machines	Male	300	3.8800	1.21264	.07001
	Female	85	3.6941	1.29121	.14005
Using defective tools and equipment	Male	300	3.7133	.99723	.05758
	Female	85	3.2824	1.29662	.14064
Engaging in horse play	Male	300	3.8400	.99886	.05767
	Female	85	4.2471	.91164	.09888
Improper use of Personal Protective Equipment	Male	300	3.9667	1.00445	.05799
	Female	85	4.6588	.47692	.05173
Answering phone call during operations	Male	300	3.5533	1.50600	.08695
	Female	85	4.0706	.88356	.09584
Failure to adhere to safety rules regulations	Male	300	4.1000	.86361	.04986
	Female	85	4.8353	.37312	.04047
Failure to tag-out/lock-out	Male	300	4.1100	.46037	.02658
	Female	85	3.9059	.86772	.09412
Working on an unearthed electrical equipment	Male	300	3.7667	.82937	.04788
	Female	85	3.5647	1.10677	.12005
Trying to catch a falling tool	Male	300	3.5000	1.10789	.06396
	Female	85	3.5059	1.11935	.12141
Drinking alcohol/taking drugs on duty	Male	300	3.3867	1.55946	.09004
	Female	85	3.2588	1.66299	.18038
Using lift jack without chocking the vehicle	Male	300	3.9767	.79471	.04588
	Female	85	3.6706	1.33085	.14435
Carrying many materials at a time	Male	300	3.9267	.94389	.05450
	Female	85	4.0000	1.13389	.12299
Using strained ropes, chains or slings	Male	300	3.6667	.84336	.04869
	Female	85	2.9647	1.25780	.13643
Using generator in an enclosed space	Male	300	3.4567	1.20816	.06975
	Female	85	3.7294	1.36616	.14818
Trying to stop a revolving /rotating part with hands	Male	300	4.0867	1.14755	.06625
	Female	85	3.6706	1.28534	.13941
Welding in a confined space	Male	300	3.7833	.99651	.05753
	Female	85	3.3647	1.28958	.13987

Working on suspended scaffold/ladder	Male	300	3.5300	1.11651	.06446
	Female	85	3.5647	1.08504	.11769
Using are welding machine to weld a part of vehicle without removing the battery terminals	Male	300	3.5033	1.26834	.07323
	Female	85	3.6471	1.28828	.13973
Overstretching oneself on a ladder	Male	300	3.3233	1.11487	.06437
	Female	85	3.1882	1.13907	.12355
Using water to quench electrical fire	Male	300	3.5200	1.28651	.07428
	Female	85	3.8471	1.18025	.12802
Improper planning	Male	300	3.5267	.96214	.05555
	Female	85	4.2706	.91792	.09956
Inexperienced and untrained staff	Male	300	3.7100	.99458	.05742
	Female	85	3.6824	1.10423	.11977
Lack of safety consciousness	Male	300	3.7733	.96179	.05553
	Female	85	4.2706	1.06221	.11521
Bad lifting techniques	Male	300	3.5700	.92083	.05316
	Female	85	4.1882	.89302	.09686
Over confidence	Male	300	3.6833	1.30719	.07547
	Female	85	3.6941	1.11295	.12072
Prolong activities	Male	300	3.4667	1.21950	.07041
	Female	85	3.6941	1.14459	.12415

Hypothesis three

Group Statistics

	Location	N	Mean	Std. Deviation	Std. Error Mean
Inadequate supports on guards	Urban	154	3.8442	1.09144	.08795
	Rural	231	4.1039	.58050	.03819
Poor house keeping	Urban	154	3.6558	1.21203	.09767
	Rural	231	3.9307	.46106	.03034
Inadequate tools and materials	Urban	154	4.1169	.83194	.06704
	Rural	231	4.2035	.52518	.03455
Distraction from other people	Urban	154	3.9091	1.03130	.08310
	Rural	231	3.6104	.99768	.06564
Slippery floor	Urban	154	3.8442	1.41943	.11438
	Rural	231	3.8095	.97717	.06429
Substandard materials/equipment	Urban	154	3.6948	1.29518	.10437
	Rural	231	3.6061	.98500	.06481
Lack of regular inspection/maintenance	Urban	154	3.7273	1.38749	.11181
	Rural	231	4.0736	.58141	.03825
Ineffective earthling system	Urban	154	3.7403	1.00199	.08074

	Rural	231	3.8745	.46326	.03048
Inadequate lighting/illumination	Urban	154	3.7273	1.35893	.10951
	Rural	231	3.9740	.33521	.02206
Lack of personal protective equipment	Urban	154	4.0455	1.19553	.09634
	Rural	231	4.1255	.41368	.02722
Overloading equipment above its rated capacity.	Urban	154	3.9740	1.22580	.09878
	Rural	231	3.6450	1.15135	.07575
Leaking gas cylinder	Urban	154	3.5455	1.49549	.12051
	Rural	231	4.0779	.60648	.03990
Congestion in work place	Urban	154	3.5779	1.42243	.11462
	Rural	231	3.9913	.60427	.03976

Hypothesis four

Group Statistics

	Working Experience	N	Mean	Std. Deviation	Std. Error Mean
Unauthorized operations of Machines	More experienced	317	3.8328	1.20670	.06778
	Less experienced	68	3.8676	1.34835	.16351
Using defective tools and equipment	More experienced	317	3.6845	1.00388	.05638
	Less experienced	68	3.3088	1.36324	.16532
Engaging in horse play	More experienced	317	3.8675	.95539	.05366
	Less experienced	68	4.2206	1.11764	.13553
Improper use of Personal Protective Equipment	More experienced	317	4.0095	.99837	.05607
	Less experienced	68	4.6324	.48575	.05891
Answering phone call during operations	More experienced	317	3.5678	1.46239	.08214
	Less experienced	68	4.1324	1.00602	.12200
Failure to adhere to safety rules regulations	More experienced	317	4.1262	.85491	.04802
	Less experienced	68	4.8971	.30614	.03713
Failure to tag-out/lock-out	More experienced	317	4.0852	.49267	.02767
	Less experienced	68	3.9706	.88048	.10677
Working on an unearthed electrical equipment	More experienced	317	3.7603	.82634	.04641
	Less experienced	68	3.5441	1.17732	.14277
Trying to catch a falling tool	More experienced	317	3.5457	1.07413	.06033
	Less experienced	68	3.2941	1.24659	.15117
Drinking alcohol/taking drugs on duty	More experienced	317	3.2524	1.58694	.08913
	Less experienced	68	3.8529	1.46873	.17811
Using lift jack without chocking the vehicle	More experienced	317	3.9338	.82602	.04639
	Less experienced	68	3.7941	1.37742	.16704
Carrying many materials at a time	More experienced	317	3.8864	1.02795	.05774
	Less experienced	68	4.2059	.72398	.08780
Using strained ropes, chains or	More experienced	317	3.5836	.89837	.05046

slings	Less experienced	68	3.1765	1.30374	.15810
Using generator in an enclosed space	More experienced	317	3.4953	1.16549	.06546
	Less experienced	68	3.6176	1.58377	.19206
Trying to stop a revolving /rotating part with hands	More experienced	317	4.0284	1.15389	.06481
	Less experienced	68	3.8382	1.34509	.16312
Welding in a confined space	More experienced	317	3.7508	1.00523	.05646
	Less experienced	68	3.4118	1.35201	.16395
Working on suspended scaffold/ladder	More experienced	317	3.5773	1.06045	.05956
	Less experienced	68	3.3529	1.30172	.15786
Using are welding machine to weld a part of vehicle without removing the battery terminals	More experienced	317	3.5205	1.23134	.06916
	Less experienced	68	3.6029	1.45725	.17672
Overstretching oneself on a ladder	More experienced	317	3.3344	1.10315	.06196
	Less experienced	68	3.1029	1.18624	.14385
Using water to quench electrical fire	More experienced	317	3.5931	1.26854	.07125
	Less experienced	68	3.5882	1.28406	.15572
Improper planning	More experienced	317	3.5804	.96979	.05447
	Less experienced	68	4.2059	.98585	.11955
Inexperienced and untrained staff	More experienced	317	3.6814	1.00130	.05624
	Less experienced	68	3.8088	1.09623	.13294
Lack of safety consciousness	More experienced	317	3.7129	.97902	.05499
	Less experienced	68	4.6765	.70056	.08496
Bad lifting techniques	More experienced	317	3.5931	.90096	.05060
	Less experienced	68	4.2353	.99428	.12057
Over confidence	More experienced	317	3.6246	1.32685	.07452
	Less experienced	68	3.9706	.88048	.10677
Prolong activities	More experienced	317	3.4669	1.23106	.06914
	Less experienced	68	3.7500	1.05625	.12809

Hypothesis five

Group Statistics

	Working Experience	N	Mean	Std. Deviation	Std. Error Mean
Hazard identification and reporting	More experienced	317	4.1262	1.05085	.05902
	Less experienced	68	4.4559	.50175	.06085
Effective supervision	More experienced	317	4.0284	.93244	.05237
	Less experienced	68	4.4853	.50350	.06106
Compliance with safety rules and regulation	More experienced	317	4.2050	.97382	.05470
	Less experienced	68	4.8824	.32459	.03936
Management commitment	More experienced	317	4.0189	.84173	.04728
	Less experienced	68	4.4265	.49824	.06042

Routine inspection and preventive maintenance	More experienced	317	4.3218	.87000	.04886
	Less experienced	68	4.3382	.47663	.05780
Use of safety tips and flyers	More experienced	317	4.0662	.93051	.05226
	Less experienced	68	4.2206	.72987	.08851
Accident investigation and reporting	More experienced	317	4.0252	1.03697	.05824
	Less experienced	68	4.4265	.49824	.06042
Regular safety meetings	More experienced	317	4.0032	.80935	.04546
	Less experienced	68	4.4265	.49824	.06042
Fortified aid box	More experienced	317	3.9590	1.01954	.05726
	Less experienced	68	4.1324	1.10500	.13400
Adequate waste disposal unit	More experienced	317	3.9779	.89451	.05024
	Less experienced	68	4.3824	.48958	.05937
Provision of accident statistic board	More experienced	317	4.0252	.91713	.05151
	Less experienced	68	4.0000	.79175	.09601
Good house keeping	More experienced	317	4.1956	.73750	.04142
	Less experienced	68	4.2500	.63187	.07662
Provision of adequate tools and equipment	More experienced	317	4.2208	.74745	.04198
	Less experienced	68	3.8824	1.13991	.13823
Provision of standard safety devices	More experienced	317	4.1230	.89337	.05018
	Less experienced	68	4.7794	.41773	.05066

Hypothesis six

Group Statistics

	Gender					
	Male			Female		
	N	Mean	Std. Deviation	N	Mean	Std. Deviation
Hazard identification and reporting	300	4.14	1.06	85	4.35	.63
Effective supervision	300	4.02	.93	85	4.42	.64
Compliance with safety rules and regulation	300	4.21	.97	85	4.74	.60
Management commitment	300	3.99	.82	85	4.45	.65
Routine inspection and preventive maintenance	300	4.32	.86	85	4.34	.63
Use of safety tips and flyers	300	4.08	.94	85	4.13	.75
Accident investigation and reporting	300	4.04	1.05	85	4.29	.61
Regular safety meetings	300	4.01	.81	85	4.33	.62
Fortified aid box	300	4.04	.99	85	3.81	1.18

Adequate waste disposal unit	300	4.04	.85	85	4.08	.86
Provision of accident statistic board	300	4.03	.92	85	3.99	.81
Good house keeping	300	4.18	.71	85	4.31	.74
Provision of adequate tools and equipment	300	4.19	.72	85	4.05	1.16
Provision of standard safety devices	300	4.12	.89	85	4.65	.63