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COLLEGE OF TECHNOLOGY EDUCATION –KUMASI

SCHOOL OF RESEACH AND GRADUATE STUDIES

OBSERVANCE OF SAFETY PRACTICE IN MECHANICAL DEPARTMENT IN TECHNICAL INSTITUTE IN GHANA THE CASE OF CAPE COAST TECHNICAL INSTITUTE

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(M.TECH MECHANICAL)

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AUGUST, 2013

DECLARATION

STUDENT'S DECLARATION

I WILLIAM EDMUND THOMPSON DECLARE THAT THIS DISSERTATION, WITH THE EXCEPTION OF QUOTATIONS AND REFERENCES CONTAINED IN PUBLISHED WORKS WHICH HAVE ALL BEEN IDENTIFIED AND DULY ACKNOWLEDGED, IS ENTIRELY MY OWN ORIGINAL WORK, AND IT HAS NOT BEEN SUBMITTED, EITHER IN PART OR WHOLE FOR ANOTHER DEGREE ELSEWHERE .

SIGNATURE…..……...……..……..

DATE……..……

SUPERVISOR'S DECLARATION

I HEREBY DECLARE THAT THE PREPARATION AND PRESENTATION OF THIS WORK WAS SUPERVISED IN ACCORDANCE WITH THE GUIDELINES FOR SUPERVISION OF DISSERTATION AS LAID DOWN BY THE UNIVERSITY OF EDUCATION, WINNEBA.

NAME OF SUPERVISOR: AMOAKOHENE S.K.

SIGNATURE……..……

DATE……...……..…….

ACKNOWLEDGEMENT

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My immeasurable gratitude to Mr Amoakohene, my supervisor for his fatherly advice, guidance, great cooperation, useful suggestions and constructive criticism, all of which contributed to the success of this study.

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Finally, to my wife and all my Children am so grateful for your love and encouragement.

DEDICATION

This thesis is dedicated to my lovely wifeMrs Esther Ama Thompson

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ABSTRACT

This study was an assessment of how students observe safety and health practices in the Mechanical workshops of Cape Coast technical institute. Questionnaires comprising both open and closed ended items were employed to collect data from70 students from cape coast technical institute. A descriptive research design of the survey type was adopted for this study.Data collected were analysed with the statistical package for social sciences (SPSS) Version 16 for windows.

The results showed that the students had fair knowledge of the safety regulations guiding the operations of the various equipment and machines used during practical sessions in the workshops. Also the results indicated that students had good knowledge about safety practices in the workshops. However, few students adhered to safety precautions whenever they are undertakinga practical lesson.

The researcher recommends that since safety is a core component in the teaching and learning activities of Technical Institutes; and also as a serious matter in the world of work, it must be made part of the daily activities of the students.

CHAPTER ONE: INTRODUCTION

1.0 Overview

This chapter set the context for a research study into the observance of health safety practices in the technical and vocational institutions by providing forthe background to the study that relates to the need for good health and safety environment in these institutions in particular and safety consideration in the work environment in Ghana in general. The development of Cape Coast Technical Institute which is selected for the study has also been provided as background to the study that seeks to examine the observance of health and safety practices in Ghana Technical Institutes.

1.1 Background to the Study

Development of safe working skills and attitudes is paramount in the training of students who will become part of the labour force in the near future in Ghana. However, dangerous situations and possible health hazards, which may lead to accidents and injuries, exit in all areas of public educational institutions. The situations in Technical Institutions is more serious as compared to other kinds of Institutions because students in Technical Institutions are often exposed to dangerous situations and possible health hazards as they handle both light and heavy duty machines at the workshop.

The duties of today‘s educator must include, not only imparting knowledge and experience, but also to be constantly alert to possible danger zones and take measures to diminish the likelihood of accidents. Ignorance, carelessness, and apathy have been found to be contributing factors in accidents in most cases. To address problems of carelessness and apathy, each person involved in an activity in every sphere of life must have a vested interest in his or her own personal safety and the safety of those around him or her.

Thygerson as cited in Witty (1981), points out that inasmuch as the accident rate in society has not declined, there is a need to re-examine teaching techniques for accident reduction in schools. The school has been the first training grounds for safety measures for most people. According to Shashack (2002), the long-term objective of safety instruction is very important. Safety attitude acquired and developed during schooling, serve as the foundation for safe or unsafe behaviour and this goes a long way to affect the performance of students when they join the labour force. Strict adherence to safety measures is something that teacher must instil in students of technical and vocational education and training (TVET) institutions so as to make it a worthwhile habit.

Since the TVET institutions are responsible for training people in various vocations, it is necessary that these institutions produce for the nation, graduates who are highly challenged and always poised to work in a safe environment with good safety attitude. Williams, (cited in Witty, 1981), makes it clear that it is necessary for schools to include accident prevention programmes in their schools activities, in order to eliminate accidents that have the potential of injuring teachers and students, visitors or other staff of the school. According to Williams, as cited by Gliem and Miller (1993), when public school administrators first undertook the obligation of providing shop and laboratory experiences for youth and adults enrolled in their schools, they assumed a responsibility to provide an accident-free environment and a program of instruction which would include emphasis on effective safety practices.

It is unlikely that a safety culture can be established overnight. Given sufficient effort, it will evolve over time. For a developing country like Ghana, it is necessary that all technical and vocational schools make efforts to promote safety culture.

According to Stranks (2006) the term ‗environment' is of French origin meaning ―the surroundings or that which surrounds us". The duty of every vocational and technical education principal or administrator is to provide and maintain a working environment for his or her teachers, students and non-teaching staff as well as visitors. That is the principal must ensure that the working environment is reasonably safe without risks to health. This requires that adequate facilities and arrangements are provided at the work place for the welfare of every person.

In any work situation, the working environment covers a broad range of safety issues. These include the design of the workplace, structural arrangements, and control over environmental stressors, such as extremes of temperature, poor lighting and inadequate ventilation. Others are the provision and maintenance of a range of welfare amenities such as sanitation, washing facilities, and prevention of overcrowding.

According to Stranks (2006) most organizations incorporate in their safety arrangements a chain of command from the most senior people downwards to employees. Fundamentally, orders pass down the system and information passes back up the system to create safety awareness .There are many factors which influence the way people behave at work, particularly with regard to the operation of safe procedures, the use of personal protective equipment, and the correct use of hazardous substances A number of organizational characteristics also influence safety-related behaviour. They include:

1. The promotion of a positive safety climate in which health and safety is seen by both management and employees as being fundamental to the organization‘s day-to-day operations, that is, the creation of a positive safety culture;
2. The need to ensure that policies and systems which are devised for the control of risk from the organization‘s activities take proper account of human capabilities and fallibilities; Commitment to the achievement of progressively higher standards which are demonstrated at the top of the organization and cascaded through successive levels of same;
3. Demonstration by senior management of their active involvement, thereby galvanizing managers throughout the organization into action; and
4. Leadership where an environment is created which encourages safe behaviour(Stranks,2006.p250)

Stranks (2006) has noted that developing and promoting the right safety culture within an organization involves changing people‘s attitudes, commitment at all levels and the promotion of health and safety as an important feature of the management system.

The Health and Safety general of UK (as cited in Rimington, (l989)outlines the main principles involved in the establishment of a safety culture as follows:

1. the acceptance of responsibility at and from the top, exercised through a clear chain of command, seen to be actual and felt throughout the organization;
2. a conviction that high standards are achievable through proper management;
3. setting and monitoring of relevant targets/objectives, based upon satisfactory information systems;

4. systematic identification and assessment of hazards and the devising and exercise of preventive systems which are subject to audit and review; in such approaches, where particular attention is given to the investigation of error;
5. immediate rectification of deficiencies; and
6. promotion and reward of enthusiasm and good results.(Rimington, 1989)

Parliament of the Republic of Ghana in 2003 passed the labour Act, 2003(651) which became active on the 8th of October 2003. The Act 651 was passed to amend and consolidate the laws relating to labour, employers and industrial relations among others. Under this Act the Minister of Manpower Youth and Employment is empowered to use legislative instrument to make regulations providing for specific measures to be taken by employers to safeguard the health and safety of workers employed by them.

Section 10 of the Labour Act 2003 deals with rights of a worker and makes working under satisfactory, safe and healthy conditions a right of the worker. However, since all rights go with some amount of responsibility the worker has been charged with the duty to take all reasonable care for the safety and health of fellow workers.

Part XV of labour Act 651 deals specifically with occupational health and safety conditions under section 118 and states as follows:

1. It is the duty of an employer to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions
2. Without limiting the scope of subsection (1), an employer shall

(a) provide and maintain at the workplace, plant and system of work that are safe and without risk to health;

(b) ensure the safety and absence of risks to health in connection with use, handling, storage and transport of articles and substances;

(c) provide the necessary information, instructions, training and supervision having regard to the age, literacy level and other circumstances of the worker to ensure, so far as is reasonably practicable, the health and safety at work of those other workers engaged on the particular work;

(d) take steps to prevent contamination of the workplaces by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health;

(e) supply and maintain at no cost to the worker adequate safety appliances, suitable fire-fighting equipment, personal protective equipment, and instruct the workers in the use of the appliances or equipment;

(f) provide separate, sufficient and suitable toilet and washing facilities and adequate facilities for the storage, changing, drying and cleansing from contamination of clothing for male and female workers;

(g) provide adequate supply of clean drinking water at the work-place; and

(h) Prevent accidents and injury to health arising out of, connected with, or occurring in the course of, work by minimizing the causes of hazards inherent in the working environment.

The Act further states in section (3) that it is the obligation of every worker to use the safety appliances, fire-fighting equipment and personal protective equipment provided by the employer in compliance with the employer‘s instructions. In this regard the worker has been made to understand that the employer shall not be liable for injury suffered by a worker who contravenes subsection the provisions where the injury is caused solely by non-compliance by the worker.

It is not out of place for the school and for that matter the TVET institution to be identified as the first training grounds on matters of safety as the very students of today will be tomorrow‘s workforce. The first step and perhaps the most important step in achieving that goal is safety instruction. Many experts believe that such instruction should be presented to the student before he/she welds the first piece of metal, cuts the first board, or places the first wrench to an engine.

1.2 Safety Concerns for the Study Area

Like most Technical Institutes in Ghana, Cape Coast technical institute runs programmes which include Block laying and concreting, Electrical installation, Fashion /Dressmaking, Mechanical Engineering Craft Practice, Motor vehicle, Electronics/Electrical, Plumbing, Carpentry and joinery, Refrigeration and air-conditioning, Furniture , Auto body repairs and Catering.

Most programmes offered in these institutes in one way or other involve using tools and equipment that require high voltage to operate them. Some of the equipment produces temperature of over 700°C. Hence, the slightest error is likely to lead to irreparable damage to both humans and property.

In view of the rapid technological and educational changes and the increasing importance of technical and vocational education for socio- economic development, the government recently considered it necessary to strengthen and enhance the capacity of public technical institutes including Cape Coast and other Technical Institutes As a result, modern and heavy equipment have been installed for programmes in the following departments: mechanical, carpentry and joinery, block laying and concreting, electrical and auto mechanics departments. The equipment includes modern lathe machines, power saw, industrial welding machines, industrial drilling machines, industrial hydraulic press and lift with some sensitive gadgets that need special care.

The nature of the equipment is such that it puts responsibility on both the teacher and student to ensure safety and absence of risk to health in connection with the use and handling of equipment. Safety is an attitude. For the student to develop the proper safety attitude to promote accident free environment he should be involved in the process and be aware of the consequences attached to not following laid down rules, which aim at ensuring safety. The student should become familiar with labels on equipment, safety data sheets, the definitions and descriptions on safety practices in the workshops.

The newly installed machines and equipment at Cape Coast and other Technical Institutes expose teachers and students to such risks as: lifting heavy weights, exposure to motor-driven cutting tools, repetitive strain. Other risks are exposure to hot cooking equipment, slippery floors, sharp objects, hot grease, volatile and highly flammable cleaning solutions, ultraviolet (UV)rays, red hot materials, and

electrocution from high voltage, Further risk includes noise which has potential to damage eardrums.

The nature of the equipment and activities in the Cape Coast Technical put demand on instructors to be better informed on ways to avoid pitfalls as well as how to deal with accidents.

1.3Statement of the Problem

According to Bill and Poston (1982), at the dawn of the 20th Century, more than 50 of every 100,000 workers were accidentally killed on the job. It is estimated that the figure could have been lesser if good safety practices were in place According to Williams, when public school administrators first undertook the obligation of providing shop and laboratory experiences for youth and adults enrolled in their schools, they assumed a responsibility to provide an accident- free environment and a program of instruction which would include emphasis on effective safety practices.

The observation stated above indicates that, regardless of the emphasis upon health and safety practices in industry and modern schools, accidents still occur. The school curricula have expanded to include more occupational and technical training and so, the potential for situations that contribute to accidents have increased, especially in the technical institute (Kigin. 1983).Therefore the concern of good health and avoidance of risk, as well as the issues of ensuring safety and healthy environment become very critical consideration if not demanding in technical institutes.

Ever since the new machines and equipment were installed in the technical institutions in the country no studies have been conducted in these institutions to investigate the observance of safety practices by students. Furthermore, despite occasional reports of accidents at the workshops every term, there have been no special programmes to train the students to observesafety practices. In the 2010-2011 academic year for instance, a student in the mechanical department of Cape Coast Technical Institute lost one eye through negligence of safety precautions. It is against this background of lack of studies on observance of safety practices in Ghanaian institutions that this study was designed. It is important for every student to realize that ―right way to perform any task is the safe way", and this attitude leads to reduction in ones proneness to accident in school and also in their life after school.

1.4Objectives of the study

The general objective of this study was to investigate the safety practices of students of Cape Coast and Technical Institutes. The specific objectives were to:

1. Find out whether students of Cape Coast Technical Institute have any knowledge about safety precautions in the institute workshop.
2. Examine the extent to which students of Cape Coast Technical adhere to safety guidelines in the institute workshop.
3. Determine the level of awareness of the safety equipment available in the school workshop of the Institute.

1.5 Research Questions

The research questions that will guide the study are:

1. To what extent do the students of Cape Coast Technical Institute have knowledge about health and safety practices in institute workshop?
2. To what extent do students of Cape Coast Technical adhere to health and safety guidelines in the institute workshop?
3. What is the level of awareness of students of Cape Coast Technical regarding the safety equipment within the institute workshop?

1.6 Significance of the study

In the school situation, the instructor and school administrators have the legal responsibility for accidents that involve students or visitors while they are within the school setting. Regardless of the various persons who may be held legally responsible for the health and safety of students and others in the school setting, the ultimate responsibility for an effective safety program rests heavily upon each teacher. The findings of this study will help to know to some degree the true picture of safety attitude and culture existing in the technical Institutes. This will help teachers to advance remedial measures to help students develop appropriate safety attitudes (if necessary).

The study will be useful to other institutions; it will serve as a springboard for other institutions to undertake similar studies. The study could also provide new ideas for heads of departments in the technical institutes which may encourage them to recommend for in-service training for teachers. It could increase the awareness of educational administrators towards policy formulation and the strategies to put in

place for accident free and healthy environment

The study would be useful to curriculum developers to decide on the appropriate learning experiences in line with the finding of the study.

1.7 Delimitation of the Study

The study was delimited to students of Cape Coast Technical Institute.The researcher was interested in only mechanical engineering students becausethey operate in most hazardous workshop. First year students were not included in the study as they had little knowledge in matters of safety as at the time the study was being conducted. This made it inappropriate to involve them in the study. Hence only second and third and year students were involved in the study.

1.8 Limitation

The following were the limitations that affected the study:

1. It took over four meetings at different schedules for the researcher to come into agreement with the Head of department and the teachers regarding the form, place, and time to undertake the test.
2. Apart from the supervisors who were readily available for advice, finding other experts in specialised field such as fire, gas, electricity and electronics was a problem. In some cases, the researcher had to travel to Kumasi, Takoradi and Tema for consultations and itput heavy financial burden on the researcher.

The researcher in his three years quest for literature on the issue of safety had very little to gather on safety in connection with Ghana. In most of the cases, the literature obtained was irrelevant to the study and sometimes lacked the appropriate authority. While, there seems to be more information on safety concerning motor vehicle transport from the police motor traffic transport unit (MTTU) but actual literature on safety concerning Ghana specifically, was lacking. The only authoritative document on how the employer and the employee should handle matters about health and safety, and it could be seen that it is the only authoritative source cited from Ghana in this research, a situation the researcher considers unfortunate.

CHAPTER TWO:LITERATURE REVIEW

2.0 Introduction

This study has as its prime objective to look at the observance of safety and health practices by students of technical Institutes in Ghana. This chapter endeavours to bring to the reader reviewed related literature about health and safety. The literature has been discussed as follows:

1. Theories of Accident Causation
2. Conceptual framework of the study
3. Health and Safety in the statutes laws of Ghana
4. Measurement of Health and Safety Conditions at Work
5. Summary of the literature

2.1 Theories of Accident causation

Safety involves both people and technology. People are involved because they experience injury or are involved with making technology work. Technology produces risks from the design of the machine or the process itself. People will have certain attitudes towards safety, for example some people, and consider it fun to drive fast or to have control of a car whilst under the influence of drink. These are people or psychological concerns. Technology involves the safety of the procedure itself rather than the attitudes of the people carrying out the procedure. Safety can be considered from the perspective of the way people act and from the engineering of the equipment being used. There are a number of models that have been developed out of these two basic ideas. A number of theories have been developed based on the idea of ―if we can get the technology right we can control the risks" whilst others feel that ―we must get the people's attitudes right". There are several

major theories concerning accident causation, each of which has some explanatory and predictive value.

1. The domino theory developed by H. W. Heinrich, a safety engineer and pioneer in the field of industrial accident safety.
2. Human Factors Theory
3. Accident/Incident Theory
4. Epidemiological Theory
5. Systems Theory
6. The energy release theory, developed by Dr. William Haddon, Jr., of the Insurance Institute for Highway Safety.
7. Behaviour Theory

Accident theories guide safety investigations. They describe the scope of an investigation.

2.2.1 Heinrich's Domino Theory

The domino theory is heavily oriented towards the human approach and was formulated by H. W. Heinrich. He carried out detailed research into the cause of accidents and found that approximately 88% of them were as a result of unsafe acts committed by human beings. The remaining 12% were caused by technological factors. From these observations, he developed the domino theory. Heinrich considered that there were a number of factors that contribute to an accident. These could be likened to a number of dominoes standing in a row—if one is knocked down the remainder also fall Remove one of these dominoes and the possibility of a loss occurring is reduced.

In his view, there are four dominoes that lead to an accident:

1. The social environment.
2. The fault of the person.
3. The unsafe act.
4. The injury itself.

Social environment: individuals are brought up in a particular environment. Some people have little concern for their own or other people‘s safety-they may consider it macho to take chances. This could be argued to be a result of the culture of the society or organisation in which the individual is situated.

The fault of the person:this means that the person has particular tendencies to enter into unsafe situations. The psychological make-up of the person may lead to him or her to deliberately do something that is unsafe, perhaps because he or she has not absorbed training given or is unaware that he or she is carrying out an unsafe act. It is the person who is at fault—that person's psychology—as opposed to society‘s effect on the person concerned.

The unsafe act: this is the actual act that leads to the injury, such as the loss of balance while riding a bicycle or the failure to secure the door of one‘s house so that no dangerous animal enters.

The injury itself: this is an injury to the person or to property

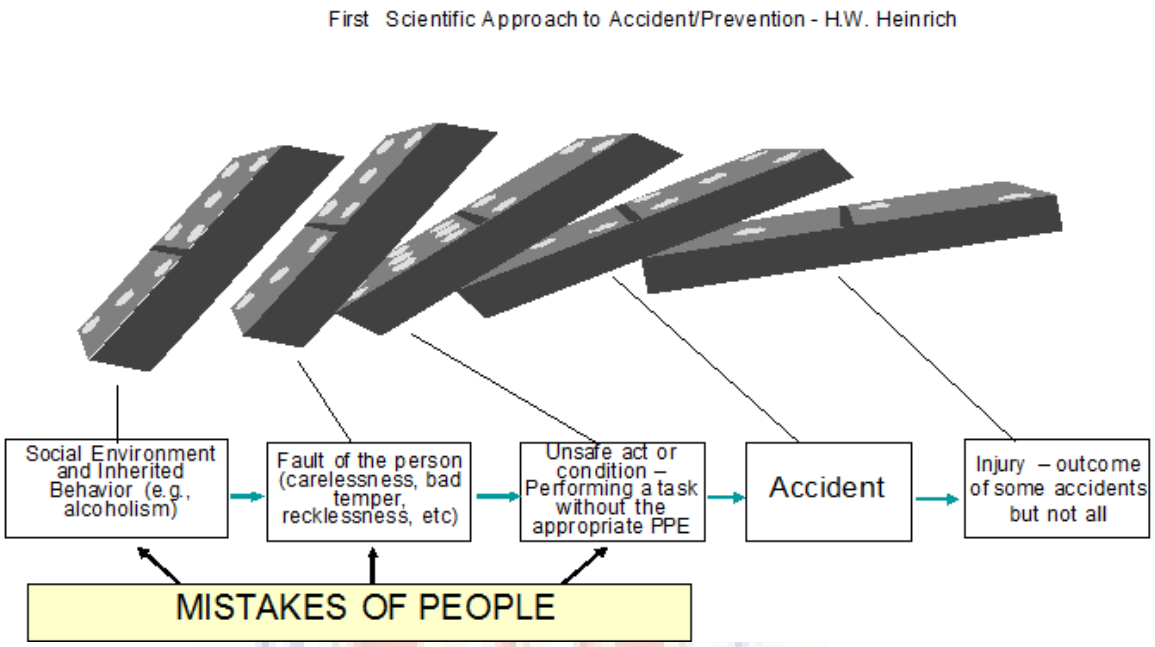

Fig 2.1 First Scientific Approach to Accident/Prevention - H.W. Heinrich

Heinrich's Dominos - The Process

Source: Adapted from Accident Theories by Work Zone Safety and Efficiency Transportation Center, Cleveland State University, (2010)A personal injury (the final domino) occurs only as a result of an accident.

1. An accident occurs only as a result of a personal or mechanical hazard.
2. Personal and mechanical hazard exist only through the fault of careless persons or poorly designed or improperly maintained equipment.
3. Faults of persons are inherited or acquired as a result of their social environment or acquired by ancestry.
4. The environment is where and how a person was raised and educated.

2.2.2Heinrich's Domino Theory -Critical Issues

Heinrich identified three critical issues that need consideration in the discussion of accidents. These are:

1. The factor preceding the accident (the unsafe act or the mechanical or physical hazard) and it should receive the most attention.
2. Heinrich felt that the person responsible at a company (school workshop) for loss control should be interested in all five factors, but be concerned primarily with accidents and the proximate causes of those accidents.
3. Heinrich also emphasized that accidents, not injuries or property damage, should be the point of attack.

2.2.3Heinrich‟s Domino Theory-Corrective Action Sequence (The three “E”s)

Heinrich concluded his accident theory by proposing corrective measures that must be put in place to minimize accidents at the workplace. In his view, the measures should consider engineering, education and enforcement (the three E”s) as explained below.)

1. Engineering

- Control hazards through product design or process change

2. Education

- Train workers (students)regarding all facets of safety
- Impose on management (teachers) that attention to safety pays off

3 Enforcement

- Ensure that internal and external rules, regulations, and standard operating Procedures are followed by workers (students) as well as management (teachers)

2.2.4Multiple Causation Theory

According to Raouf (2008) the multiple causation theory is an outgrowth of the domino theory, but it postulates that for a single accident there may be many contributory factors, causes and sub-causes, and that certain combinations of these give rise to accidents. According to this theory, the contributory factors can be grouped into the following two categories:

- Behavioural. This category includes factors pertaining to the worker, such as improper attitude, lack of knowledge, lack of skills and inadequate physical and mental condition.
- Environmental. This category includes improper guarding of other hazardous work elements and degradation of equipment through use and unsafe procedures.

The major contribution of this theory is to bring out the fact that rarely, if ever, is an accident the result of a single cause or act (www.ilo.org/safework_bookshelf/english?content&nd').

2.2.5The Pure Chance Theory

According to the pure chance theory, every one of any given set of workers has an equal chance of being involved in an accident. It further implies that there is no single discernible pattern of events that leads to an accident. In this theory, all accidents are treated as corresponding to Heinrich's acts of God, and it is held that there exist no interventions to prevent them.

2.2.6Biased Liability Theory

Biased liability theory is based on the view that once a worker is involved in an accident, the chances of the same worker becoming involved in future accidents are either increased or decreased as compared to the rest of workers. This theory contributes very little, if anything at all, towards developing preventive actions for avoiding accidents.

2.2.7 Accident Proneness Theory

Accident proneness theory maintains that within a given set of workers, there exists a subset of workers who are more liable to be involved in accidents. Researchers have not been able to prove this theory conclusively because most of the research work has been poorly conducted and most of the findings are contradictory and inconclusive. This theory is not generally accepted. It is felt that if indeed this theory is supported by any empirical evidence at all, it probably accounts for only a very low proportion of accidents without any statistical significance.

2.3Conceptual Frame Work

Effective safety and health management is an integral part of all TVET institutional activities. If TVET is to reflect contemporary technological practice, methods of safety planning should reflect what happens in technological practice and the relevant regulations and standards that underlie safe practice in the different technological areas.

The conceptual framework guiding the study is based on managing health and safety of people in a TVET institution. It was adapted by the researcher from Stranks (2006). This framework helps to understand the processes needed for effective safety and health of students and teachers while they are involved in learning activities and also for that of people using their environment.

Health and safety management in TVET Institute

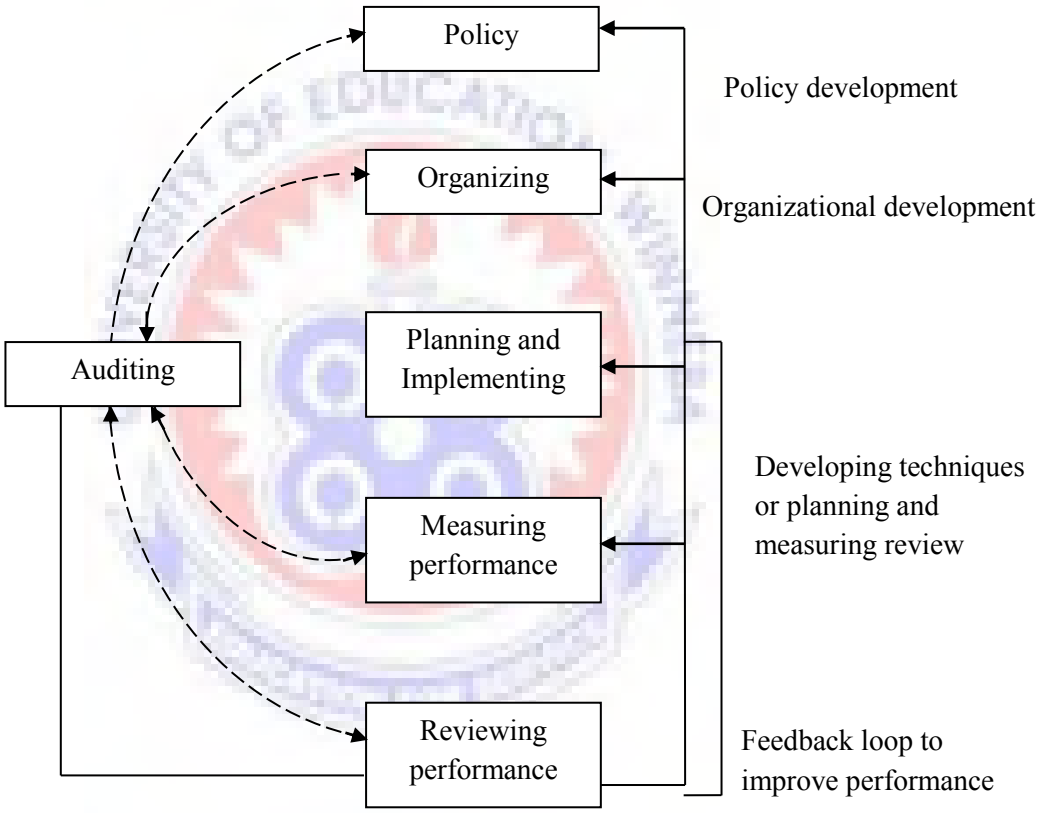

Figure 2:2 shows the conceptual framework upon which the study is based

Adapted from Stranks (2006).A practical guide to health and safety law.

2.4Health and Safety inTVET Institutions

Health and safety issues in TVET are not well-researched but there are signs of increased impact on job satisfaction and teaching capacity due to stress and student indiscipline in some mainly high-income countries. As in many domains addressed in this report, the evidence based on health and safety issues in TVET is thin. A few countries such as Finland have reported concerns over high levels of stress among TVET teachers (CEDEFOP, 2009: 108). In general education, the climate of insecurity, even violence, in classrooms and learning sites has been growing in recent years as changes in social norms, the demographic make-up of student populations and technology (Internet-based cyber bullying) undermines teacher authority, respect and inevitably a safe and quality learning environment. High profile cases of school violence in TVET settings in normally stable, high-income countries such as Finland and Germany in recent years only underscore the potentially explosive nature of such violence. Far more common is that recorded in the daily working environments of TVET teachers and trainers.

An official career publication in the United States has highlighted these difficulties, with TVET teachers facing unruly students, violence, stress and isolation in classrooms. Aside from the disruption such an environment produces on learning outcomes, there is little information available to indicate that either sporadic, high-profile violence or more recurrent, low-level forms have a deep-seated impact on TVET recruitment, retention or motivation.According to the International Labour Organisation (2005) estimates, 250 million work accidents occur annually while 160 million are estimated to suffer from work-related illnesses. About 1.2 million die due to such accidents - a death toll averaging some 5,000 workers a day.

2.4.1 Health and safety in the statutes laws of Ghana

Section 118 of the labour Act 2003 which deals with general health and safety conditions states as follows:

1. It is the duty of an employer to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions
2. Without limiting the scope of subsection (1), an employer shall
    a. provide and maintain at the workplace, plant and system of work that are safe and without risk to health;
    b. ensure the safety and absence of risks to health in connection with use, handling, storage and transport of articles and substances;
    c. provide the necessary information, instructions, training and supervision having regard to the age, literacy level and other circumstances of the worker to ensure, so far as is reasonably practicable, the health and safety at work of those other workers engaged on the particular work;
    d. take steps to prevent contamination of the workplaces by, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health; supply and maintain at no cost to the worker adequate safety appliances, suitable fire-fighting equipment, personal protective equipment, and instruct the workers in the use of the appliances or equipment; provide separate, sufficient and suitable toilet and washing
    e. facilities and adequate facilities for the storage, changing, drying and cleansing from contamination of clothing for male and female workers;
    f. provide adequate supply of clean drinking water at the work-place; and

g. Prevent accidents and injury to health arising out of, connected with, or occurring in the course of, work by minimizing the causes of hazards inherent in the working environment.

3. It is the obligation of every worker to use the safety appliances, fire fighting equipment and personal protective equipment provided by the employer in compliance with the employer's instructions.
4. An employer shall not be liable for injury suffered by a worker who contravenes subsection (3) where the injury is caused solely by non-compliance by the worker.
5. An employer who, without reasonable excuse, fails to discharge any of the obligations under subsection (1) or (2) commits an offence and is liable on summary conviction to a fine not exceeding 1000 penalty units or to imprisonment for a term not exceeding 3 years or to both.

Exposure to imminent hazards 119

Article 119(f) of the ILO's Occupational Safety and Health Convention of 1981 states that a workers should report forthwith to his immediate supervisor any situation which he has reasonable justification to believe presents an immediate and serious danger to his life or health; until the employer cannot require workers to return to a work situation where there is continuing imminent and serious danger to life or health. Ghana's Labour Act also ensures that this article of ILO is respected in its entirely and states as follows in section 119

1. When a worker finds himself or herself in any situation at the workplace which she or he has reasonable cause to believe presents an imminent and

serious danger to his or her life, safety or health, the worker shall immediately report this fact to his or her immediate supervisor and remove himself or herself from the situation.

2. An employer shall not dismiss or terminate the employment of a worker or withhold any remuneration of a worker who has removed himself or herself from a work situation which the worker has reason to believe presents imminent and serious danger to his or her life, safety or health.

3. An employer shall not require a worker to return to work in circumstances where there is a continuing imminent and serious danger to the life, safety or health of the worker. Employer to report occupational accidents and diseases.

4. An employer is required to report as soon as practicable as and not later than seven days from the date of the occurrence to the appropriate Government agency, occupational accidents and diseases which occur in the work place. (Labour Act of Ghana, Act 651)

2.5Measurement of Health and Safety Conditions at Work

According to Giovanis (2010) the measurement and evaluation of an organization's performance on health and safety conditions at work (H&S) mainly aims at the provision of information about the current situation and the progress of the strategies, processes and activities that are adopted by an organization with the view to keep H&S hazards under control.

A key division of safety performance indicators is based on their timing, (i.e. their measurement either before or after the incident) In this case, we talk of proactive assessment, which monitors the achievement of certain preventive objectives and the progress of certain programs to improve safety, and for subsequent monitoring, which records the ―failures" of the system, such as any kind of losses, accidents and illnesses and the related financial cost.

Safety, according Powell, as cited in Giovanis (2010) is a notion which refers to the activities whose aim is the hazard reduction (hazard is defined as the possibility to have a non-desirable event) and the decrease of the consequences that are caused by the non-desirable events; however, it concerns a notion that also includes the personal assessment of hazard. Safety seems to defy one single definition and as result has been defined, differently by various authors as:

- The state of being safe, namely the lack of hazard, injury or loss (Webster, 1989)
- The possibility of experiencing non-desirable consequences caused by a certain event(Rowe, 1977)
- The relative protection from exposure to hazards (Hammer, 1981)
- The opposite of hazard (Harms-Ringdahl, 1993)
- The appropriate handling of a substance or carrying out of an action with the view to efface the possibility of causing an injury or damage (Confer and Confer, 1994)
- The lack of hazard that could cause damage (Van Steen, 1996).

Giovanis (2010) has observed that because of the various definitions that are given to the notion of safety, it is difficult to give a one-way definition to the safety measurement. In an effort to combine some of the above definitions, we accept that safety measurement deals with the quantity and quality of the activities that aim at the hazard reduction, as well as the quantity of the non-desirable events.

In the international literature, the term safety performance evaluation is more frequently used as it gives a better meaning to the measurement quality dimension. Each measurement system or safety performance evaluation system use one or more safety performance indicators which are sometimes identified, at a semantic level, with the measurement method(e.g. unsafe behaviours observation) and, other times, are used in terms of measurement size (e.g. incident frequency, namely the number of incidents per 100.000 man-hours).

2.5.1 Categories of Safety Performance Indicators

Goal determination (determination of what is wanted) has been seen by Grimaldi and Simmonds (1989) as the most important step towards the development of the safety performance indicators. Two goals, the incident prevention and the loss control are identified. Grimaldi and Simmonds (1989) emphasise that it is not enough for the performance indicators to provide reliable data on the safety programs effectiveness but there should also be a convincing prospect either through the cost-benefit analysis, or through incident indicators, or even through information regarding the degree of hazard of certain activities. The authors divide the safety performance indicators into organic and systemic, depending on their object. According to them organic indicators examine the planning as well as the

safety program implementation and include the safety inspection, the safety audit and benchmarking. The systemic indicators assess the programs‘ results and include the incident indicators, the incident cost, safety climate surveys and work sampling methods.

Petersen (1998) conducted another important division, *macro measures*, which assess the total effort that is made by an organization, and *micro measures*, which deal with the individual performance. Macro measures include incident data, survey results, probing of the staff‘s opinion. The individual indicators or accountability measures are divided in two categories: performance indicators and results indicators. The performance indicators are proposed for use in the lower and middle level of the hierarchy and concern activities that the safety management system (SMS) requires to be executed at these levels. The indicators results are proposed for use in the middle and upper level of the hierarchy and are based on ―pre-incident" evidence, such as safety inspections and observations of safe behaviour, and on ―post-incident" evidence, such as incident rates and the respective costs per unit.

Regarding *liability indicators,*Stricoff (2000) separates them from the performance indicators and argues that they are based on management-by-objectives and cannot be used as direct result indicators. Stricoff divides performance indicators on safety based on their timing, before or after the event and based on their validity. The aim is, according to the author, to identify indicators which are calculated before the event and have the utmost reliability. To determine this, he considers a theoretical model of the route to the incident, in which the starting points are hazards followed by hazard controls, exposure to hazard and finally the incident. The indicators

relating to hazards are not considered significant since they ignore the existing safety measures. Safety inspections and other indicators concerning safety measures have a questionable relationship with the reduction of exposure. The report is presented as an indicator of high validity, as it is directly proportional to the incident. For this reason, observations of safe and unsafe behaviour that are indicative of workers' exposure to hazards are proposed as useful indicators of safety performance.

A different approach, based on the principles of total quality, distinguishes three stages in the subject of safety, as regards quality, safety control, safety assurance and total safety management (Giovanis 2010).

According to Giovanis in the first control stage, results are evaluated mainly based on indicators of incidents. In the second phase of safety assurance, the management commits on safety objectives and these are implemented through standard safety management systems. The evaluation of performance and the system‘s inspection are incorporated in the SMS. In the third stage of total safety management, safety inspections, including the observation of safe conduct and inspections of the system are used as indicators of the system‘s quality. The investigations of staff attitudes towards safety are used to measure the safety climate (Giovanis 2010).

2.5. 2 The Development of Safety Performance Indicators

Giovanis 2010 asserts that the development of standard management systems for occupational health and safety and their integration in the general administrative process of an organisation set additional requirements for measuring safety

performance in an organization. On behalf of the International Labour Office (ILO, 2001), the International occupational Hygiene Association implemented an in-depth analysis of 24 international, national and local safety management systems, the conclusions of which were used to create the International Labour Office Guidelines on safety management systems (Newell, 2001).

The systems‘ analysis was conducted using a general safety management systems evaluation model, developed in the University of Michigan. According to this model, the development of reliable and valid methods for measuring safety performance require the establishment of indicators, variables, measurement units and their logical relationships. Of particular importance are the indicators that can anticipate emerging problems, where root-cause analysis is essential in their development.

1. In most safety management systems, the evaluation of performance is associated with the following stages: Planning and implementing, this defines the objectives, determining the desired performance through performance standards. The standards relate to:
    - what is entered in the system, i.e. the natural resources, human resources and information that enter the organisation
    - the system itself and more specifically the interaction between man and work, which includes the equipment, environment, materials and procedures
    - what exits the system, i.e. the products or services, information and anything else that comes out of the organisation
2. The monitoring phase, where performance is measured in relation to predetermined standards. The measurement takes place with the following methods:

- proactive monitoring (active monitoring systems), which monitors the achievement of specific goals and standards
- ex post monitoring (reactive monitoring systems), which examines any ―failure" of the system, such as incidents, illnesses, losses, hazards, weaknesses or omissions in performance standards.

3. The review, which assesses the overall effectiveness of the system. The review requires a systematic, detailed audit of the system, which may be effected through a ―vertical incision ―in the system considering each activity at each level of the system, or a ―horizontal incision" in the system, which examines one system level (e.g. planning) or a combination of the above in depth.

2.5.3 Indicators of Accidents and Incidents

The most widespread indicators in this category are: the *incidence rate*, the *incident frequency rate* and the *incident severity rate.*

2.5.4 Safety Inspection and Audit

The *safety inspection* has been the main tool for maintaining safe conditions and monitoring unsafe practices from the time Heinrich formulated his theory on the causes of incidents and for many years thereafter (Petersen, 1998). The introduction of safety management systems created the requirement forth *safety audit,* which is a detailed examination and evaluation of all components of the system to ensure that they comply with prescribed standards. Safety audits may include: safety inspections, inspection of documents and interviews. In both methods, quantitative results can be used as indicators of an organization's safety and are both a measure of long-term monitoring and a way of evaluating staff attitudes on safety issues.

However, both methods regard the organisation as a closed system, which, in the case of the safety inspection has the characteristics of a Taylor organizational approach, or, in the case of safety audits, adopts a socio-technical approach (Van de Kerckhove, 1998). Both methods provide a static picture and do not facilitate an in-depth understanding of the system‘s dynamics.

With respect to safety inspections, their advantages include the fact that they require the involvement of staff at all levels; that they provide a direct picture of the situation and reveal problems that must be corrected immediately and that they give a sense that safety issues are ―under control”. The disadvantages of safety inspections include the possible lack of knowledge or other shortcoming of the inspector that may lead to incorrect or incomplete results, the frequent repetition of issues that have either not been resolved or arise anew, which are gradually established as problematic situations that are finally accepted, and their failure to uncover the root causes that lead to these records, which are usually associated with organizational and administrative problems. With respect to safety audits, their main advantage is that they take place before any incident.

Performance in safety issues is quantified at each level of the organization and therefore may be part of any overall personnel and management evaluation system. As system audits (accounting, quality, environmental) are now accepted administrative tools, the management of an organization allocates time and money with greater ease to conduct such tests, thus demonstrating its commitment to safety issues in practice.

Nonetheless, this same wealth of audits, especially in large organizations, has been found to diminish their importance, especially when they are repeated very often.

The use of ready audit packages often does not cover all areas of activity in a particular organization, while the development of internal control systems in the organisation, apart from high costs, could lead to results that are difficult to compare with other organizations. Here too, as in safety inspections, the knowledge and experience of auditors determine the outcome.

2.5.6 Monitoring of Safe and Unsafe Behaviours at the workplace

The 80s saw the beginning of the use of applied behaviour analysis as a tool to improve performance in safety issues. It was greatly developed in the 90s, under the influence of the principles of Total Quality Management (Krause, 2001). The method is based on the recording of random samples of occupational behaviour and their comparison with predetermined safe and unsafe behaviours. The setting of goals and the continuous feedback of employees with the findings of the recordings are key elements of behaviour-based safety programs.

The recording of safe and unsafe behaviour (behaviour sampling) in such a program, used for some time, may lead to change not only in behaviour but also in attitudes to safety, which indeed is the main advantage of this method.

However, the description of all critical safe and unsafe behaviours (as the method requires) and the training of staff and observers regarding their identification, requires time, money and expertise and this is the main deterrent in implementing such programs. Moreover, as a relatively new method, its relationship with the reduction of incidents and overall performance in safety matters are still under investigation (Sulzer-Azaroff and Austin, 2000).

2.6Exploring the Safety Climate

According to Giovanis(2010) in recent years the emphasis has shifted to a purely social approach, where in order to optimize the man-machine-environment system, we require the creation and maintenance of a positive safety culture. The concept of the safety culture was defined after the Chernobyl disaster, as the set of characteristics and attitudes at the level of organization and employee, which ensure that the safety of facilities is prioritised according to their importance (International Atomic Energy Authority - IAEA, 1986). *Safety climate* is a term used to describe how employees perceive safety in the organisation they work (Byrom and Corbridge, 1997).

According to Giovanis(2010) the measurement of the safety climate through questionnaires is a proactive method of evaluation that reveals information on elements of the safety management system that cannot be identified by other methods, such as the level of communication, the commitment of senior management and the sustainability of the system. Moreover, the measurement before and after implementing a safety improving program can be an effective measure of its improvement.

Giovanis was of the view that the development of a questionnaire investigating the safety climate requires specialized expertise, as, if the guiding questions are unclear, they may lead to incorrect conclusions. In addition, the usually anonymous questionnaires are filled in by those who have a positive attitude towards safety and this view is reflected in their responses. Finally, the frequent use of such questionnaires may ~~–ti~~re" staff. It is generally considered that the measurement of the safety climate cannot replace other methods of assessing performance in safety issues, but rather complement these.

2.6.1 Explanations of the Elements of the Model

Policy

A TVET institution will be successful in achieving high standards of safety and health practices, when it has in place a safety and health policy that outlines the responsibilities and expectations of management, staff and students. The policy must take cognizance of prevailing laws, regulations and standards in safety and health in industry, educational institutions and the society at large. It must also address financial implications such as funding, losses and liabilities.

Organizing

In order to achieve high safety and health standards, a TVET institution has to be structured and operated in such a way that it will be able to implement the policy effectively. In this connection, a positive culture is to be created to secure full involvement and participation of all staff and students. In particular, the leadership role of the instructors is crucial and must be clearly identified and stated. Another important consideration is effective communication to promote shared responsibilities among staff and students to sustain the policy.

Planning

Planning should identify nature and types of hazards, causes of hazards and effects of hazards. It should also consider effective strategies for managing hazards and methods for eliminating hazards.

2.6.2 Measuring Performance

Safety and health performance is measured against predetermined standards to reveal when and where action is needed to improve performance. The success of an action taken to control risk is assessed through active self-monitoring techniques.

These techniques include examination of hardware (premises, plants, and substances), software (people, procedures, systems) and individual behaviours.

On the other hand, failures of control are assessed through reactive monitoring which requires thorough investigations of accidents, ill-health, and incidents with potential to cause harm or loss. In both active and reactive monitoring, the objects are to determine immediate causes of poor performance, identify the underlying causes as well as the implications for the design and operation of safety and health management systems in place.

2.6.7 Auditing and Reviewing Performance

Learning from relevant experience and applying the lessons learnt are important elements in safety and health management systems. In other words, auditing safety and health management system is very essential and must be done systematically through regular review of performance. The auditing can be carried out through regular monitoring activities or from an independent audit of the whole safety and health management system.

The standards of performance in safety and health management system achieved by a TVET institution is assessed by internal reference to key performance indictors as well as by external comparison with the performance of similar institutions. Auditing of safety and health management system is encouraged and given attention when the audit reports are included in the annual reports of the institutions.

CHAPTER THREE: METHODOLOGY

3.0 Introduction

The study area is about safety practices in Technical institutes in Ghana. This chapter presents information related the population, research instruments and procedure for the collection of data.

3.1 The Study Area

The study was, Cape Coast Technical Institute (Cape Tech) which started as a private school by the late Joseph Kadesh Abraham of Cape Coast in the year 1955. (Cape Coast Technical Institute 50th Anniversary Brochure).

The name of the school at that time was College of Architecture, and was later changed to Electrical Institute. It was again renamed Cape Coast Polytechnic. In 1975, the Ghana Education Service absorbed it and named it Cape Coast Technical Institute. The Institute started in a building around Cape Coast Kingsway. It moved to Savoy Hill, and then to Aquarium and finally moved to the current present site at Abura-Pedu Village in Cape Coast. The initial population in 1955 comprised 24 students with two teachers. The population in 2012, with Mr. Ernest Henry KojoLyall as the principal, comprised 990 students, 75 teachers and 25 non-teaching staff.

3.2 Research Design

This study adopted descriptive method to gather the relevant data obtained from the research area. It was because of data, and the plan of analysis the descriptive study seeks to gather information so that a description of what is going on can be made. This method may be designed to discover whether there is any relationship between

two variables (Agyedu et al 2011). Therefore it was used to describe the nature of the situation as it stood during the research period.

3.3 Population

The population of this survey constituted everything the researcher want to study. In this regard, the population was made up of mechanical engineering students in Cape Coast Technical Institute who have completed a year‘s study with the institute. The estimated number given by the school authorities put the figure at 70.

3.4 Sample

Because of the small nature number of the population it was necessary that the researcher engage the entire population in the study. This, the researcher believes will make the results more valid and reliable.

3.5 Sampling procedure

The mechanical department was used for the study. All the 70 students in the department were used.

3.6 Data

Clarke and Dawson (1999) have classified the research data into primary data and secondary data. The primary data are collected to satisfy the specific purpose of the study. Secondary data on the other hand are published findings from earlier research studies and may not pertain specifically to the current study. Secondary data are often collected at the beginning of research to provide back ground and basic information about the topic being researched (Anderson and Nylander, 1999).

3.7 Secondary Data Collection

Several forms of secondary data have been employed in this research. These include published safety articles of various forms concerning the subject. For instance, the researcher depended to a large extent on research conducted outside our immediate environment bordering on the subject. This helped the researcher gained a deeper understanding of the presented research problem. These secondary data were employed to a significant extent in the preparation and writing of the background. Quite a number the secondary data were used for the literature review and the drafting of the questionnaire.

It could be said that although a major part of the data came from the field, secondary data in the forms of policy document of Ghana Education service, the International Labour Organization, UNESCO, and many relevant documents regarding safety and TVET needed to be collected and analyzed. This information helped the researcher to understand the subject understudy better.

3.8 Primary Data

Primary data is the data which is collected by the researcher directly from his own observations and experiences. Primary data for this study were collected using questionnaires. The instruments were administered by the researcher in person.

3.9 Data Collection of Instruments

The main instrument of data collection was the questionnaire(Appendix A). This study employs two different self-administered questionnaires. The merits of questionnaires are enumerated by Mouly (1970) as including:

1. It permits wide coverage at minimum expense both in money and effort.
2. It affords wider geographic coverage and reaches persons who are difficult to contact.
3 It makes for greater validity of results through promoting the selection of a larger more representative sample.
4 Anonymity may elicit more candid and objective replies.
5 It allows for greater uniformity in the manner in which the questions are posed, ensuring greater comparability in the answers (cited in Lacey, 2000).

Because of the reasons enumerated above, and the nature of research being conducted the questionnaire was found very appropriate data collection instrument to enable the researcher collect the kind of information needed.

3.10 The Questionnaire

The questionnaire has been divided into sections A to H. The entire questionnaire was made up of 35 questionnaire items. Section A of the questionnaires is about personal data and sections B- Hwhich sought to elicit from the respondents their knowledge on the operations of general workshop machines such the lathe, milling, drilling, shaper etcetera, and also the respondents‘ degree of observance of the various safety precautions needed to operate these machines and equipment available to them in the school workshop.

Section ‗B‘ sought to elicit from the respondents matters regarding the machine shop. This was answered in the form of a test supervised by the researcher and one tutor from the school. This section deals with General safety in the machine shop. It was made up of 8 test items. Section ‗C‘ was also a test about the lathe machine,

made up of 4 test items which main purpose were to find out from the students their degree of understanding in the use of the lathe machine. Section ‗D' dealt with knowledge about the shaper. This section was made up of 4 test items. Section ‗E' was a test on safety regarding the use of the milling machine. This was made up of 4 test items. Section ‗F' dealt with safety test for the Grinder and was made up of 4test items. Section ‗G' was a test about drilling machines, comprising 4 test items. Section ‗H' consisted of 4 test items seeking to know about the respondents' degree of observance of electricity and electronics safety in the school workshop. .

The researcher would like to admit that a good number of the questionnaire items were adapted from the literature on that was gathered for purpose of review.

3.11 Data Collection Procedure

The researcher chose a day during the internal examination period of the institute. The reason was that during examination period it was difficult for students to be absent and that either absenteeism is nonexistent or reduced to barest minimum. The tests were supervised by the researcher. The approximate time for the completion of the questionnaires was 70 minutes. The researcher had a 100 per cent rate of response.

3.12 Methods of Data Analysis

The data obtained from the respondents was analysed using the Statistical Package for Social Sciences version (SPSS v 16). This was chosen for easy analysis and a better understanding of the study by interested parties.

CHAPTER FOUR:ANALYSIS OF RESULTS

4.0 Introduction

This chapter presents data gathered from the field, and also endeavours to discuss and make analysis in attempt to answer the research questions posed in chapter one. In all 70 respondents took part in the study. The researcher was successful in retrieving all the 70 questionnaires that were given to the respondents.

The study was about safety as an important component of every technician's working life and also a key matter of serious considerations as far as the curriculum of every TVET institution is concerned. This study set as its parameters matters on general safety for students in schools workshop and also in the knowledge, usage, and adherence to safety in the operation of such machines as lathe machine, shaping machine, milling machine, grinding machine, and the drilling machine. Because almost all the machines used in modern TVET institutions rely on electricity and electronics for its smooth operation and precision, the respondents were also tested on electricity**.**

4.1 General Safety Testin the Machine Shop

This section ascertains the general safety measures at the machine shop.

General Safety Test in the Machine Shop

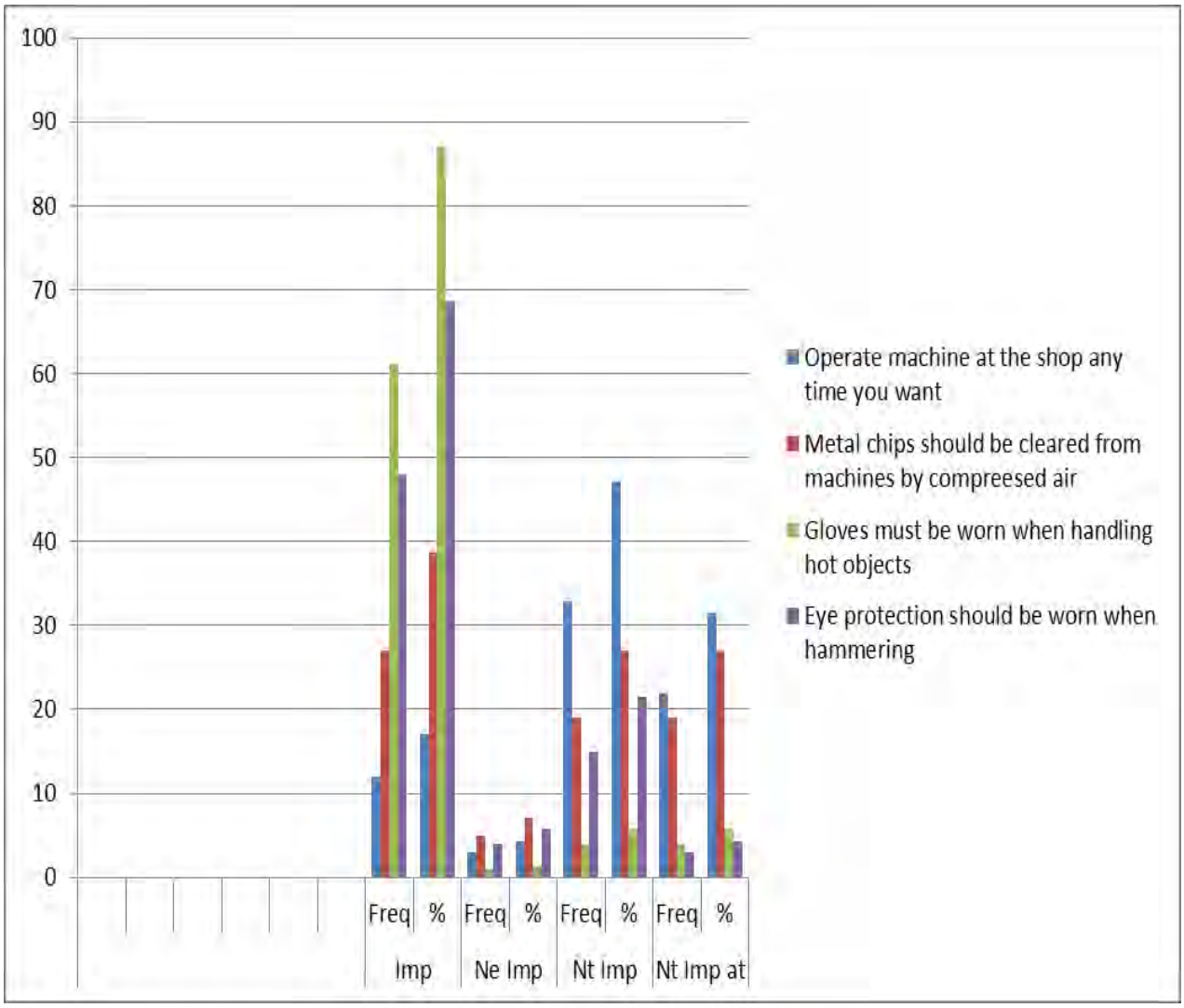

Figure 4.1: General Safety test for the machine shop

The result in figure 4.1 indicates that majority 48 (68.6%) of the respondents perceived the importance of wearing goggles when hammering as against only 3 (4.3%) responding not important at all. With regards to the operation of machine at the shop any time you want, 12 (17.1%), 33(47.1) and 22(31.4%) of the respondents indicated important, not important and not important at all respectively to the

statement. The figure also shows that more than one-third (38%) of the respondents pointed out that it is important to clean metal chips from machines by means of compressed air while 19 (27.1) of the respondents stated not important and not important at all. Again, majority 61 (87.1%) of the respondents were of the view that gloves must be worn when handling hot objects whereas only four (5.7%) were against the assertion.

4.2 Safety Test for the Lathe Machine

This section determines the safety measures to observe when using the lathe machines.

Safety Test for the Lathe Machine

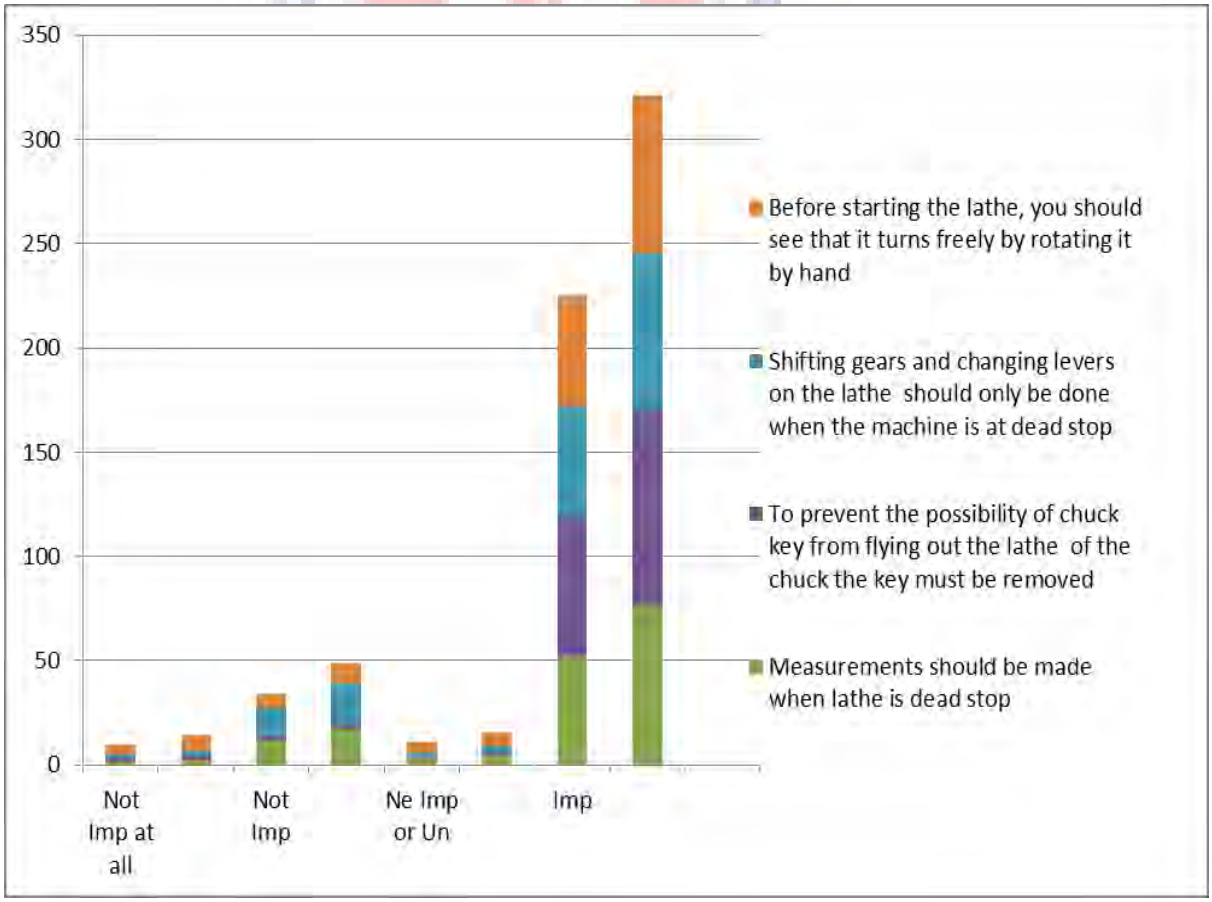

Figure 4.2: Safety test for the lathe machine

The result in Figure 4.2 indicates that majority 53 (75.7%) of the respondents indicated that it is important to take measurement when the lathe is at dead stop whilst 12 (17.1%) of the respondents showed that it is not important to the statement. The Figure again shows that almost all 66 (94.3%) of the respondents specified that it is important to remove the chuck key to prevent the possibility of chuck key from flying out of the lathe chuck whereas only one (1.4%) of the respondents indicated that it is not important at all. The Figure further shows that majority 53 (75.7%) of the respondents indicated that it is important to shift gears and change levers on the lathe when the machine is at dead stop with only 13 (18.6%) of the respondents indicated that it is not important at all. The Figure again shows that majority 53 (75.7%) of the respondents perceived that it is important to hand turn lathe machine freely before starting the machine as against only seven (10.0%) responded not important.

4.3 Safety Test for the Shaping Machine

This segment determines the safety measures to be observed when using the shaping machine.

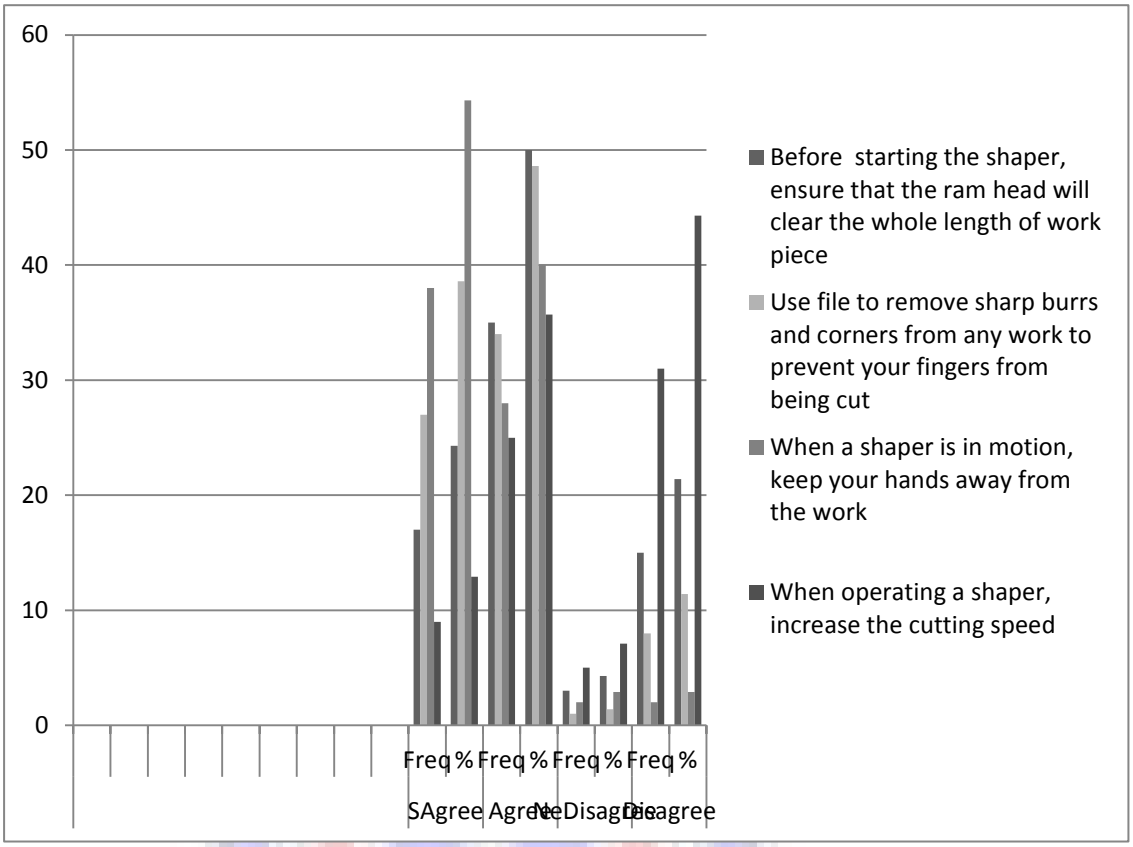

Figure 4:3: Safety test for the shaping machine

The result in Figure 4.2 indicates that half 35 (50.0%) of the respondents agreed that before stating the shaping machine, the ram and head must clear the whole length of work piece whilst only 15 (21.4%) of the respondents disagreed to the statement. The Figure further shows that almost half (48.6%) of the respondents agreed that files must be use to remove sharp burrs and corners from any work to prevent fingers injured whereas only eight (11.4%) of the respondents disagreed to the assertion. The Figure again shows that more than half (54.3%) of the respondents strongly agreed that whenever the shaper is in motion, hands must be kept away from the work as against only two (2.9%) of the respondents who disagreed to the statement. The Figure also shows that more than three-seventh (44.3%) of the respondents disagreed that cutting speed must be increased when operating a shaping machine while nine (12.9%) of the respondents strongly agreed to the proposition.

4.4 Safety Test for the Milling Machine

This part determines the safety measures to be observed when using the milling machines.

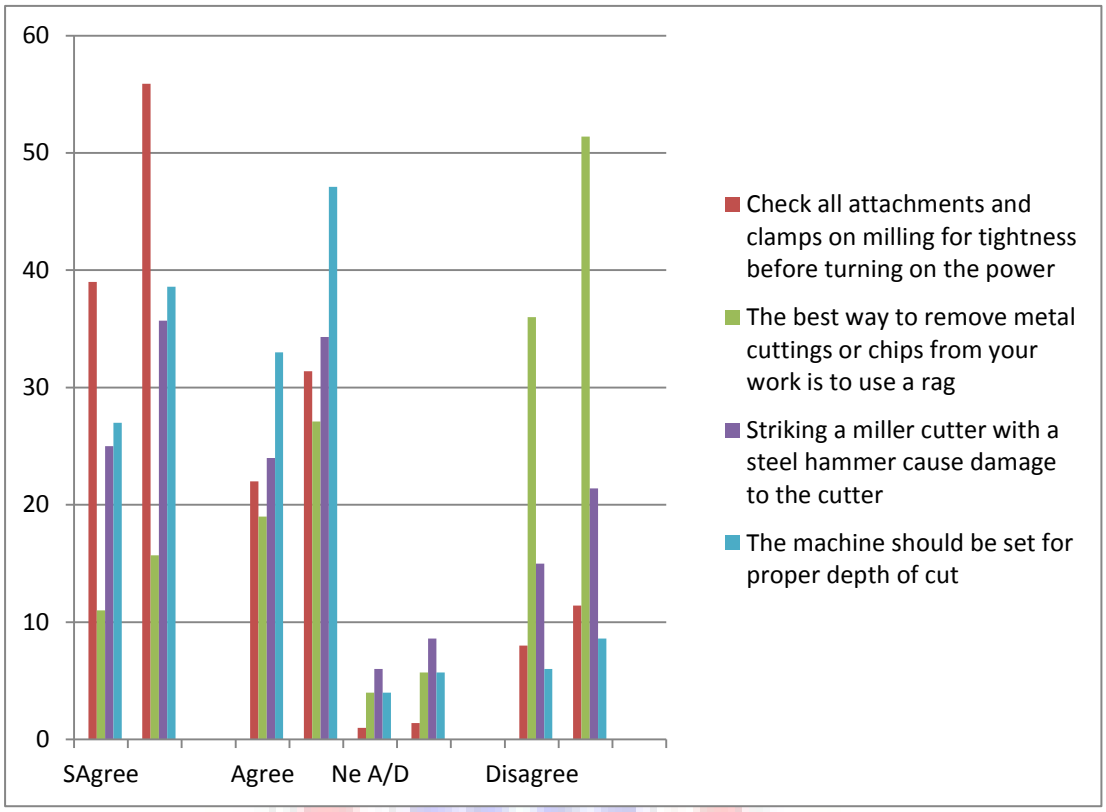

Figure 4.4: Safety test for the milling machine

The result in Figure 4.4 indicates that most of the respondents 39(55.9%) strongly agreed that before switching on the power source, all attachments and clamps on the milling machine must be check for tightness while eight (11.4%) of the respondents disagreed to the statement. The Figure further shows that more than half (51.4%) of the respondents disagreed that files the best way to remove metal cuttings or chips from work piece is to use rag while 11 (15.7%) of the respondents strongly agreed to the assertion.

The Figure also shows that more than one- third (35.7%) of the respondents strongly agreed that striking a milling cutter with steel hammer causes damage to the cutter whereas 15 (21.4%) of the respondents disagreed to the position. The Figure continues that more than half (38.6%) of the respondents strongly agreed that proper depth of cut must be set whilst only six (8.6%) of the respondents strongly agreed to the proposition.

4.5 Safety Test for the Grinding Machine

This section finds out the safety measures to be observed when using the grinding machines.

Table 4.1: Safety Test for the Grinding Machine

No	Statement	Strongly agree		Agree		Neither agree nor disagree		Disagree	
		Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)
1	You must wear goggles when grinding because particles will fly into your eyes.	2	2.9	6	8.6	2	2.9	60	85.7
2	To grind small pieces of work should be held in a hand vice.	5	7.1	3	4.3	5	7.1	57	81.4
3	You should stand to one side of the grinding wheel while it is gathering speed because wheel may break.	1	1.4	2	2.9	-	-	67	95.7
4	When using the grinder, you should keep your hands away from the wheels.	1	1.4	5	7.1	1	1.4	63	90.0

Source: Researcher's field result, (2013)

The result in Table 4.1 indicates that majority 60 (85.7%) of the respondents disagreed that goggles must be worn when grinding work piece while only two (2.9%) of the respondents strongly agreed to the statement. The Table also added that more than two-thirds (81.4%) of the respondents disagreed that small pieces of work should be held in a hand vice when grinding whereas five (7.1%) of the respondents strongly agreed to the assertion. The Table further shows that almost all 67 (95.7%) of the respondents disagreed that grinders should stand on one side of

the grinding wheel while it is gathering speed because the wheel may break whilst only one (1.4%) of the respondents strongly agreed to the statement. The Table also shows that 63 (90.0%) of the respondents disagreed that grinders should keep hands away from the wheels when revolving while only one (1.4%) of the respondents strongly agreed to the proposition.

4.6 Safety Test for the Drilling Machine

This part determines the safety measures to be observed when using the drilling machines.

Table 4.2: Safety Test for the Drilling Machine

No	Statement	Not important at all		Not important		Neither important nor unimportant		Important	
		Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)
1	Work should be held in vice or clamps when drilling	1	1.4	5	7.1	1	1.4	63	90.0
2	Centre punch where the hole is to be drilled	3	4.3	2	2.9	-	-	65	92.9
3	Chuck should be stopped from revolving in completion of work by hand	26	37.1	18	25.7	6	8.6	20	28.6
4	Wearing of goggles when drilling to protect the eyes	4	5.7	4	5.7	1	1.4	61	87.1

Source: Researcher's field result,(2013)

The result in Table 4.2 indicates that majority 63 (90.0%) of the respondents indicated that it is important that work piece must be held in vice or clamps when drilling whereas only 1 (1.4%) of the respondents showed that it is neither important nor unimportant. The table further shows that almost all 65 (92.9%) of the respondents agree that it is important to centre punch a hole to be drilled whiles only 2 (2.9%) of the respondents perceived that it is not important. The table again shows that more than two-thirds (37.1%) respondents indicated that it is not important at all that chuck must be stopped from revolving in completion of work piece by hand whereas more than one-third (28.6%) of the respondents showed that it is important. The table also shows that majority 61 (87.1%) of the respondents agreed that it is important that wearing of goggles protect the eye when drilling whilst only four (5.7%) of the respondents indicated that it is not important at all.

4.7 Safety Test for Electricity

This section investigates the safety measures to be observed when using electricity in the workshop.

Table 4.3:Safety Test for Electricity

No	Statement	Strongly agree		Agree		Neither agree nor disagree		Disagree	
		Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)	Freq.	Percentage (%)
1	Down wires lying on the ground should be reported to the Police.	5	7.1	11	15.7	6	8.6	48	68.6
2	When fuse burns out you should first place a heavy wire in the fuse holder.	4	5.7	11	15.7	8	11.4	47	67.1
3	Wear protective clothing when working with acids and etchants.	34	48.6	27	38.6	2	29.2	7	10.0
4	Steel ladders for working on electrical equipment are the best.	12	17.1	13	18.6	4	5.7	41	58.6

Source: Researcher's field result,(2013)

The result in Table 4.3 indicates that majority 48 (68.6%) of the respondents disagreed that down wires lying on the ground must be reported to the Policewhereas 11 (15.7%) of the respondents agreed to the proposition. The Table further shows that 47 (67.1%) of the respondents disagreed that heavy wire must be used to replace burnt fuse while only four (5.7%) of the respondents strongly agreed to the assertion. The Table also shows that almost half (48.6%) of the respondents

strongly agreed that protective clothing must be worn when working with acids and etchants whereas only seven (10.0%) of the respondents disagreed to the statement. The Table again shows that more than half (58.6%) of the respondents disagreed that steel ladders are the best equipment for working on electrical installations whereas 13 (18.6%) of the respondents agreed to the suggestion.

CHAPTER FIVE: DISCUSSION OF RESULTS

5.0 Introduction

This discussion section is based on the findings that resulted from the study and information gathered from literature, which have been categorized and analysed. The findings will revolve mainly around the stated objectives and the research questions of the study. The areas to me discussed include the followingsub-headings:

- Students of Cape Coast Technical Institute knowledge about health and safety practices in the workshop.
- Students of Cape Coast Technical Institute adherence to health and safety guidelines in the workshop.
- Students of Cape Coast Technical Institute awareness of safety equipment available in the workshop.

5.1 Students of Cape Coast Technical Institute Knowledge about Health and Safety Practices inthe Workshop

The result of the findings showed that a greater percentage of students in the Cape Coast Technical Institute have knowledge about health and safety issues in the workshop. This result was in agreement with the health and safety conditions(l 18) in the statutes laws of Ghana (Labour Act of Ghana, Act 651). The law states that:

1. It is the duty of an employer to ensure that every worker employed by him or her works under satisfactory, safe and healthy conditions
2. Without limiting the scope of subsection (1), an employer shall
   a. provide and maintain at the workplace, plan a system of work that are safe and without risk to health;

b. ensure the safety and absence of risks to health in connection with use, handling, storage and transport of articles and substances;

c. provide the necessary information, instructions, training and supervision having regard to the age, literacy level and other circumstances of the worker to ensure, so far as is reasonably practicable, the health and safety at work of those other workers engaged on the particular work;

d. take steps to prevent contamination of the workplaces, and protect the workers from, toxic gases, noxious substances, vapours, dust, fumes, mists and other substances or materials likely to cause risk to safety or health; supply and maintain at no cost to the worker adequate safety appliances, suitable fire-fighting equipment, personal protective equipment, and instruct the workers in the use of the appliances or equipment; provide separate, sufficient and suitable toilet and washing

e. facilities and adequate facilities for the storage, changing, drying and cleansing from contamination of clothing for male and female workers;

f. provide adequate supply of clean drinking water at the work-place; and

g. prevent accidents and injury to health arising out of, connected with, or occurring in the course of, work by minimizing the causes of hazards inherent in the working environment.

3. It is the obligation of every worker to use the safety appliances, fire fighting equipment and personal protective equipment provided by the employer in compliance with the employer‘s instructions.

4. An employer shall not be liable for injury suffered by a worker who contravenes subsection (3) where the injury is caused solely by non-compliance by the worker.

5. An employer who, without reasonable excuse, fails to discharge any of the obligations under subsection (1) or (2) commits an offence and is liable on summary conviction to a fine not exceeding 1000 penalty units or to imprisonment for a term not exceeding 3 years or to both.

The labour law section 119 adds that:

1. When a worker finds himself or herself in any situation at the workplace which she or he has reasonable cause to believe presents an imminent and serious danger to his or her life, safety or health, the worker shall immediately report this fact to his or her immediate supervisor and remove himself or herself from the situation.
2. An employer shall not dismiss or terminate the employment of a worker or withhold any remuneration of a worker who has removed himself or herself from a work situation which the worker has reason to believe presents imminent and serious danger to his or her life, safety or health.
3. An employer shall not require a worker to return to work in circumstances where there is a continuing imminent and serious danger to the life, safety or health of the worker. Employer to report occupational accidents and diseases.
4. An employer is required to report as soon as practicable as and not later than seven days from the date of the occurrence to the appropriate Government agency, occupational accidents and diseases which occur in the work place.

(Labour Act of Ghana, Act 651 and International Labour Organization, 2001)

5.3 Students of Cape Coast Technical Institute Adherence to Health and Safety Guidelines in the Workshop

The results emanating from the study indicated that majority of students of Cape Coast Technical Institute adhere to health and safety guidelines in the workshop. The findings were in collaboration with a research conducted by Giovanis (2010) that, the measurement and evaluation of an organization‘s performance on health and safety conditions at work (H&S) mainly aims at the provision of information about the current situation and the progress of the strategies, processes and activities that are adopted by an organization with the view to keep H&S hazards under control.

The research continued that a key division of safety performance indicators is based on their timing, (i.e. their measurement either before or after the incident) In this case, we talk of proactive assessment, which monitors the achievement of certain preventive objectives and the progress of certain programs to improve safety, and for subsequent monitoring, which records the ―failures" of the system, such as any kind of losses, accidents and illnesses and the related financial cost.

Safety, according Powell, as cited in Giovanis (2010) is a notion which refers to the activities whose aim is the hazard reduction (hazard is defined as the possibility to have a non-desirable event) and the decrease of the consequences that are caused by the non-desirable events; however, it concerns a notion that also includes the personal assessment of hazard. Safety seems to defy one single definition and as result has been defined, differently by various authors as:

- The state of being safe, namely the lack of hazard, injury or loss (Webster, 1989)
- The possibility of experiencing non-desirable consequences caused by a certain event(Rowe, 1977)
- The relative protection from exposure to hazards (Hammer, 1981)
- The opposite of hazard (Harms-Ringdahl, 1993)
- The appropriate handling of a substance or carrying out of an action with the view to efface the possibility of causing an injury or damage (Confer and Confer, 1994)
- The lack of hazard that could cause damage (Van Steen, 1996).

Raouf (2008) entitledthese accident or injury as the domino theory which heavily oriented towards the human approach; and carried out detailed research into the cause of accidents and found that approximately 88% of them were as a result of unsafe acts committed by human beings. The remaining 12% were caused by technological factors. From these observations, he developed the domino theory. Heinrich concluded that there were four factors or dominoes leading to an accident:

1. The social environment.
2. The fault of the person.
3. The unsafe act.
4. The injury itself.

5.4 Students of Cape Coast Technical Institute Awareness of Safety Equipment Available in the Workshop

The study revealed that larger number of students of Cape Coast Technical Institute was mindful of safety equipment available in the workshop. This finding was in conformity with the views ofGrimaldi and Simmonds (1989);Petersen (1998);Stricoff (2000) andGiovanis(2010), who all supported the idea of awareness on safety issues and emphasise that it is not enough for the performance indicators to provide reliable data on the safety programs effectiveness but there should also be a convincing prospect either through the cost-benefit analysis, or through incident indicators, or even through information regarding the degree of hazard of certain activities. The authors divide the safety performance indicators into organic and systemic, depending on their object. According to them organic indicators examine the planning as well as the safety program implementation and include the safety inspection, the safety audit and benchmarking. The systemic indicators assess the programs‘ results and include the incident indicators, the incident cost, safety climate surveys and work sampling methods.

Petersen (1998) conducted another important division, *macro measures*, which assess the total effort that is made by an organization, and *micro measures*, which deal with the individual performance. Macro measures include incident data, survey results, probing of the staff‘s opinion. The individual indicators or accountability measures are divided in two categories: performance indicators and results indicators. The performance indicators are proposed for use in the lower and middle level of the hierarchy and concern activities that the safety management system (SMS) requires to be executed at these levels. The indicators results are proposed for use in the middle and upper level of the hierarchy and are based on ~~–p~~re-

incident" evidence, such as safety inspections and observations of safe behaviour, and on "post-incident" evidence, such as incident rates and the respective costs per unit.

Regarding *liability indicators*,Stricoff (2000) separates them from the performance indicators and argues that they are based on management-by-objectives and cannot be used as direct result indicators. Stricoff divides performance indicators on safety based on their timing, before or after the event and based on their validity. The aim is, according to the author, to identify indicators which are calculated before the event and have the utmost reliability. To determine this, he considers a theoretical model of the route to the incident, in which the starting points are hazards followed by hazard controls, exposure to hazard and finally the incident. The indicators relating to hazards are not considered significant since they ignore the existing safety measures. Safety inspections and other indicators concerning safety measures have a questionable relationship with the reduction of exposure. The report is presented as an indicator of high validity, as it is directly proportional to the incident. For this reason, observations of safe and unsafe behaviour that are indicative of workers' exposure to hazards are proposed as useful indicators of safety performance.

Again, report by Peterson (1998) explained that*safety inspection* has been the main tool for maintaining safe conditions and monitoring unsafe practices from the time Heinrich formulated his theory on the causes of incidents and for many years thereafter. The introduction of safety management systems created the requirement forth *safety audit,* which is a detailed examination and evaluation of all components of the system to ensure that they comply with prescribed standards. Safety audits

may include: safety inspections, inspection of documents and interviews. In both methods, quantitative results can be used as indicators of an organization‘s safety and are both a measure of long-term monitoring and a way of evaluating staff attitudes on safety issues. However, both methods regard the organisation as a closed system, which, in the case of the safety inspection has the characteristics of a Taylor organizational approach, or, in the case of safety audits, adopts a socio-technical approach (Van de Kerckhove, 1998). Both methods provide a static picture and do not facilitate an in-depth understanding of the system‘s dynamics.

With respect to safety inspections, their advantages include the fact that they require the involvement of staff at all levels; that they provide a direct picture of the situation and reveal problems that must be corrected immediately and that they give a sense that safety issues are ―under control". The disadvantages of safety inspections include the possible lack of knowledge or other shortcoming of the inspector that may lead to incorrect or incomplete results, the frequent repetition of issues that have either not been resolved or arise anew, which are gradually established as problematic situations that are finally accepted, and their failure to uncover the root causes that lead to these records, which are usually associated with organizational and administrative problems. With respect to safety audits, their main advantage is that they take place before any incident.

Performance in safety issues is quantified at each level of the organization and therefore may be part of any overall personnel and management evaluation system. As system audits (accounting, quality, environmental) are now accepted administrative tools, the management of an organization allocates time and money with greater ease to conduct such tests, thus demonstrating its commitment to safety issues in practice.

Nonetheless, this same wealth of audits, especially in large organizations, has been found to diminish their importance, especially when they are repeated very often. The use of ready audit packages often does not cover all areas of activity in a particular organization, while the development of internal control systems in the organisation, apart from high costs, could lead to results that are difficult to compare with other organizations. Here too, as in safety inspections, the knowledge and experience of auditors determine the outcome (Petersen, 1998; Van de Kerckhove, 1998;Krause, 2001).

However, the description of all critical safe and unsafe behaviours (as the method requires) and the training of staff and observers regarding their identification, requires time, money and expertise and this is the main deterrent in implementing such programs. Moreover, as a relatively new method, its relationship with the reduction of incidents and overall performance in safety matters are still under investigation (Sulzer-Azaroff and Austin, 2000).

CHAPTER SIX: SUMMARY CONCLUSIONS AND RECOMMENDATION

6.0 Introduction

This chapter comprises the summary, findings of the study, conclusions based on the findings, recommendations and suggestions for further research

6.1 Summary

The study was conducted to find out students of technical schools‘ knowledge in health and safety guidelines /regulations in the school workshop as they pursue their various programme of study. Questionnaire was the main instrument employed for data gathering. Students in Cape Coast technical institute have faire knowledge in safety guidelines and regulations in the school workshop but teachers and administrators should enforce the safety regulations so it can become part of them as they go to the field of work.

6.2 Findings

The research yielded the following results:

1. It came out of the research that students had fair knowledge on matters of safety at the school workshop.
2. The students demonstrated that they have fair knowledge about the various machines used in the school‘s workshop including the various safety guidelines
3. Majority of the respondents knew workshop guidelines on safety. When asked to list about five (5) guidelines of safety, 81.7% of the respondents were able to state all five guidelines.

4. Most of the students were of the view that there were times that one could ignore the safety rules, giving situations such as, when one is tired, when one is in hurry, or when behind schedule in beginning a particular practical work.

6.3 Conclusion

From the research, it could be concluded that the students of Cape Coast Technical Institute have fair knowledge about safety at the school workshop. However, the students seemed to have some misconceptions about what safety really is about. The fact that they could set aside some of the regulations, indicated that they will need better education on safety and the need for adopting a good safety attitude and culture while in school so they could appropriately translate these attitude into productive outcome in the world of work.

6.4 Recommendations

Based on the research findings, and what was gathered from the reviewed literature, the following recommendations are made:

1. A copy of every school's general health and safety rules should be given to all fresh students so that in their leisure times they can read them.
2. The safety regulation of every school should be displayed on Notice Boards and that all students should ensure that they are aware of these and follow them.
3. To promote the highest standards of safety and the elimination of injury, loss or damage in school workshops or during practical lessons, Principals in technical schools should endeavour to make safety an essential and integral part of teacher accountability.

4. Demonstrating the required level of commitment to safety management at the school workshop. Teachers in the technical schools should endeavour to make their students accept safety as an individual responsibility and pre-requisite in the planning of all work related duties.
5. Teachers must be made to report to the Principals on the level of compliance and standard of health and safety at the school workshop after every academic term.
6. School authorities must ensure that all fresh students are given induction training which includes the precautions and procedures appropriate to their specific programmes.
7. Fresh and old students are supposed to be told of the procedures for reporting accidents.
8. Students must be made to familiarise themselves with the routines in case of fire or other emergency that might require evacuation from the premises.
9. Students should be shown the location of first aid boxes.
10. Students should be taught the use of firefighting equipment.

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APPENDIX

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION

DEPARTMENT OF DESIGN AND TECHNOLOGY EDUCATION

QUESTIONNAIRE FOR TECHNICAL STUDENTS

The researcher is a Master of Technology Education in Mechanical Technology Student at the University of Education, Winneba, Kumasi Campus. This project is undertaken solely for academic use and it is being conducted to find out the observance of safety practices by students of Technical Institutes in Ghana. Your responses to the following questions will help in making this study a success. Please do not write your name, and do remain anonymous.

SECTION A

PERSONAL DATA

Sex: Male [ ] Female [ ]

Age: 12- 15 [ ] 16 – 19 [ ] 20 – 22 [ ]

Level: Year 1[ ] Year 2 [ ]

SECTION B

GENERAL SAFETY TEST FOR THE MACHINE SHOP

Statement	Not important at all	Not important	Neither important nor unimportant	Important
1. Eye protection should be worn when hammering.				
2. Operate a machine at the shop anytime you want.				
3. Metal chips should be cleaned form machines by compressed air.				
4. Gloves may be safely worn when handling not objects				

If you believe the statement is true, circle „T" if you believe it is false circle „F"

1. Occasionally a practice joke is good for the moral and keeps people ~~–o~~n t their toes"T/F
2. Clean your work station frequently to ensure safe working conditions.T/F
3. Machines must be stopped before oiling them.T/F
4. Metal cutting tools should be kept dull so they won't cut the inexperienced machinist T/F

SECTION C

SAFETY TEST ON THE LATHE MACHINE

Statement	Not important at all	Not important	Neither important nor unimportant	Important
1. Measurements should be made when the lathe is at dead stop.				
2. Possibility of the chuck key from flying out of the lathe chuck the key must be removed.				
3. Shifting gears and changing levers on the lathe should only be done when the machine is at dead stop.				
4. Before starting the lathe, you should see that it turns freely by rotating it by hand.				

SECTION D

SAFETY TEST ON THE SHAPING MACHINES

Statement	Strongly agree	Agree	Neither agree nor disagree	Disagree
1. Before starting the shaper, you should make sure that the ram and head will clear whole length of the work piece.				
2. Files should be used to remove sharp burrs and corners from any work to prevent your fingers from being cut.				
3. When the shaper is in motion, you should keep your hands away from the work.				
4. When operating a shaper you should increase the cutting speed.				

SECTION E

SAFETY TEST ON MILLING MACHINE

Statement	Strongly agree	Agree	Neither agree nor disagree	Disagree
1. Attachments and clamps on the milling machine should be checked for tightness before turning on the power.				
2. The best way to remove metal cuttings or chips from your work is to use a rag.				
3.Striking a miller cutter with a steel hammer may damage the cutter				
4. The machine should be set for proper depth of cut.				

SECTION F

SAFETY TEST ON THE GRINDER

Statement	Not important at all	Not important	Neither important nor unimportant	Important
1. You must wear goggles when grinding because particles will fly into your eyes.				
2. To grind small pieces of work it should be held in a hand vice.				
3. You should stand to one side of the grinding wheel while it is gathering speed because wheel may break.				
4. When using the grinder you should keep your hands away from the wheel				

SECTION G

SAFETY TEST ON THE DRILLING MACHING

Statement	Not important at all	Not important	Neither important nor unimportant	Important
1. Work should be held in vice or clamps when drilling.				
2. Centre punch where the hole is to be drilled.				
3. Chuck should be stopped form revolving in completion of work by hand.				
4. Wearing of goggles when drilling to protect the eyes.				

SECTION H

GENERAL SAFETY TEST FOR ELECTRICITY/ELECTRONICS

Statement	Strongly agree	Agree	Neither agree nor disagree	Disagree
1. Down wires lying on the ground should be reported to the police department.				
2. When fuse burns out you should first place a heavy wire in the fuse holder.				
3. Wear protective clothing when working with acids and etchants.				
4. Steel ladders for working on electrical equipment are the best.				

Thank you