

**FACTORS INFLUENCING SELECTION, USE AND MAINTENANCE OF  
PROTECTIVE CLOTHING BY STUDENTS IN TECHNICAL INSTITUTIONS  
IN CENTRAL KENYA**

BY

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selection, use and*



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**DECLARATION**

This thesis is my original work and has not been presented for a degree in any other university.

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### DEDICATION

To my children for their encouragement, concern and support which has made it possible for me to attain my goal.

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**LIST OF ABBREVIATIONS ACRONYMS**

BLS	Bureau of Labor and Statistics
CPC	Chemical Protective Clothing
EH & S	Environmental Health & Safety
GoK	Government of Kenya
ISTs	Institutes of Science and Technology
KEBS	Kenya Bureau of Standards
MoHEST	Ministry of Higher Education, Science and Technology
NCST	National Council of Science and Technology
OHS	Occupation Health Safety
OSHA	Occupation Safety and Health Act
PPE	Personal Protective Equipment
SPSS	Statistical Package of Social Sciences
TIs	Technical Institutions
TIVET	Technical Industrial Vocational and Entrepreneurship Training
TTIs	Technical Training Institutes

## OPERATIONAL DEFINITION OF TERMS

**Appropriate** - Suitable for a particular person, condition, occasion, or place; fitting (Trevor, 2008)

**Asphyxiation**- Is a condition caused by lack of air in the lungs leading to suffocation which causes discomfort in breathing and can cause death (Trevor, 2008).

**Attitude** - This is a predisposition to behave in a certain way with respect to a specific object like clothing (Barnard, 2002).

**Dry-cleaning**- It is the process of cleaning fabrics with organic solvents to remove any soiling matter (Tony, 1995).

**Fashionable** - Conforming to fashion or established mode; according to the prevailing form or style (Yuniya, 2005).

**Non-disposable protective clothing** - These are protective clothing which are not thrown away after use and can be reused (Crane, 2001).

**Personal protective equipment** - Special clothing or equipment worn for protection against health and safety hazards when carrying out a manual task (Torres, 2007).

**Protective clothing selection** - Decisions one makes when choosing protective clothing for work wear (Crane, 2001)

## ABSTRACT

This research sought to investigate selection, use and maintenance of protective clothing; in Technical Institutions in Central Kenya. The objectives of this study were to investigate factors influencing selection of protective clothing, appropriateness of protective clothing used, to establish the factors influencing cleaning and storage of non-disposable and to investigate the general safety practices at workplace. A conceptual framework was used to show the process of selection, use and maintenance of protective clothing. The study area was purposively selected as it has majority of the Technical Institutions. Stratified sampling was used to select three Technical Institutions which participated in the study. Qualitative data was collected using a questionnaire which was administered by the researcher to a sample of 119 respondents in the participating departments. Majority of the respondents (88.2%) identified that colour was important when selecting protective clothing. Harmful materials handled by respondents and price were also important when selecting protective clothing. Most respondents indicated that lack of protective clothing made performance of certain tasks difficult. On investigating the factors influencing use of protective clothing, 79% of the respondents strongly agreed that use of protective clothing was very important, over 50% disagreed that there was adequate protective clothing in their institutions. It was established that injuries were common during practical lessons since 39.5% of the respondents indicated that they had been injured during practical lessons. In the study, 97.5% of the respondents felt that there is need for training on protective clothing but only 48.7% had participated in such training. The respondents had a positive attitude towards the use of protective clothing with 82.4% indicating that they were comfortable with the use of protective clothing. From the study, it emerged that there were inadequate cleaning and storage facilities in Technical Institutions with 70.6 % of respondents indicating that there were no cleaning facilities while 84% of the respondents felt that storage facilities were not available. Availability of signage indicating need for use of protective clothing was also identified as an important safety measure. Pearson's correlation coefficient was used to determine the relationships between selected key variables. The study concluded that protective clothing is not fully used by students in Technical Institutions in Central Kenya. Technical Institutions in Central Kenya need to enlighten their students on care of textile articles and use in terms of selection, use and maintenance of protective clothing. The study indicated that, the training students had received on protective clothing did not play a significant role towards selection, use and maintenance. The study recommended that, the students in Technical Institutions in Central Kenya be trained on the use of protective clothing by their course instructors on reporting to the institutions. It also recommended that, the individual institutions should ensure that safety measures are adhered to in workshops and laboratories to promote the culture of using protective clothing.

## CHAPTER ONE: INTRODUCTION

### 1.1 Background Information

Protective clothing is used to reduce or minimize the exposure or contact to injurious physical, chemical or biological agents. The workshops/laboratories contain environmental, chemical, biological and physical hazards which with proper control can be eliminated. All the same, a hazard cannot completely be eliminated by protective clothing, but the risk of injury can be greatly reduced (University of St. Andrews, 2008). However, Protective clothing is appropriate in all situations where a person is potentially exposed to hazards. Some of the Protective clothing used in different workshops and laboratories are as shown in table 1.1.

**Table 1.1: Protective clothing used in different workshops and laboratories**

<b>Departments</b>	<b>Protective clothing</b>
Electrical engineering workshop	Eye goggles, face mask, face shield, leather gloves, hard foot wear, leggings, helmet, navy blue dustcoat, knee caps, ear muffs and nose muffs.
Applied science laboratories	Nose muffs, gumboots, white dust coat, latex or rubber gloves, face mask, gas mask with respirator.
Clothing Technology workshop	Aprons, gloves, face and nose muffs, closed shoes. Dust coats

Source: Scotland, University of St. Andrews, 2008 and Trevor, 2008

Protective clothing material and design is supposed to protect against the specific hazards encountered in the workplace, cover and protect the areas of the body potentially exposed to the identified hazards, and provide a comfortable and secure fit (Simiyu, 2002).

Internationally, the importance of the use of protective clothing in higher institutions of learning has been captured in the Environmental Health and Safety (EH & S) policies

(University of Toronto, 1999). The respective institutions in the United States of America thus emphasizes on these policies. The EH & S policies conform to the requirement given by the Occupational Safety and Health Administration (OSHA), which requires that employers protect their employees from workplace hazards that can cause injury (OSHA 3151-12R, 2003). In the University of Toronto, EH & S policies, supervisors and other individuals are charged with the responsibility of ensuring that employees, students and visitors are adequately informed about protective work clothing. The supervisors are given the responsibility of conducting a job hazard analysis for each employee in order to determine the need for protective clothing and equipment (The Regents of the University of California, 2006). As a result of lack of proper control measures on the need for protective clothing, some employees may use part of the required protective clothing and neglect others. According to the findings of a survey in industries, 15% of workers who were required to wear a face shield were found to wear one (Torres, 2007).

In Kenya, Health and Safety Control; measures are not left out. The Ministry of Education has been involved in ensuring the general safety and protections in technical institutions. Government of Kenya, GoK (2008) points out the need for protective clothing in technical institutions by the employees. The report recommends that a recorded risk assessment be carried out on the tasks that require employees to use protective clothing and where possible, personal protective clothing be issued on personal basis. Personal protective clothing should also be supplied to non-employees in case they are exposed to hazards caused by operations.

Research has also been done to inspect the safety standards in all technical institutions by GoK (2008). The research findings indicate that the use of personal protective clothing in the institutions was not adequate for the employees. This study focuses on protective clothing worn by students in technical institutions workshops and laboratory in Central Kenya.

## **1.2 Problem Statement**

From the background given above, selection, use and maintenance of protective clothing are very important in all situations where a person is potentially exposed to hazards. The area of protective clothing is less researched in Kenya. In Technical Institutions there are many activities that take place, which may require the use of protective clothing by students and staff. Most of the courses which are offered in the Technical Institutions involve practical lessons, which should be performed at the laboratory or workshops. Anybody involved in the practical lessons is exposed to different hazards.

In Kenya, the need for the use of protective clothing has been stipulated in The Occupational Safety and Health Act, 2007. According to the Act, every employer is supposed to provide and maintain suitable protective clothing for employees, where they are exposed to wet or any injurious or offensive substance. The Act further gives the Director of Occupational Safety and Health Services the mandate of registering safety consultants who are to assess suitability and effectiveness of protective clothing and appliances (GoK, 2007a). The study done by (GoK, 2007a) indicates a lack of an effective personal protective clothing replacement programme in place and lack of knowledge on selection and utilization of the same by employees. Students sometimes do not have the appropriate protective clothing during their practical lessons and other times

do not have at all. There is need for a study to be done on the factors that surround the use of personal protective clothing by students in the Technical Institutions.

Therefore, appropriate protective clothing is necessary in laboratories, where chemical, biological or other hazardous materials are used and stored. In most laboratory conditions, hazards can be rated as being mild to moderate in nature. In such circumstances, protective clothing must be worn when working in the laboratory. This study focused on selection, use and maintenance of protective clothing by students in Technical Institutions in central Kenya.

### **1.3 Purpose of the Study**

To investigate the factors that influences the selection, use and maintenance of protective clothing by students in Technical Institutions in Central Kenya.

### **1.4 Objectives**

- i. To investigate the factors that influences the selection of protective clothing by students in Technical Institutions in Central Kenya.
- ii. To investigate availability and appropriateness of the protective clothing used by students in Technical Institutions in Central Kenya.
- iii. To explore the factors influencing the use of protective clothing by students in Technical Institutions in Central Kenya.
- iv. To investigate the students attitude towards protective clothing.
- v. To establish the factors influencing cleaning and storage of non- disposable protective clothing by students in Technical Institutions in Central Kenya.
- vi. To determine the general safety practices at workplace in relation to protective clothing among Technical Institutions students in Central Kenya.

### **1.5 Significance of the Study**

It is anticipated that the results of this study will be made available to the Ministry of Higher Education, Science and Technology and will help the policy-makers in understanding the factors influencing the selection, use and maintenance of protective clothing. This will assist the policy makers to put in place policy guidelines on selection, use and maintenance of protective clothing. The information on protective clothing identified to be lacking, will be used as the basis for appropriate training on selection, use and maintenance of protective clothing in Technical Institutions in Central Kenya. The findings of this study will contribute significantly to students in the prevention and control measures on the anticipated hazards. The findings of this study will contribute to significant research literature for scholarly work and for comparison of regional and global practices related to protective clothing. Results of this study will form basis for further research in the area of protective clothing.

### **1.6 Delimitation of the Study**

- i. The study was limited to protective clothing used by students in laboratories and workshops in Technical Institutions in Central Kenya.
- ii. Since the study was limited to Technical Institutions in Central Kenya, generalizations of the findings to other geographical areas should be done with caution.

### **1.7 Limitations of the study**

According to Orodho (2008) limitations are conditions beyond the control of the researcher that may place restrictions on the conclusions of the study and their applications to other situations. Therefore the research limitation was;

The attitude of the respondents towards the study may have had some influence on their response due to the various types of protective clothing used in workshops and laboratories. This could be due to the safety control measures that are put in place for the outlined hazards.

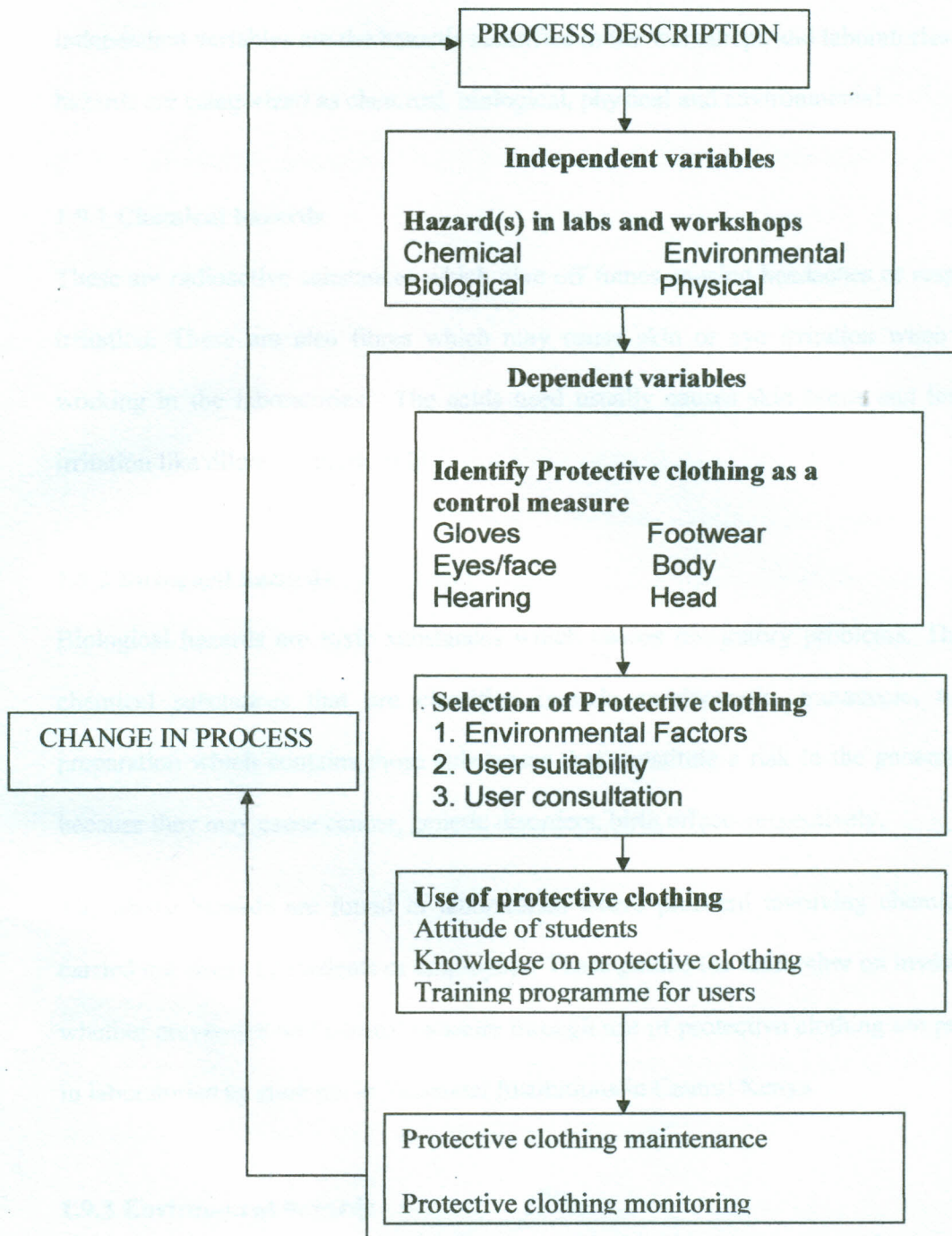
### 1.8 Assumptions

This study was based on the following assumptions:

- i. That the administrators of the selected Technical Institutions will allow data collection to take place in their institutions.
- ii. That the target respondents will be willing to give accurate information in the questionnaires.
- iii. That the respondents make use of protective clothing.

### 1.9 Conceptual framework on protective clothing

The conceptual frame work (figure 1.1) has been used as a research guide tool which clearly shows the indicators of the study.



Source: Adopted from University of St. Andrews (2008)

**Figure 1.1 Conceptual Framework on selection, use and maintenance of protective clothing**

The study was guided by a conceptual framework on selection, use and maintenance of protective clothing which was adopted from university of St. Andrews (2008). The conceptual framework (figure 1.1) gives protective clothing process description. The independent variables are the hazards identified in the workshops and laboratories. These hazards are categorized as chemical, biological, physical and environmental.

### **1.9.1 Chemical hazards**

These are radioactive substances which give off fumes causing headaches or respiratory irritation. These are also fibres which may cause skin or eye irritation when one is working in the laboratories. The acids used usually causes skin burns and breathing irritation like dilute sulphuric acid.

### **1.9.2 Biological hazards**

Biological hazards are toxic substances which causes respiratory problems. The toxic chemical substances that are classified include carcinogenic, mutagenic, toxic or preparation which contains those substances that constitute a risk to the general public because they may cause cancer, genetic disorders, birth effects respectively.

The above hazards are found in laboratories where practical involving chemicals are carried out either by students or employees. These guided the researcher on investigating whether preventive and control measure through use of protective clothing are practiced in laboratories by students in Technical Institutions in Central Kenya.

### **1.9.3 Environment hazards**

These are hazards which are encountered within the working area as a result of the activities taking place. They include noise and vibration caused by machines in the

workshops, poor waste matters disposal in laboratories, poor illumination, ventilation, untidy work place, overcrowding in work place among others. These hazards are caused by lack of proper guidance on the conditions to be observed by the employer or administration of a given institution. With regard to the research under study, the information assisted the researcher in determining the general safety practices at work place in relation to protective clothing by students in Technical Institution in Central Kenya.

#### **1.9.4 Physical hazards**

These are hazards caused by tools and equipment that one could be using in the workshop or laboratory. The hazards are also said to be as a result of human error. This is where the person working with the tools is careless and not paying attention to what he/she is doing within the workshop and laboratories. It is also caused by a person who could be doing things that he/she is not competent in or has not been trained. In considering the above, some of the physical hazards are falling objects or material, working at haste or in a confined space, handling moving objects with bare hands, handling object with extreme temperature. All the above hazards should be prevented or controlled through proper selection, use and maintenance of protective clothing.

#### **1.9.5 The dependent variables**

Identify protective clothing as a control measure in workshops and laboratories such as gloves, eyes/face muffs, ear plugs, foot wear, body suit and helmet.

Selection of appropriate protective clothing – This should be done by putting into consideration; environmental factors where the protective clothing will be used, the user

suitability whether he / she is physically challenged as well as consulting the users so as to know the various types of protective clothing and size required for the task at hand.

After selecting, the person in charge of the employees and the students need to assess their attitude towards use of protective clothing, knowhow of the employees, students and training required on protective clothing.

In this study all the students need to be informed on selection, use and maintenance of protective clothing through training so as to understand the nature of hazards associated with workshops and laboratories. This will enable the students to understand the importance of wearing protective clothing and proper hygiene practice in workshop and laboratories.

Once the students and the employees have been trained, maintenance of protective clothing need to be done as well as monitoring so as to know whether all the proactive components are being used as control measures in workshops and laboratories. As a result the evaluation of protective clothing performance is done by accessing their quality, durability, comfort, compatibility with other protective equipment as well as environmental compatibility. The researcher believed that, with the acquired information from the conceptual framework, the study had a guide and direction to achieve the anticipated results.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Introduction

This chapter reviews related literature to this study under the following sub-headings: types of personal protective equipment; areas that require the use of protective clothing; selection of protective clothing; training on use of protective clothing; attitude towards use of protective clothing; factors that affect clothing care, cleaning and storage, dry cleaning, Kenya Standard Code of Practice for dry cleaning. A summary of literature review and identified gaps are the final section.

### 2.2 Types of Personal Protective Equipment

There are different types of protective clothing that are designed to protect particular parts of the body which are exposed to occupational hazards. A protective helmet for head protection against impact blows must withstand penetration and absorb the shock of a blow. In some cases helmets should protect against electric shock (Juergens, 2004). The head needs to be protected from injuries as it is classified together with the chest as being the areas that are vital to life (Simiyu, 2002).

For protection against falling or rolling objects, sharp objects, molten metal, hot surfaces and wet, slippery surfaces, workers should use appropriate foot guards, safety shoes or boots and leggings. Nash (2004), (Trevor, 2008) confirms that safety shoes should be sturdy and have an impact-resistant toe.

Face injuries are caused by metal objects, most often blunt and weighing one pound or more. Accidents result in cuts, lacerations, or punctures, and fractures (including broken or lost teeth). Protection should be based on the kind and degree of hazard present

(Taylor, 2005). Therefore, face masks, respirators and goggles need to be worn any time a person is working in the workshop.

Exposure to high noise levels can cause irreversible hearing loss or impairment. It can also create physical and psychological stress (Trevor, 2008). Preformed or molded ear muffs should be individually fitted by a professional. Disposable earplugs should be used once and thrown away; non-disposable ones should be cleaned after every use for proper maintenance (Juergens, 2004).

Burns, cuts, electrical shock, amputation and absorption of chemicals are examples of hazards associated with arm and hand injuries. A wide assortment of gloves, hand pads, sleeves and wristlets for protection from these hazards are available for use in the workshops. The devices should be selected to fit the specific task. Rubber and latex material is considered the best for insulating gloves and sleeves (Trevor, 2008).

Many hazards can threaten the torso, for example heat, splashes from hot metals and liquids, impacts, cuts, acids, and radiation. A variety of protective clothing is available, such as vests, jackets, aprons, overalls, and full body suits. Fire retardant wool and specially treated cotton clothing items are comfortable, and they adapt well to a variety of workplace temperatures. Other types of protective clothing include, leather, rubberized fabrics, and disposable suits (Nash, 2004).

Proper protective equipment with respirators are required to control occupational diseases caused by breathing air contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, and vapors (University of St. Andrews, 2008 ), (University of Wollongong, 2009)

### 2.3 Areas that require use of Protective Clothing

It is important to use protective clothing in areas that pose environmental, chemical, biological and physical hazards as a safety control measure (Trevor, 2008). Protective clothing is required in situations where the body or skin is exposed to hazards (Torres, 2007). The hazards under consideration include chemicals, infectious agents, radioactive materials, harmful dusts, sharp objects, burns and harmful extreme temperatures. At least one or combinations of these conditions are likely to be encountered by students in their workshops and laboratories in Technical Institutions in Central Kenya.

In most Technical Institutions in Central Kenya, there are chemical and biological laboratories, where chemicals or other hazardous materials are used and stored. Laboratory coats are used in order to protect one from minor splashes or spills. Gloves are used to prevent one's hands from infectious chemicals. To minimize contamination of ordinary clothing, Laboratory coats need to be worn in the laboratory. Wearing protective clothing in other places like eating places, administrative office areas or in other public areas like libraries, washrooms, seminar rooms and public meeting places is inappropriate (University of Toronto, 1999).

Places with extreme temperatures; either very low or very high, also require protective clothing. In Technical Institutions, high temperatures are likely to be encountered in work places. Some of the activities that may lead to high heat generation are welding and smelting of metals. Cold temperatures are encountered in storage facilities, where some specimens and chemicals that require these special conditions are stored (Krueger and Banderet, 1997). Working outdoors or dealing with cryogenic materials may also expose

one to cold conditions. Dyeing and painting are other activities that require the use of masks and gloves as protective clothing so as to protect one from fumes (Pizzoto, 2005).

#### **2.4 Selection of Protective Clothing**

Once the need for protective clothing has been established, the next task is to select the proper type of protective clothing putting into consideration user suitability, the degree of protection required and the appropriateness of the equipment to the situation (University of St. Andrews, 2008). The degree of protection and design of protective clothing must be integrated because both affect its overall efficiency, wearability and acceptance (Trevor, 2008). Therefore a check list on issues to be considered in the selection of protective clothing should be used (appendix 2) (University of Wollongong, 2009). There are so many types of protective clothing that make appropriate selection difficult. Four factors that require consideration when selecting appropriate protective clothing include: Chemical, biological, physical and environmental (University of St. Andrews, 2008).

When it comes to choosing the appropriate type of protective clothing, the functional role should be emphasized (Trevor, 2008). Ideally, the practical function of clothing is to protect the human body from dangers in the environment. Crane (2001) identifies such environmental dangers as weather (strong sunlight, extreme heat or cold and precipitation), insects, noxious chemicals, weapons and contact with abrasive substances and other hazards.

For maximum protection, appropriate protective clothing should be chosen (University of St. Andrews, 2008). For one to choose the appropriate protective clothing, the purpose

for which the protective clothing is being chosen should be first understood (Crane, 2001). For example, a laboratory coat is meant to protect the wearer against minor splashes or spills, as well as keeping the ordinary clothing away from contamination by the materials used in the laboratory. For very cold conditions, thermally insulated clothing like coats, vests, underwear and aprons must be worn (Torres, 2007).

Laboratory coat fabrics need to be suitable for the work environment, the objects that are being handled and the task at hand. The most appropriate fabric used in the making of laboratory coats is cotton or cotton/polyester (Beryl, 1976). In addition, clothing needs to fit properly, when worn and provide appropriate flexibility to carry out tasks (Tselepis & De Klerk, 2004). Due to the fact that laboratory coats offer limited protection, other appropriate clothing like aprons, leggings, masks, sleeve protectors and overalls are required to be worn so as to achieve the required standard of protection (University of Toronto, 1999), (University of St. Andrews, 2008).

There are varieties of protective clothing which can be used for high temperature exposure. The choice of the protective clothing may include apparel made of leather, aluminized fabric, or other heat resistant materials, depending on the source of heat (The Regents of the University of California, 2006). Activities that involve the generation of heat are also accompanied by the generation of loose particles and sparks. It is, therefore, necessary to protect the eyes from excess light and the face from flying particles. Cutting and welding activities are some of the common activities that take place in Technical Institution in Central Kenya workshops, where hazards are likely to occur.

In industrial and military settings, where workers are exposed to potentially hazardous solvents, materials and chemical agents, there is need for workers to wear chemical protective clothing (CPC). The components of a CPC are a gas mask with a respirator; a protective hood that covers the head and shoulders; a suit (trousers and overcoat, or overalls); industrial protective gloves; and rubber over boots. A CPC collection can be worn in various configurations, depending on the required level of protection. Both the military and commercial sectors provide guidelines meant to obtain the appropriate level of protection. Krueger and Banderet (1997), notes that maximum protection can be achieved, when all components of the CPC are worn.

According to data which were published by the Bureau of Labour and Statistics (BLS) in 2005, it is revealed that 1.2 million American workers were injured on the job, 34,740 being eye injuries, and required recuperation away from work (Torres, 2007). These injuries can be drastically reduced if there is proper face and eye protection. This is clearly indicated by a report by Prevent Blindness America, where it is recognized that more than 86,000 workers, who were involved in potentially serious incidents, managed to save their sight by wearing proper eye and face protectives (Torres, 2007).

In a research which was conducted in Technical Institutions by the GoK (2008), it was revealed that there was no provision related to PPEs for workers (GoK, 2008). The research also identified that there is lack of a sound procedure for the maintenance of PPEs. The maintenance team was found to be lacking. Another shortcoming was lack of signage that would prompt the use of protective gears in certain areas. Trevor (2008) notes that after training has been offered, it is the users sole responsibility to select appropriate combinations of chemical protective suits and ancillaries for his particular

application. The user needs to evaluate the performance of protective equipment such as durability, comfort, quantity, compatibility with other personal protective equipment and environmental compatibility. This study aimed at establishing the factors surrounding the selection, use and maintenance of protective clothing in Technical Institutions in Central Kenya. The study goes further to find out whether the students' know-how about protective clothing in terms of selection, use and maintenance.

## **2.5 Training on the Use of Protective Clothing**

Protective clothing wearers must be fully trained in the use of equipment, how to wear it and what its limitations are (University of St. Andrews, 2008). To enhance proper selection, use and maintenance of protective clothing, there is a great need for training (University of St. Andrews, 2008). This need for training has also been emphasized by the Occupation Health and Safety (OHS) guidelines for Technical Institutions (GoK, 2007b).

According to the guidelines, Health and Safety Training Induction Programme needs to be established, where documented Health and Safety policies/procedures and other documents are communicated to new and transferred employees at all levels. The guidelines further stipulate that health and safety training programmes should be established for all levels of staff, in order to carry out their respective common law and statutory duties as prescribed in the Occupational and Health Act 2007. The guidelines also give directives on who is to receive training, when and how the training is to take place. This study will investigated training on use of protective clothing by students in Technical Institutions in Central Kenya.

Training is very important as it enlightens staff and students on the importance of using protective clothing (University of St. Andrews, 2008). The University emphasizes that all employees and students must receive training with respect to protective clothing selection, use and maintenance. The students should be given particular attention on understanding the nature of hazards associated with exposure to workshops and laboratories. Also they should be trained on importance of wearing protective clothing as well as good personal hygiene.

According to the research that was done in Technical Institutions by GoK (2008), it was established that there was no effective training on use of PPE (GoK, 2009). The training which was being undertaken by learners, academic staff and other employees in Technical Institutions in health and safety was limited to cases where the curriculum required such training. It was further established that no institution had appointed members of the Health and Safety Committee, and trained them on proper ways to perform their roles as committee members (GoK, 2007b). New learners, academic staff and other employees in the institutions had not received essential health and safety information such as, how to report an accident at work and handling of hazardous materials.

In general, it was found that training activities at all levels of workers and learners, who required health and safety awareness was limited. In over 50% of institutions, there was no or little indication of involvement in safety and health training (GoK, 2008). This study involved investigating the training status of students, in addition to finding out the importance the students attach to the training. The respondents were given a chance to air

their views on the issues pertaining training on use of protective clothing through a questionnaire.

The need for employees and students to be informed about the importance of the use of protective clothing in higher institutions of learning has also been captured in the Environmental Health and Safety (EH & S) policies of the respective institutions in the United States of America. The EH & S policies conform to the requirement given by the Occupational Safety and Health Administration (OSHA) which requires that employers protect their employees from workplace hazards that can cause injury (OSHA 3151-12R, 2003).

In the University of Toronto (1999), EH & S policies supervisors and other individuals are charged with the responsibility of ensuring that employees, students and visitors are adequately informed about protective clothing. The supervisors are given the responsibility of conducting a job hazard analysis for each employee in order to determine the need for protective clothing and equipment (The Regents of the University of California, 2006). As a result of lack of knowledge on the need for protective clothing, some employees may use part of the required protective clothing and neglect others. According to the findings of a survey in industries, 15% of workers who were required to wear a face shield were found to wear one (Torres, 2007). This study aimed at finding out if similar practices occur in Technical Institutions in Central Kenya. This study also investigated the occurrence of injuries during practical lessons and the reasons of injuries occurrence.

## 2.6 Attitude towards the Use of Protective Clothing

According to Barnard (2002) attitudes are predispositions to behave in a certain way with respect to a specific object like clothing. An individual may have either a positive or a negative attitude towards a particular style, brand name or social appropriateness of clothing (Steele, 2010; Pearson, West and Turner (1995). The students of Technical Institutions in Central Kenya may have differing attitudes towards the use of protective clothing. The attitude towards the use of protective clothing may also be positive due to the fact that clothing acts as a symbol of role and status of the individual in society (Storm, 1987). Alternatively, protective clothing may be looked at as being unfashionable. Some students and staff who may be required to use protective clothing such as overalls, gloves and face shields may have a negative attitude towards the use of such clothing because they may associate them with manual jobs, which they may consider to be of low societal status (Horn, 1975).

Horn (1975) note that exclusive and expensive styles have been adopted by people in the upper class to indicate their superior social positions over those in the lower classes. Due to this fact, the use of protective clothing which tends to cover the ordinary clothes and are considered to be fashionable in most of the working hours may cause students to have a negative attitude towards protective clothing. Yuniya (2005) note that a fashion mechanism does not appear in response to a need of class differentiation and class emulation, but in response to a wish to be in fashion, to be abreast of what has good standing and to express new tastes which are emerging in a changing world. Storm (1987) and Arnold (2001) asserts that consumers use different forms of clothing to differentiate themselves symbolically from other consumers.

The fact that clothing is used as a means of communication may also affect the attitude students and staff members have towards their use of protective clothing. Paola and Muller (1980), Loschek (2009), note that the language of clothing is influenced by one's culture. Clothing is expected to give important information about the wearers' occupation, origin, personality, opinions, tastes and current moods (Schorman, 2003.; Kuhn, 2005 ). Misinformation can also be communicated since clothing can be used in creation of illusion (Migunde, 1993; Crane, 2001). Jensen and Ostergaard (1998), Wood (2009) define non-verbal communication as the sending and receiving of thoughts and feelings without words. Several researchers explored the effects of clothing on social interactions and characteristics perception. Entwistle (2000) found that fashionable clothing resulted in perception of greater sociability than did unfashionable clothing. Thurow (1987), Barnard (2002) also found that clothing fashionability was a factor in interpersonal distance.

### **2.7 Factors that Affect Clothing Care**

Glock and Kunz, (2009) explains that a combination of several characteristics of a garment or textile household article, usually determines the care it should receive. Carr, Tyler and Lathan (2008), state that fiber content, type of fabric construction and garment construction are all factors that influence the care of textile products. This is important in the section of protective clothing as the material to be used in making protective clothing need to be easy to maintain so as to be able to fulfill the functional requirements. Colour and fastness of the dye also influence the choice of the laundering methods in the course of their care (Glock and Kunz, 2009). Information on the stated factors is provided to the consumer by use of a product level or care label. However, in the Kenyan situation, some textile articles do not bear any label. In this study, the care given in form of maintenance

to protective clothing used by the students in Technical Institutions in Central Kenya will be investigated.

### **2.7.1 Fiber Content**

Carr et al (2008), define fiber content as the type and amount of fiber used in making a textile product. A fiber is the smallest unit in fabric construction. Fibers are classified as natural and man-made. Natural fibers include cotton, linen, jute, wool, silk and others. Cotton, being a plant fiber, is mainly composed of cellulose. It is strong and has a 10% increase in strength when wet. Cotton fabrics are therefore washable and dry cleanable with least damage to the fabric (Pizzuto et al, 2005). Therefore, cotton fabric is appropriate for protective clothing. It can also be blended with polyester fibre so as to improve on its characteristics as a protective clothing fabric. This will make the protective clothing comfortable to wear as well as its maintenance.

Linen is the strongest of the vegetable fibers, but since linen fibers are inelastic, linen articles require frequent ironing to remove wrinkles. Linen is both washable and dry cleanable. The need to iron linen articles may disqualify it from being the best choice of protective clothing like lab coats in Technical Institutions in Central Kenya. This is due to the fact that ironing facilities may not be available at all or the availability of such facilities may not be always guaranteed due to power failure or breakage. Wool is an animal fiber and is mainly composed of proteins. The fiber has good resiliency while dry, but poor when wet as it loses about 25% of its strength in this condition. Articles made of this fiber require careful handling during washing to prevent felting and shrinkage. This is one reason why dry cleaning is recommended rather than hand wash (Glock & Kunz, 2009). Silk fabrics can be washed or dry cleaned, although sometimes

the dye or the finish used necessitates dry cleaning only. Chloride bleach should not be used in washing silk as it makes it turn yellow.

Man-made fibres include acetate, acrylic, modacrylic, nylon, polyester and rayon, among others (Accumen, 2011). Acetate is a fiber made from cellulose acetate. Acetate fabrics have poor elasticity, durability and become 30% weaker when wet. For this reason, acetate should be dry cleaned or carefully laundered ( Zieman, 2004; GoK, 2001). Due to its low wet strength, washing acetate by machine should be avoided. Acrylic is also a man-made fibre; it has good resiliency and elasticity with excellent resistance to sunlight and weathering. It is therefore, washable or dry cleanable. Nylon, polyimide man-made fiber produces durable and resilient fabrics. Polyester fibre has excellent resiliency which gives good wash and wear qualities. On the other hand, polyester is almost completely hydrophobic. If a textile product made out of such a fiber is stained by oil or grease, dry cleaning may be required. Rayon, a regenerated cellulose fiber is fairly durable but loses 30-50% of its strength when wet (Warson, 2001). It requires great care when laundering and it is also dry cleanable. In this study, the cleaning arrangement offered in the institutions will be investigated. The study will investigate whether the type of fabric on protective clothing is appropriately selected, used and maintained.

Often fibers are combined in making fabrics and so producing blends or mixtures. The care required for blends depends on fibers making up the fabric. If a care label is not available, the fabric should be cared for according to the most sensitive fiber in it (Beryl, 1976). For example, if a fabric is a blend of wool and nylon, it should be handled carefully when wet because of the wool fiber content. This makes it important for manufacturers to ensure that labels are available on household textile articles and that

there is adequate information relating to their fiber content, performance and directions for use and care (Shirley Institute, 2000).

### **2.7.2 Fabric Construction**

Fabric construction is the process by which yarns are put together to form a fabric (Chui, 2011). There are various methods of construction; the most commonly used being weaving and knitting. Each type of construction has characteristics that finally affect the appearance, dimensional stability, durability, absorbency and eventually the care required (Horn, 1975). The looseness or firmness of a weave or knit influences the care needed. A closely woven or firmly knit fabric will withstand more handling without stretching than one that is loosely woven or knit and that loose weaves are more likely to shrink than close weaves (Accumen, 2011).

### **2.8 Cleaning**

Accumen (2011), note that care of fabrics is a means of keeping fabric in good condition. Frequent and quality cleaning is likely to encourage the use of protective clothing by the students. Some of the problems that may occur when cleaning protective clothing, like overalls and laboratory coats include damage of textile articles, unpleasant odours of fabric, discolouration of articles, fading of colour and stretching (Schorman, 2003).

Dry cleaning may be used in the cleaning of protective clothing. Dry cleaning is the process of cleaning fabrics with organic solvents to remove dirt and some stains (Tony, 1995). Articles being dry cleaned are immersed in an organic solvent cleaning and agitated the same way clothing is agitated in a home washing machine (Stone, 2001; Pizzuto, 2005). The term dry is used because the solvents are non-aqueous and so do not wet fibres. Shrinkage therefore, does not occur and there is no effect on most dyes.

However, pigment dyes are sensitive to dry cleaning fluids. This is because the colour fastness of a colour pigment is dependent on durability of binder fixing it to the fabric. If the binder is worn out by the dry cleaning solvents, there is loss of colour (Frings, 2004).

In a dry cleaning plant, textile articles may be handled by several specialists before the cleaning services are completed. The first step involves labelling the goods with identification tags, followed by sorting. Sorting is based on the colour of the goods, degree of soiling, fabric use, and reaction of the textile to the solvents, mechanical action and reaction to moisture during basic dry cleaning (KBS, KS08-442, 1987). Heavy clothes such as coats and suits may be combined when cleaning. Lightweight garments are separated from heavy ones to avoid damage to the fibre. After cleaning, the articles are pressed in the finishing department. Steam and air are used to return the garment to shape and remove wrinkles.

There are two categories of organic solvents used in dry cleaning; the studded solvent type and chlorinated hydrocarbon type. The principle chlorinated hydrocarbon solvent used is perchlorethylene, while nanotech is a studded solvent. The temperature of the solvents is carefully controlled in cleaning, never exceeding 90<sup>0</sup> F. The fluids are continuously circulated and filtered to remove fiber particles from the clothes and other solid soils. Dry cleaning fluids are recycled and used over and over to reduce on the cost incurred. The organic solvents have excellent ability to remove soils of greasy nature and other materials e.g. tars and paints, which are soluble in these fluids. It is clear that there is need give the responsibility of handling the dry cleaning process in technical institutions. The consequence of having unqualified person will range from excessive use of detergents, and poor laundering results and destruction of laundering machine.

Water soluble soils, perspiration salts and sugar stains cannot be removed by organic solvents and their removal can only be accomplished by charging the cleaning solvent through addition of a little water and detergent in it (Pizutto, 2005; KBS KS08-442, 1987). The amount of moisture in the charged bath is critical. Too little moisture is ineffective for cleaning, while excess moisture can cause irreversible felting action and shrinkage of wool. Excess moisture in a charged system also causes wrinkling of textile articles (Ulwick, 2005).

Garments and textile articles that may be stained by substances insoluble in the dry cleaning solvents are removed by spotting before cleaning. Spotting is the process of removing stains from textiles mechanically by simultaneous use of water, steam and chemicals (spotting agents) (Beryl, 1976). An expert spotter must understand fabrics, dyes and garment construction in order to select the best treatment for each garment (Yuniya, 2005). This is essential because improper spotting can permanently damage a fabric. In Technical Institutions in Central Kenya students need this information so that they can maintain protective clothing.

## **2.9 Storage**

All protective clothing need to be kept in a safe place and within reach when required (Wollongong, 2009). As a result, storage facilities need to be installed in workshops and laboratories (Trevor, 2008). Safety goggles should be kept in a case, lab coats should be hanged up in lockable wardrobes, boots should be stored in a shoe rack, among others. Provision of storage facilities prevents wearing protective clothing outside workshops and laboratories (Trevor, 2008). The storage facilities provision in Technical Institutions

can affect the attitude of the students towards the use of protective clothing. Good storage arrangement will ensure that no losses of protective clothing occur.

### **2.10 Kenya Standard Code of Practice for Dry Cleaning**

The Kenya code of practice was prepared by a technical committee on dyestuffs, chemicals and auxiliary, under the guidance of the textile industry committee and the National Standards Council (KBS, KS08-442, 1987). The code was formulated because of complaints from consumers directed at the dry cleaning industry. The complaints included shrinkage of garments, distortion of garments, unpleasant odour of fabrics, damage of garments, non-removal of stains and even formation of new stains. The code specifies appropriate cleaning procedures for adoption by dry cleaners when using various solvents, so as to reduce the risks of damage to textiles (KBS KS08-442, 1987).

### **2.11 Summary of Literature Review and Identified Gaps**

In the previous sections of literature review, types of personal protective equipment are well outlined. The area where protective clothing is required is clearly stated. Factors that are to be considered when selecting protective clothing have been given as the environmental, biological and chemical where colour, texture, size and design as well as the functional role has to be looked into. The need for training on use of protective clothing has been discussed, which has been emphasized by (Trevor, 2008), (University of St. Andrews, 2008) and Occupational Health and Safety (OHS). The training offered in Technical Institutions in Kenya has been noted to be limited to what is contained in the curriculum. The literature review has shown that attitude can affect the use of protective clothing, where a person may have a positive or negative attitude towards its use. From the literature review, it is clear that little research has been done on protective clothing within our region. The research that was done in Technical Institutions by GoK

(2008) had a general approach on use of protective clothing by the employees, as an aspect of safety control measure in technical Institutions by employees which did not focus on selection, use and maintenance of protective clothing by students. This leaves a gap, which the researcher aimed to close through the study on factors influencing selection, use and maintenance of protective clothing by students in Technical Institutions in Central Kenya.

### 3.1 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a way that aims to minimize bias and maximize the validity of the empirical findings (Creswell, 2012). The research design employed depicts the what the researcher is going to do in the study, theoretical approach used. This involves the selection of a research design, sampling method, data collection methods in the workplace and instruments used to collect data on selection, use and maintenance of protective clothing.

### 3.2 Study Area

The study was conducted in Murang'a and Kiambu Counties in central Kenya. The study area was selected to represent a high number of technical institutions (OJK, 2011) with a high number of students. The study was conducted in five technical institutions of Murang'a County and five institutions of Kiambu County. The study area was selected because of the central location of the study area about the location of the researcher. The study area was selected to ensure that the researcher had sufficient part-time employees. The study was also chosen as a primary institution by the researcher.

## CHAPTER THREE: METHODOLOGY

### 3.1 Introduction

This chapter covers research design, location of the study, target population, sample size and sampling techniques, research instruments, pre-testing, validity, reliability data collection procedures, data analysis and logistical and ethical consideration.

### 3.2 Research Design

A research design is the arrangement of conditions for collection and analysis of data in a way that aims at minimizing expenditure of efforts, time and money (Kombo and Tromp, 2006). Orodho (2008) posits that the research design employed depends on what the researcher is trying to investigate. In this study, descriptive survey was used. This method was preferred because information would be readily obtainable from respondents in the workshops and laboratories, concerning their attitudes on selection, use and maintenance of protective clothing.

### 3.3 Study Area

The study area was Nyeri, Murang'a and Kirinyaga Counties in Central Kenya. The area was purposively selected as it has a high number of Technical Institutions (GoK, 2011), which consists of three Technical Training Institutes (TTIs) and five Institutes of Science and Technology (ISTs) (Appendix 3). The central location of the study area makes the Technical Institutions in Central Kenya more accessible to students and staff from different parts of the country. The area was also chosen as it is easily accessible by the researcher.

### **3.4 Target Population**

The target population of this research comprised of students of Technical Institutions in Murang'a, Nyeri and Kirinyaga Counties in Central Kenya, who belong to the following departments: clothing technology, electrical engineering, and applied sciences. These departments were chosen because most of their courses are more practical oriented than theoretical. The mentioned departments pose the highest percentage of accidents, since the students are directly in contact with live wires, solid and liquid chemicals, contagious gases, harmful dust like cloth dust, loud noise and harmful temperature extremes.

### **3.5 Sample Size and Sampling Techniques**

The sampling units for the study consisted of Technical Institutions in Nyeri, Murang'a and Kirinyaga Counties in Central Kenya, where a purposive sampling method was used to get the Technical Training Institutes (TTIs) and Institutes of Science and Technology (ISTs). These were; Murang'a College of Technology, Kirinyaga Technical Institute and Nyeri Technical Institute.

The study targeted all the second year students undertaking a three-year diploma course in Clothing Technology, Electrical Engineering or Applied Science Departments. These groups of respondents were targeted because they have been in the institutions for a considerable time and this made them have more information than the first years who had just joined the institutions. While the third year students might have had more information they were busy with their projects and preparation for their final exams. This hindered them from participating in the study.

All the second year diploma students in the three institutions and belonging to the three departments were requested to participate in the study, by filling in a questionnaire. There were 20 respondents from Clothing Technology department, 57 from Electrical Engineering department and 42 from Applied Sciences department. Therefore, from the three institutions, each having three departments, the total number of respondents who participated in the study was 119.

### **3.6. Research Instrument**

The tool used in this study was a questionnaire.

#### **3.6.1 Questionnaire**

A self administered questionnaire was used as the research instrument in this study.

The questionnaire consisted of four sections which were demographics, factors influencing selection, factors influencing use and factors influencing maintenance (cleaning and storage) of protective clothing. The questionnaire contained both open-ended and close-ended questions. The close-ended questions provided an easy way of coding, while the open-ended ones enabled the researcher to gather wide and free opinions from the respondents.

### **3.7 Pre-Testing**

The research instrument was pre-tested in Michuki Technical Institute, which was randomly selected within the study area, and was not included in the main study. In the institution, a total of 10 students from each of the three departments were sampled to participate in the pre-testing exercise. The total number of the respondents in the pretesting exercise was 30. After pre-testing the tools were analyzed through descriptive statistics.

The pre-testing established that the instrument was well-designed in most of the areas except for grammatical errors and double barreled questions which were rectified, in order to increase the understanding of the questions by the respondents.

### **3.8 Validity and reliability**

According to Orodho (2008), validity refers to establishing whether the content of the research instruments measure what they purport to measure. The instrument was submitted to the researcher's supervisors in the Fashion Design and Marketing department of Kenyatta University for scrutiny. The supervisors established that the instrument presented the concepts under study, although they had grammatical errors and double barreled questions which were corrected for clarity.

Kombo and Tromp (2006) define reliability as a measure of the degree to which a research instrument yields consistent results on data after repeated trials. To ensure reliability, the researcher pre-tested the instrument in Michuki Technical Training Institute. The respondents filled the questionnaire twice in a span of two weeks. After analyzing the responses of the respondents, it was established that the research instrument yielded the same results.

### **3.10 Data Collection Procedures**

Before conducting the research, permission was sought from the MOHEST and the Graduate School of Kenyatta University. The researcher consulted the heads of institutions and the respondents in the Technical Institutions in Central Kenya. The respondents were assured of anonymity and that the information given in the questionnaire was to be treated with confidentiality and would only be used for the purpose of the study.

The questionnaire was filled by respondents in the presence of researcher so as to ensure that the exercise took the shortest time possible. It also helped the respondents to fill the questionnaire appropriately since the researcher was around to make any clarification if need arose. Ample time was given to the respondents to respond to the questionnaire. Observations were made by the researcher during pre-testing and actual research exercise. Field notes were made on what the researcher heard, saw, experienced and thought in the course of data collection.

### **3.11 Data Analysis**

In a descriptive survey study, the methods commonly used in data reporting are frequencies, percentages, means, mode, median, standard deviations, variances and correlations (Kombo, 2006). In this study descriptive statistical method of data analysis was used, using the Statistical Package for Social Sciences (SPSS), version 17.0. Pearson correlation coefficient was used to examine the relationship, the strength and direction of association between the study variables. The analyzed data was summarized by percentages and presented using tables, bar graphs and pie charts.

## CHAPTER FOUR: FINDINGS AND DISCUSSION

### 4.1 Introduction

This chapter reports on the major findings of the study, as they relate to each of the six (6) research objectives. Responses on the questions were summarized in tables, graphs or pie charts. The number of the respondents was as per the table 4.1 below:

**Table 4.1: Respondents' department**

Department	Frequency	Percentage
Clothing Technology	20	16.8%
Applied Science	42	35.3%
Electrical Engineering	57	47.9%
Total	119	100%

In Clothing Technology departments there were 20 respondents. This was 16.8% of the total number of respondents. In Applied Science departments there were 42 respondents which were 35.3% of the total. In Electrical department there were 57 respondents which was 47.9% of the total.

### 4.2 Factors Influencing the Selection of Protective Clothing in Technical Institution in Central Kenya

This section gives the findings on the factors that influence the selection of protective clothing.

### 4.2.1 Importance of Colour

When the respondents were asked if colour in protective clothing selection was important, they responded as shown in the table 4.2.

**Table 4.2: Importance of Colour**

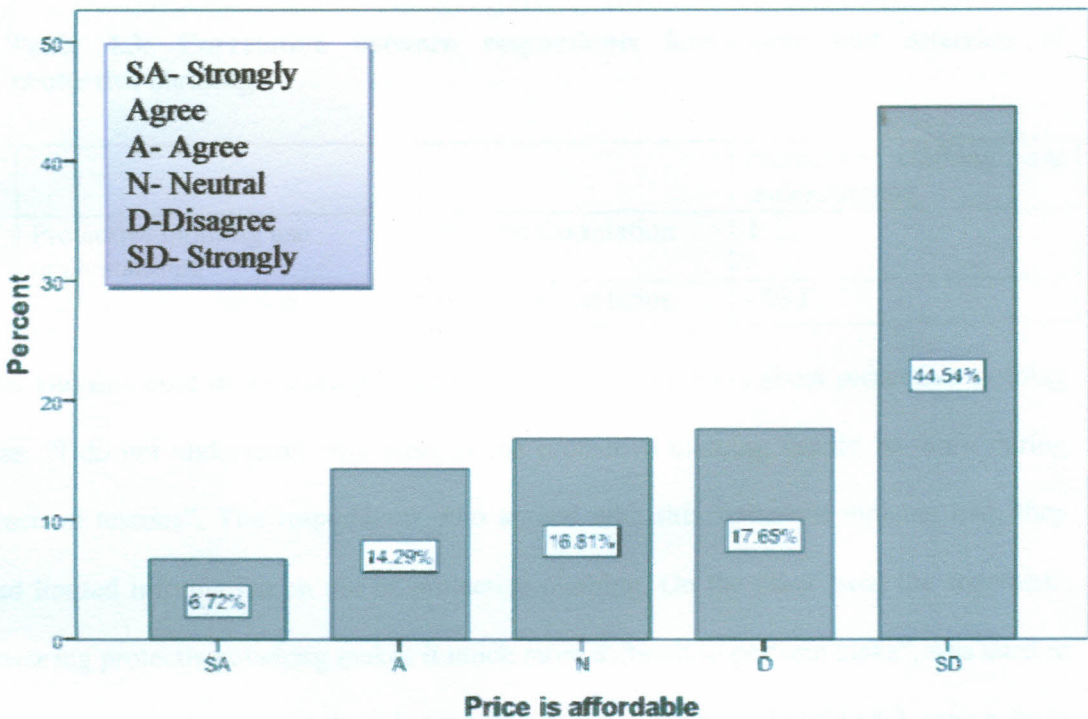
Response	Frequency	Percent
Yes	105	88.2
No	14	11.8
Total	119	100.0

Majority of the respondents, 88.24% indicated colour was important when selecting protective clothing while 11.8% did not consider colour as an important factor as in Table 4.2. The respondent's explanation for the colour significance was that it simply differentiated each department from the others, as directed by the management of the institution. Some of the respondents indicated that dull colours like black and navy blue were preferred for overalls and lab coats in Electrical Engineering department workshops. This was due to the nature of work and dust in the workshops.

The preferred colour for lab coats in Applied Science department was white as directed by the management. The white colour is important as stains are easily seen when a chemical spills on a lab coat. This helps in easy identification of stains during the cleaning process and it also encourages the students to be keen during their practical lessons, as they strive to maintain the lab coat stainless. However, none of the respondents indicated that there was need for choosing protective clothing with colour fastness.

#### 4.2.2 Price of protective clothing

Price was another factor that was highlighted by the respondents when selecting protective clothing. When the respondents were asked if the price of the protective clothing was affordable the results was as shown in figure 4.1.



**Figure 4.1: Affordability of protective clothing**

From the figure 4.1 it can be seen that majority of the respondents indicated that the price of protective clothing was unaffordable; with 44.54% of the respondents strongly disagreeing with the statement on affordability. In this case the administration in technical institutions needs to introduce cost sharing on protective clothing as they provide them to the respondents. This would eliminate the issue of unaffordability of protective clothing. However, there is need for the respondents to understand that when

considering price in choosing protective clothing, lower priced clothing can only be chosen if it serves the intended purpose.

#### 4.2.3 Correlation between respondents Knowledge and selection of protective clothing

The following table is a correlation between protective clothing use and difficulty in selection.

**Table 4.3: Correlation between respondents Knowledge and selection of protective clothing.**

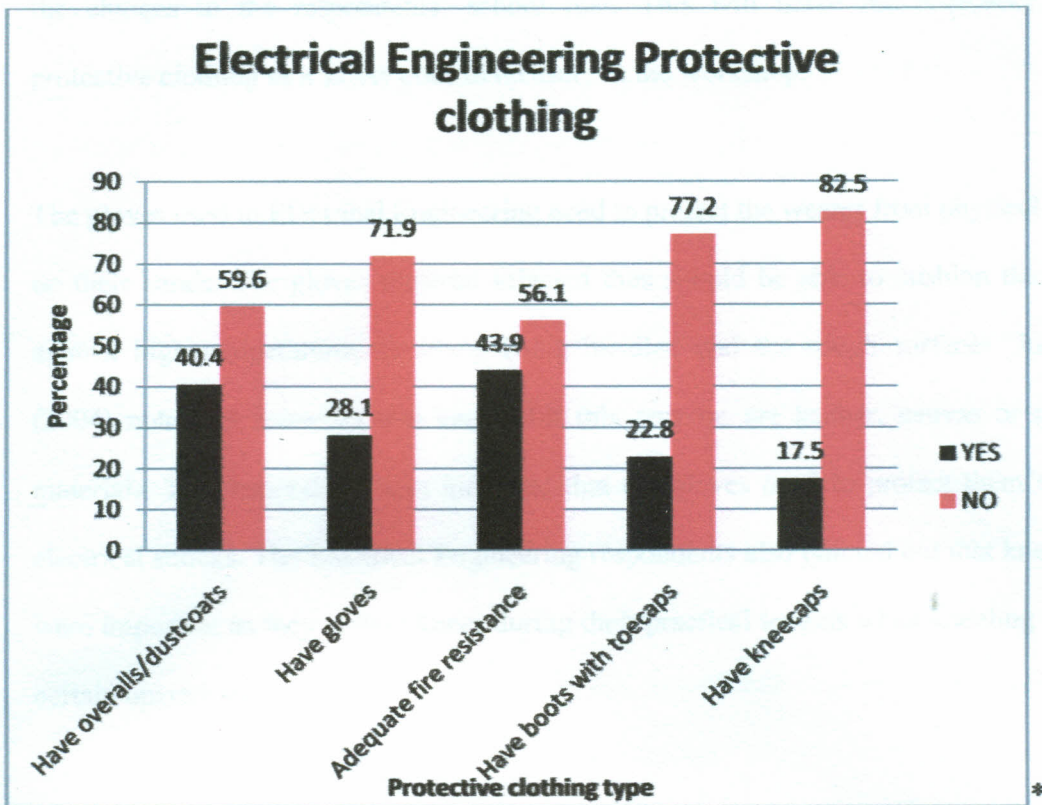
		Protective clothing use understanding
Protective clothing use understanding	Pearson Correlation	1
Difficulty in selection	Pearson Correlation	-.033

The variable used in measuring knowledge of the respondents about protective clothing was, "I do not understand why most of the protective clothing should be worn during practical lessons". The respondents who agreed with this statement indicate that, they had limited information on use of protective clothing. On the other hand the statement, "wearing protective clothing makes it much more difficult to perform tasks", was used to measure appropriateness in the selection of protective clothing. In table 4.3, respondents agreed with the statement indicating that there was difficult in selection of appropriate protective clothing. Therefore, there is no significant correlation between the two variables.

#### 4.2.4 Other Factors Influencing Selection

In the Applied Science department, the respondents were concerned about the harmful materials which they handled during their practical lessons and thus, they preferred to use protective clothing such as gloves, facemasks, gumboots and dust coats. The gloves used in Applied Science are designed to avoid the chemicals and other infectious materials from getting in contact with the body. The gloves used in Applied Science Department are latex or rubber material (Juergen, 2004). The disposable gloves and facemasks were provided to the respondents during practical lessons where the administration felt it was necessary as away of controlling safety. In the Applied Science department 30 out of the 42 respondents had lab coats while 12 of the respondents did not have any protective clothing. In the Clothing Technology department 16 out of the 20 respondents had aprons. In the department disposable gloves and face masks were provided by the management while carrying out the practical lessons.

According to University of California (2006), Electrical Engineering department, should use fire proof overalls which depends on the source of heat and material used on protective clothing to avoid injuries in the workshops. The figure 4.2 below shows protective clothing used in Electrical Engineering department.



**Figure 4.2: Protective clothing use in Electrical Engineering department**

In figure 4.2, 59.6% of the respondents indicated that they did not have an overall or a dust coat which they could have worn during the practical lesson. The fabric used on protective clothing need to be resistant to wear due to the rough conditions they are exposed to in the workshops. When the respondents were asked if the overalls and dust coats used in the department has adequate resistance to fire 56.9% disagreed. This could have been due to lack of knowledge on fire resistance protective clothing.

Boots with toecaps are required by students in Electrical Engineering Department workshops as this protects the wearer from heavy and sharp objects that may fall on the feet accidentally from the benches. From figure 4.2 it can be seen that 77.2% of the respondents from the Electrical Engineering department did not have boots with toecaps. This is an indication that the management needs to introduce cost sharing as they include

the charges in the respondents' school fees. This will make the respondents use protective clothing as a safety control measure in the workshop.

The gloves used in Electrical Engineering need to protect the wearer from physical injury on their hands. The gloves material selected thus should be able to cushion the hands against high temperatures on items being handled and the rough surfaces. Juergens (2004) note that materials that can fulfill this purpose are leather, canvas or padded materials. The respondents also indicated that the gloves need to protect them against electrical shocks. The Electrical Engineering respondents also pointed out that knee caps were important as they protect knees during their practical lessons when kneeling during certain operations.

From figure 4.2 it is observed that 71.9% of the respondents from Electrical Engineering department lacked gloves while 82.5% respondents from the same department lacked kneecaps. This is an indication that there was no adherence to full protective wear by the respondents while in the workshops. The lab coats and the overalls are selected bearing in mind the need to protect the civilian clothing underneath from getting in contact with substances like oils chemicals and fire particles. As guided by the conceptual framework, the respondents did not consider the environmental factors or the user suitability. This leaves a gap where the respondents need more information on protective clothing selection (University of St. Andrews, 2008).

The size of protective clothing was pointed out by the respondents as an important selection criterion. The respondents identified the need for all the protective clothing being well-fitting. University of Toronto, (1999) asserts that all protective clothing

requires to be well fitting when worn so as to achieve the required standard of protection (University of Toronto, 1999). It was observed that many respondents had protective clothing which were not well-fitting especially the lab coats.

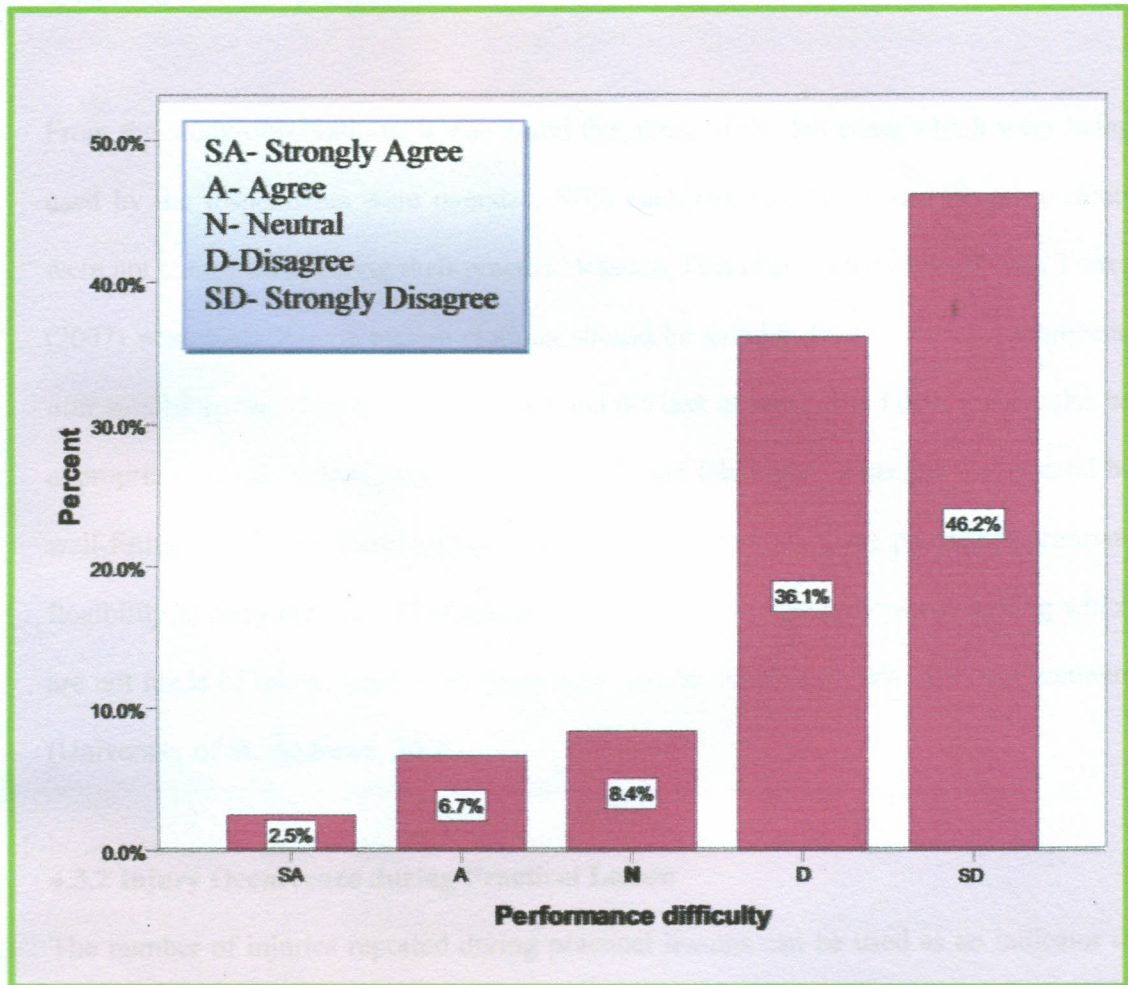
#### **4.3 Availability and Appropriateness of protective clothing**

One of the objectives of this study was to investigate the appropriateness of protective clothing used in the Technical Institutions in Central Kenya. The researcher observed lack of appropriate protective clothing during the practical lesson in workshops and laboratories since the respondents wore oversize dustcoats, open shoes and worked without gloves and face masks. This was not in line with (GoK, 2008) guidelines on protective clothing while in the workshop and laboratories where protective clothing need to be well fitting as it served the intended purpose.

The overalls and dust coat were of cotton fabric, polyester fabric and others cotton/polyester blends. The recommended fabric for dust coats and overalls is cotton/polyester blend which protects against the identified hazard (Trevor, 2008). The facemask used needs to be suitable to the user without creating other problems like preventing smooth flow of fresh air, distorting the vision of the user, leaving gaps between the side shields and the face which might allow particles to enter (Appendix 2). To overcome the problem of inappropriateness resulting from poor selection of protective clothing, the conceptual framework process description needs to be applied in Technical Institutions in Central Kenya. The students also need to be trained on understanding what the appropriateness of protective clothing is. This should not only capture the dust coats and overalls but foot wear and face wear.

### 4.3.1 Protective Clothing and Task Performance

When the respondents were asked to rate the effect of wearing protective clothing on the performance of their tasks (see attached respondents' questionnaire/appendix I), the response was as shown in the figure 4.3.



**Figure 4.3: Protective clothing effect on task performance**

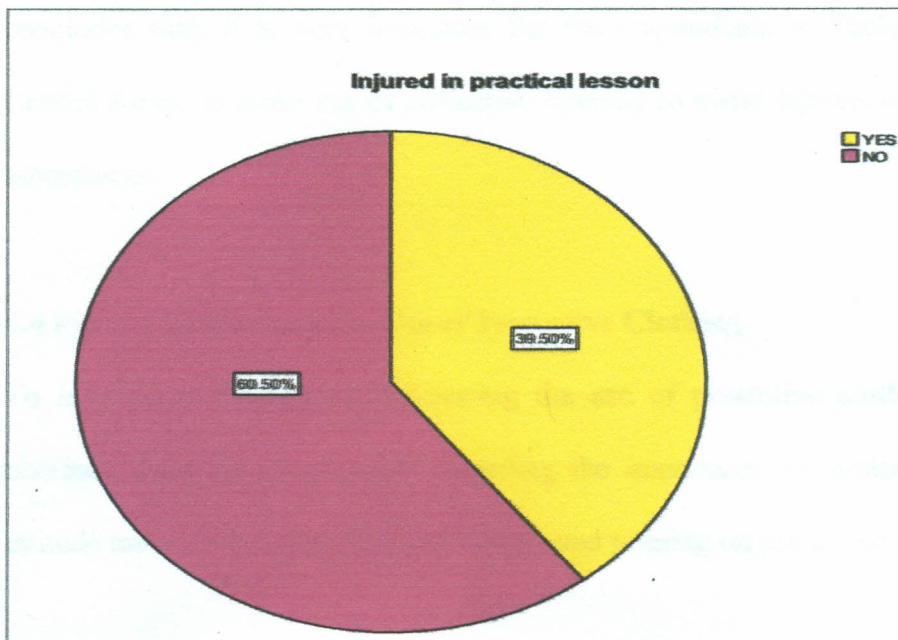
As shown in Figure 4.3, 46.2% of the respondents strongly disagreed that protective clothing made it difficult for them to perform any task while 36.1% disagreed. This response is an indication of positive attitude towards the use of protective clothing. This indicates that most of the respondents were comfortable in their protective clothing during task performance. However, there were a few (9.2%) respondents who indicated that protective clothing made performance of their tasks difficult. With proper

intervention, the respondents can wear full protective clothing while in the workshop and laboratory. The intervention is through training the respondents on workshop and laboratory hazards as well as the factors to consider on the selection of protective clothing as in conceptual framework (figure 1.1). This would ease any problem associated with task performance.

From the study observations, it was noted that most of the lab coats which were being used by the respondents were oversize. With such oversize lab coats, the respondents were not comfortable during their practical lessons. This observation concurs with Torres (2007) who notes that protective clothing should be suitable for the work environment, user suitability, the objects being handled and the task at hand. The fabric should also be appropriate, mostly cotton/polyester for overalls and laboratory coats and they should be well-fitting that is not loose and not tight on the wearer so as to provide appropriate flexibility to carry out tasks (Tselepis & De Klerk, 2004). The protective clothing which are not made of fabric, need to fit the wearer and be suitable for the work environment (University of St. Andrews, 2008).

#### **4.3.2 Injury Occurrence during Practical Lesson**

The number of injuries reported during practical lessons can be used as an indicator of appropriateness in selection and use of protective clothing. The number of respondents who had been injured during practical lessons is as in figure 4.4.



**Figure 4.4 Injury in practical lesson**

Out of the 119 respondents, 39.5% indicated that they had been injured during their practical lessons. The respondents attributed these injuries to have been due to lack of protective clothing like gloves, boots and face shields.

Injuries sustained during the practical lessons are attributed to lack of protective clothing, inappropriate protective clothing and lack of training on the use of appropriate protective clothing. Trevor (2008) notes that it's important to assess the likely chemical, biological, physical and environmental hazards associated with the task at hand. This could help to reduce the injuries as a safety control measure in the workshops/laboratories. Total quality management in Technical Institutions in Central Kenya also needs to be employed to create an environment which seeks perfection at all levels of workshop/laboratory practice. A corporate attitude which encourages students to ask why an injury has occurred so as to track down the root cause and then take action to prevent it from happening again should be encouraged. From this observation, the researcher

concludes that, it is very important for the respondents in Technical Institutions in Central Kenya to make use of protective clothing to avoid injuries in the workshops and laboratories.

#### 4.4 Factors Influencing the Use of Protective Clothing

To investigate the factors influencing the use of protective clothing, responses was obtained from the respondents regarding the importance of protective clothing, their attitude towards use of protective clothing and training on protective clothing.

##### 4.4.1 Importance of Protective Clothing

The respondents' response to the statement that protective clothing was important is summarized in figure 4.5.

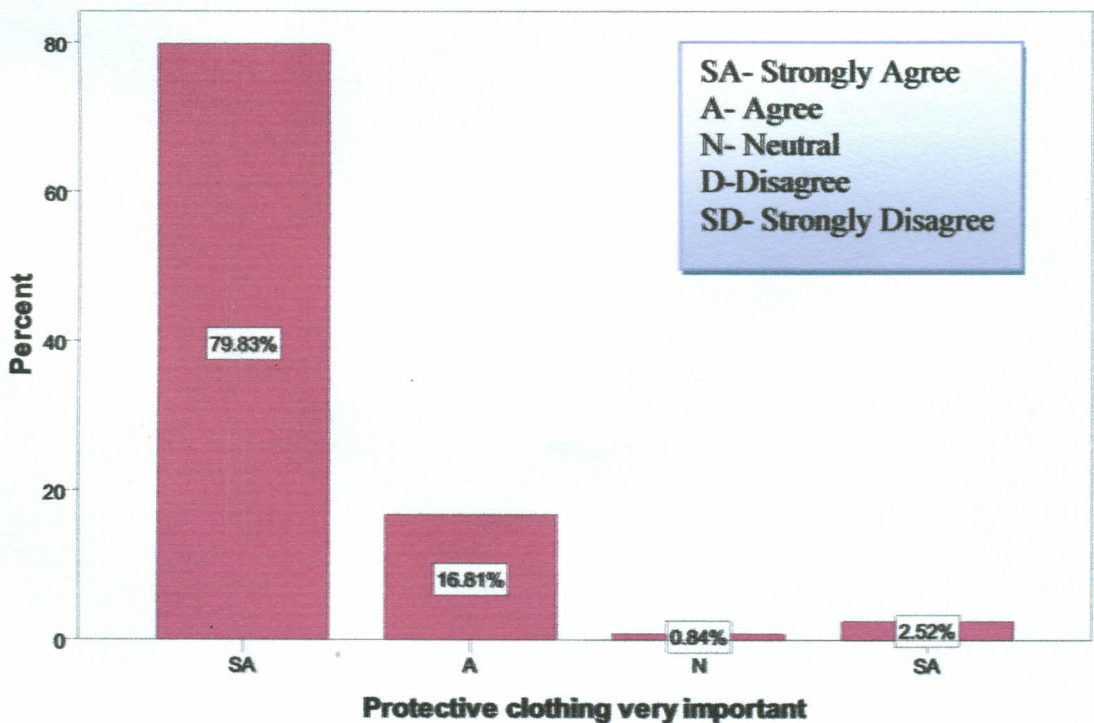
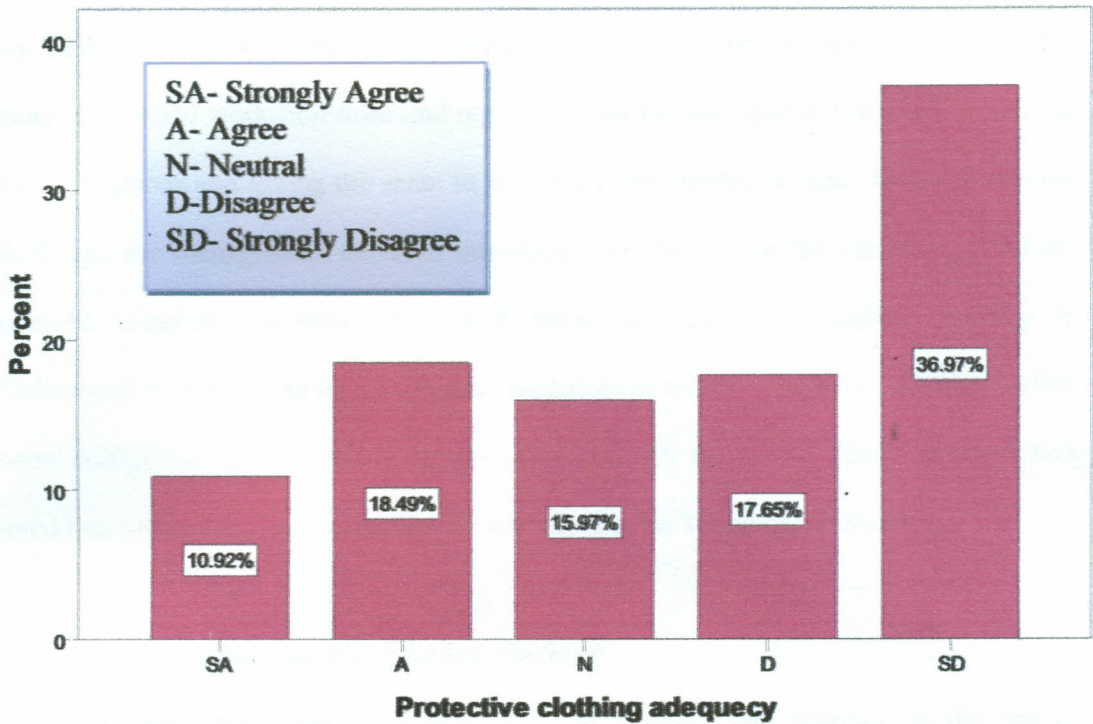


Figure 4.5: Importance of Protective Clothing

Figure 4.5, shows that, 96.6% (16.8 % agreed and 79.8 % strongly agreed) of the respondents concurred with the statement that protective clothing are important. This is an indication that there is a positive attitude towards the use of protective clothing due to the fact that the respondents see the need of using Protective clothing. This confirms what (University of Toronto, 1999) noted that full protective clothing should be worn so as to achieve the required standard of protection. Protective clothing is an important safety control measure, if adhered to, it enhances efficiency in workshops/laboratories. Protective clothing also has provision for carrying working tools thus substituting for a tool box. This helps to reduce movement in the working area thus saving time for completing a task. Appropriate protective clothing protects individuals from identified hazards and gives them confidence when carrying out a practical lesson (Simiyu, 2002).

#### **4.4.2 Adequacy of Protective Clothing**

The respondents were asked about the adequacy of use of protective clothing in their respective institutions, and the results are shown in figure 4.6



**Figure 4.6: Adequacy of Protective Clothing**

Figure 4.6, indicates that, 54.6% disagreed (17.6% disagreed and 37.0% strongly disagreed) that there was adequate protective clothing in their institutions. The inadequacy of protective clothing in Technical Institutions in Central Kenya is therefore, a factor that hinders the use of protective clothing. The inadequacy is caused by the respondents since they do not purchase the required overalls, boots and dust coats. On the other hand, the departments fail to give the respondents protective clothing like face masks, ear muffs, gloves and helmets necessary during practical lessons in the workshops/laboratories. However, as Trevor (2008) notes it's the users sole responsibility to evaluate the environmental factors and the protective equipment required so that he/she can select the appropriate combinations.

If the students in Technical Institutions are told “No protective clothing, No practicals” they will put a lot of efforts to request for the required protective clothing from their sponsors after paying the school fees. This would assist in getting rid of inadequacy in any Technical Institution in Central Kenya. In addition, students need to be reminded about laboratory/ workshop rules and regulations by the management displaying them in the work places and giving the same to students every academic year. To overcome the challenge, the management needs to introduce cost sharing for the provision of all the required protective clothing. This will boost the use of protective clothing in workshops/laboratories as a safety control measures in reducing injuries. The observation made during the data collection process concurs with the (GoK, 2008) where it was noted that protective clothing are not adequately used in Technical Institutions.

#### 4.4.3 Training on the use of Protective Clothing

The respondents were asked whether they had received any training on the use of protective clothing. The results were as shown in table 4.4.

**Table 4.4 Participation in training**

	Frequency	Percent
Yes	58	48.7
No	61	51.3
Total	119	100.0

Table 4.4, indicates that 51.3% of the respondents had not received any training on use of protective clothing. This is an indication that there is need to enhance training on protective clothing. The level of training concurs with the study done in Technical Institutions by the Ministry of Higher Education Science and Technology, where it was established that there was no effective training on protective clothing. The only training

received by the students was limited to the curriculum as outlined in the syllabus for the department concerned. The students at all levels in Technical Institutions in Central Kenya need to undergo training on understanding the environmental, physical, chemical and biological hazards associated with workshops/ laboratories (University of St. Andrews, 2008). Once the students are trained on the above areas they will be able to make use of protective clothing whenever required as they perform a task.

When the respondents were asked about the need of having training on the use of protective clothing, their response was as summarized in Table 4.5.

**Table 4.5: Need for training**

	Frequency	Percent
Strongly agree	87	73.1
Agree	29	24.4
Strongly Disagree	3	2.5
Total	119	100.0

Table 4.5 indicates that 73.1 % strongly agreed while 24.4 % agreed that there was need for training on the use of protective clothing. This indicates that the respondents in Technical Institutions in Central Kenya do not have adequate knowledge on protective clothing. Trevor (2008) and University of St. Andrews (2008) note that students and employees need to be trained on the nature of hazards, importance of wearing protective clothing, what to wear as well as good personal hygiene practice in work place. This needs to be practiced by students in Technical Institutions in Central Kenya.

#### 4.5 Attitude towards Use of Protective Clothing

In this section, the respondents were asked to respond to statements that could indicate their attitude towards the use of protective clothing.

##### 4.5.1 Discomfort with protective clothing

The respondents were asked to respond to the statement ,“I feel uncomfortable wearing protective clothing” the results were as in table 4.6

**Table 4.6 Discomfort with Protective Clothing**

	Frequency	Percent
Strongly Agree	11	9.2
Agree	6	5.0
Neutral	4	3.4
Disagree	42	35.3
Strongly Disagree	56	47.1
Total	119	100.0

Table 4.6 shows that 82.4% (35.3%, 47.1%) disagreed that they felt uncomfortable wearing protective clothing. This is an indication of positive attitude towards the use of protective clothing by respondents in technical institutions in Central Kenya. However, some of the observations made by the researcher may be used as a pointer of some form of negative attitude towards use of specific types of protective clothing. For example, the female respondents were seen in white lab coat in Electrical Engineering workshop instead of wearing overalls. It was also observed that 50% of the respondents were wearing open shoes which could be interpreted as discomfort towards use of closed shoes. The researcher feels that if the outlined hazards in the conceptual framework

**Table 4.8: Correlations between respondents' attitude and use of protective clothing**

Correlations				
		Like PPE	uncomfortable	Other priorities
Like PPE	Pearson Correlation	1	-.246**	.044
	Sig. (2-tailed)		.007	.635
	N	119	119	119
Uncomfortable	Pearson Correlation	-.246**	1	.074
	Sig. (2-tailed)	.007		.422
	N	119	119	119
Other priorities	Pearson Correlation	.044	.074	1
	Sig. (2-tailed)	.635	.422	
	N	119	119	119

\*\* . Correlation is significant at the 0.01 level (2-tailed).

From table 4.8, there is a significant correlation between “like protective clothing” and “uncomfortable”. The correlation is negative because “like protective clothing” was framed in positive sense while “uncomfortable” was framed in negative sense. There was no significant relationship between “Other priorities” and “like protective clothing” where the Pearson correlation value between the two variables was 0.044. There was also no significant correlation between “Other priorities” and “uncomfortable” where the Pearson correlation value was 0.074.

#### 4.6 Factors Influencing Cleaning and Storage Facilities

On investigating the factors that influence the cleaning and storage of protective clothing, the respondents were asked if the cleaning and storage facilities are available in their institution. The respondents were also asked about the adequacy of the cleaning and storage facilities.

#### 4.6.1 Cleaning Facility Availability

The respondents were asked about the availability of cleaning facilities with the results being as shown in Table 4.9

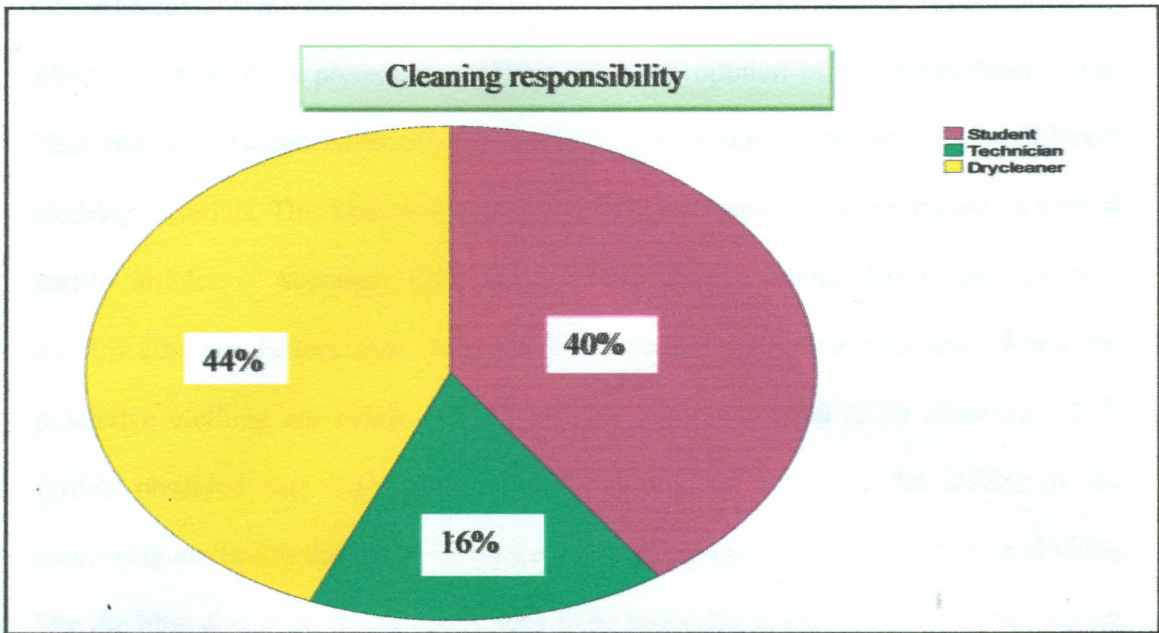
**Table 4.9 Availability of cleaning services**

	<b>Frequency</b>	<b>Percent</b>
Yes	35	29.4
No	84	70.6
Total	119	100.0

Table 4.9, shows that 70.6 % of the respondents indicated that there were no cleaning services in their institutions. The management of individual Technical Institutions need to introduce laundry and dry cleaning services for pay within the institutions. The students and other members in the institutions need to pay for the services on or before collecting their protective clothing. This will help in controlling the hygiene of protective clothing where they will be kept clean throughout. The other alternative is to make the respondents responsible of cleaning protective clothing through training them on laundering and dusting practices using the recommended detergents (Beryl, 1976). Frequent and quality cleaning is likely to encourage use of protective clothing by students (Schorman, 2003).

#### 4.6.2. Protective Clothing Cleaning Responsibility

The respondents were asked about their opinion on who should be responsible for cleaning of protective clothing, with the results being as indicated in figure 4.9



**Figure 4.8: Protective Clothing Cleaning Responsibility**

Figure 4.8, 44% of the respondents preferred that a drycleaner be engaged, 16% indicated the technicians should do the cleaning while 40% indicated that the respondents themselves should do the cleaning. This is a clear indication that majority of the respondents were not comfortable with the protective clothing cleaning arrangement in their institutions. Those who did not want to clean for themselves indicated that they had little time to spare for such activities. They also indicated that they did not have the relevant expertise to do the cleaning. Even those who preferred for students to do the cleaning, gave a further condition that detergents should be provided. With proper arrangements, the Technical Institutions in Central Kenya can adopt the KBS, KSO8-442 (1987) code which specifies appropriate cleaning procedures so as to reduce the risks of damage to textile articles.

These varied opinions on the protective clothing cleaning arrangement, it imply that this issue has an effect on the use of the protective clothing in the Technical Institutions in

Central Kenya. Some of the respondents who feel they do not have time for cleaning, are likely to put on dirty protective clothing. From the opinion of the respondents it was clear that they lacked knowledge on the different cleaning requirements for different clothing materials. This knowledge is important if the respondents are trained on care of textile articles. Accumen (2011) notes that fiber content, fabric and garment construction are factors that influence the cleaning of textile products. When the protective clothing are being cleaned, straight grain rule need to be observed. It is further observed that colour and fastness of the dye influence the choice of the laundering method in the course of protective clothing care. Coloured protective clothing like the blue dust coats and overalls need to be tested for colour bleeding. When drying the same articles, they need to be dried under the sun and then taken before they are completely dry to allow for ease in ironing (Beryl, 1976).

#### 4.6.3. Availability of Storage

The respondents were asked about the availability of storage facility with the results being as shown in Table 4.10.

**Table 4.10: Storage Availability**

	Frequency	Percent
Yes	19	16.0
No	100	84.0
Total	119	100.0

Table 4.10 indicates that 84% of the respondents noted that storage facilities were not available for protective clothing. Only 16% of the respondents felt that protective clothing storage facilities were available. This shows that storage facilities need to be put in place in every workshop and laboratory and within reach (Wollongong, 2009). It was the view of the 84% of the respondents that lockable wardrobes equipped with hangers

be provided or installed where lab coats and overalls could be kept. They also highlighted storage facilities be accessed only at stipulated times as a way of eliminating theft. If the above information can be adapted to, it would restrict respondents wearing of protective clothing outside the workshops and laboratories.

#### **4.7 Factors Influencing General Safety Practices**

All staff and students who undertake work in the workshop and laboratories must take reasonable care of their own health and safety and the health and safety of others by:

- Complying with all occupational health and safety instructions, policies and procedures including departmental safety manuals.
- Making proper use of all safety devices and personal protective equipment.
- Maintaining dress standards appropriate for the work being done. Appropriate protective clothing and footwear must be worn at all times.
- Reporting all incidents, hazards and 'near miss' incidents that occur and report them using a report form. (University of Wollongong, 2009).

From the study, factors that had an influence on the general safety in Technical Institutions in regard to the use of protective clothing were investigated. The dangers encountered were identified and found to depend on the nature of practical lessons involved in different departments in the workshops and laboratories.

Replacement of protective clothing has implications on safety of the users. Old protective clothing does not provide the anticipated protection. The lack of signage to indicate areas where protective clothing was required could be seen as an indication of lack of information on use of protective clothing. This concurs with the University of Wollongong (2009) where lack of signage in workshops and laboratories was pointed out

as a major hindrance to good housekeeping standards within the workshops and laboratories.

In Electrical Engineering, the machines did not have safety machine guard to prevent flying particles from getting into the respondents eyes. If the machine guards are put in place, the respondents' general safety in the workshop could be catered for. However, machines with exposed electrical parts and moving parts expose the users to danger such as their clothing being held by the moving parts of the machines. As a result the respondent could be cut by the machine parts.

The number of respondents using certain equipment at a time can also affect the general safety during practical lessons. When respondents are not fully involved in the practical lessons they may not understand the disciplinary procedures that is attached to non-compliance with occupational health and safety instructions (University of Wollongong, 2009).

In Applied Science department, safety depends on environmental factors, biological, chemical and other infectious materials. This will protect the respondents from coming into contact with contagious material, having skin contact with harmful chemicals. Taylor (2005) note that occupational diseases caused by breathing air contaminated with harmful dust, fogs, fumes, mists and gases can be easily controlled if the mentioned factors are controlled. In general, warning signs and barriers should be strategically placed at the entrances to the workshop and laboratories.

If good housekeeping is practiced in the workshop it would ensure that risks of injury from potential hazards in the environment are controlled (University of St. Andrews, 2008). The following precautions need to be observed to ensure safety of respondents within workshops/laboratories:

- Floors are to be kept tidy and dry
- Benches are to be kept clean and free from obstructions
- Access to all emergency equipment (fire extinguishers, first aid kits) should be kept free from obstruction.
- Work areas and equipment should be thoroughly cleaned after use.

If the above points are put into consideration in Technical Institutions in Central Kenya, general safety could improve greatly in the workshops and laboratories (University of Wollongong, 2009).

## **CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **5.1 Introduction**

This chapter gives the summary of the study, implication of the findings, conclusions, recommendation for policy and practice and recommendations for further research.

### **5.2 Summary of the Major Findings of the Study**

From the findings there was a strong indication that the use of protective clothing in most of the Technical Institutions is limited. It is also clear that respondents understand the need for having protective clothing as they have positive attitude towards their use. It also emerged from the study that many of the respondents did not understand the appropriate selection criteria for protective clothing. Most of the respondents cited price and colour as the important criterion. Some of the respondents, who cited other factors to be considered in selection, included material suitability and resistance to wear.

While all these factors are important, the protection of the user is of utmost importance. It emerged that majority of the respondents preferred that protective clothing be provided in the institution but the type of protective clothing to be decided by the students. While this could boost the use of protective clothing, caution should be taken to ensure that the right quality is provided.

Training regarding protective clothing was also investigated in the study and the outcome is a subject of discussion. Results showed that 60% of the respondents had not received any training on the use of protective clothing while 97% indicated that there was need for training. On the availability of protective clothing in the technical

institutions, 54% of the respondents were of the opinion that protective clothing in the institutions were inadequate as compared to 29% who indicated that they were adequate.

The inappropriateness of the selection of the protective clothing was associated with occurrence of injuries with 39% indicating that they had sustained injuries during their practical lessons. During the practical lesson, the respondents were observed to lack appropriate protective clothing. Concerning protective clothing storage facilities 70% of respondents indicate that there was lack of adequate storage facilities. Other needs on storage that were mentioned were provision of security and lockable wardrobes within the workshop and laboratories.

The study established that there is a positive attitude towards the use of protective clothing with 86% of the respondents indicating that they like using protective clothing. On investigating about cleaning of protective clothing in the institutions, 60% of the respondents were of the opinion that, protective clothing should either be cleaned by the lab technicians or a hired dry cleaner.

The general safety practices that affect use of protective clothing were also investigated. Lack of strictness on the use of protective clothing was reported to lower the use of protective clothing in the institutions in Central Kenya. In the institutions studied, it was noted that there was no signage to indicate that the use of protective clothing was mandatory.

- iv. Proper cleaning and storage arrangements can greatly boost the use of protective clothing in Technical Institutions in Central Kenya.
- v. Many of the injuries that occur to students during practical lessons in Technical Institutions in Central Kenya are due to lack of use of protective clothing as observed by the researcher.
- vi. Training that the students in Technical Institutions in Central Kenya had received on protective clothing did not play a significant role towards adoption of safety measures.

However, safety in the workshops and laboratories is enhanced by proper selection, use and maintenance of protective clothing (University of St. Andrews, 2008). This ensures a safe working condition as it promotes confidence in task performance. There is need to protect the lives of people in the workshops and laboratories through use of protective clothing (John, 2002).

The study achieved its objective in establishing the factors influencing selection, use and maintenance of protective clothing by students in technical institutions in Central Kenya.

### **5.5 Recommendations**

In view of the various factors that emerged from this study, the researcher made the following recommendations:

- i. The Technical Institutions administration in Central Kenya should implement a policy of providing appropriate protective clothing to students and include the changes in the school fees.

## REFERENCES

- Accumen, B. L. (2011). *Industrial protective clothing: Global market perspective market research report*.
- Arnold, R. (2001). *Fashion, desire and anxiety: Image and morality in the 20th century*. I.B.Tauris.
- Barnard, M. (2002). *Fashion as communication*. London: Routledge.
- Beryl, R. (1976). *Textile and laundry work*. 2<sup>ND</sup> edition. London: Heinemann educational Books Ltd.
- Carr, H., Tyler D.J. & Latham B. (2008). *Carr and Latham's Technology of Clothing Manufacture*. John Wiley and Sons.
- Crane, D. (2001). *Fashion and its social agendas: class, gender, and identity in clothing*. University of Chicago Press.
- Cui, F., Zhang X. & Wang, L. (2011). *Journal of Jiangsu Teachers University of Technology* [en.cnki.com.cn/Journal\\_en/H-H000-ZJTX.htm](http://en.cnki.com.cn/Journal_en/H-H000-ZJTX.htm)
- Entwistle J.(2000).*The fashioned body: Fashion, dress, and modern social theory*. New York: Wiley-Blackwell.
- Frings, G. S. (2004). *Fashion: From concept to consumer*, 6<sup>th</sup> edition. New York: Prentice Hall.
- Glock, R. E. & Kunz G.I. (2009). *Apparel manufacturing: Sewn product analysis*. Pearson/Prentice Hall.
- GoK. (2001). *Position paper on textile industry*. Nairobi: Government Printer.
- GoK (2007a). *The Kenya Gazette Supplement*. Nairobi: Government Printer.
- GoK (2007b). *Occupation health and safety guidelines for TIVET institutions*. Nairobi: Government Printer.
- GoK (2008). *Health and safety Survey in TIVET Institutions*. Nairobi: Government Printer.
- GoK (2011). *TIVET ICT Baseline survey draft report*. Nairobi: Government Printer.
- Horn, M.J. (1975). *The second skin: An inter disciplinary study of clothing*. Boston: Houghton Mifflin Company.
- Jensen, A.F, & Ostergaard, P. (1998). *Dressing for security or risk? An explanatory study of two different ways of consuming fashion*, European advanced in consumer research.

- Juergens, J. (2004). "Safety First." *Occupational Health & Safety* 73, no. 6 94-96.
- KBS KS08-442 (1987). Kenya Standard code of practice for drycleaners. Nairobi KEBS.
- Kombo, D. K. & Tromp, D. (2006). *Proposal and Thesis writing*. Nairobi: Don Bosco Printer.
- Krueger, G. P., & Banderet, L.E. (1997). *Effects of chemical protective clothing on military performance: A review of the issues*. *Military Psychology*, 9(4), 255-286.
- Kuhn, C.G. (2005) *Self-fashioning in Margaret Atwood's fiction: dress, culture, and identity*. Peter Lang, University of Michigan.
- Loschek, I. (2009). *When clothes become fashion: Design and innovation systems*. London: Berg.
- Migunde, S.O. (1993) *Socio-cultural and psychological factors affecting clothing selection for adolescents*, unpublished thesis, Kenyatta University.
- Nash, J.L. (2004)"Weyerhaeuser Subsidiary Fined \$77,000 for Failing to Record Injuries." *Occupational Hazards* 66, no. 9: 12-14.
- Orodho, J. A. (2008). *Techniques of writing a research proposal & reports in Educational and Social Science*. Maseno: Kanezja Enterprises.
- OSHA 3151-12R (2003) *Personal Protective Equipment*. U.S. Department of Labor.
- Paula, de, H & Muller, S.C. (1980). *Marketing today's fashion: England cliffs*, New Jersey Prentice Hall. Inc.
- Pearson, J.C., West, R.L. & Tunner, L. (1995). *Gender & communication*. Brown & Benchmark. New York: University of California.
- Pizzuto, J. J. (2005). *Fabric science*. New York: Cornell University, Fairchild Publications.
- Schorman, R. (2003). *Selling style: Clothing and social change at the turn of the century*. New York: University of Pennsylvania Press.
- Shirley Institute (2000). *World textile abstracts*. New York: Cornell University: Elsevier Science Ltd.
- Simiyu, J. W. (2002). *Workshop and laboratory planning and organization and managing*. Eldoret: Salanic Printers.
- Steele, V. (2010). *The Berg companion to fashion*. London: Berg.
- Stone, E. (2001). *The dynamics of fashion*. New York: Cornell University.

- Storm, P (1987). *Fashions of dress: Tools of culture and the individual*. New Jersey: Englewood Cliffs.
- Taylor, B., Jr.( 2005). *Effective Environmental Health and Safety Management Using The Team Approach*. Hoboken, NJ: Wiley & Sons.
- The Regents of the University of California (2006). *Policy and Procedure Manual*. Retrieved 25<sup>th</sup> May, 2010 from <<http://manuals.ucdavis.edu/PPM/290/290-50.htm>>
- Thurow, M. T. (1987). *Family clothing*. New York: Wiley and Sons Inc.
- Tony, P. and Peter, G, (1995). *How to do your desecration in geography and related disciplines*. UK: Chapman and Hall.
- Torres, K. (2007). *Face the Facts: Your Face Deserves Better Protection*. Retrieved 25<sup>th</sup> May, 2010 from <[http://ehstoday.com/ppp/eye-face-head/ehs\\_imp\\_75050/](http://ehstoday.com/ppp/eye-face-head/ehs_imp_75050/)>
- Trevor, L. (2008). *Advanced Electrical Installation Work*. 5<sup>th</sup> edition. New York: Elsevier Ltd.
- Tselepis, T. and De Klerk M. (2004). Early adolescent girls' expectations about the fit of clothes: A conceptual framework. *Journal of family ecology and science*, 32, 83-93.
- Ulwick, A.W. (2005). *What customers want: Using outcome-driven innovation to create breakthrough products and services*. London: McGraw-Hill Professional.
- University of St. Andrews (2008). *The Selection, Use and Maintenance of Personal Protective Equipment (PPE)*. London: Berg.
- University of Toronto (1999). *Protective Clothing Standard: Selection and Use*. Retrieved 25<sup>th</sup> May, 2010 from <[http://www.civ.toronto.edu/dept/safety/Legislation\\_etc/uoft\\_protective\\_clothing\\_policy.html](http://www.civ.toronto.edu/dept/safety/Legislation_etc/uoft_protective_clothing_policy.html)>
- University of Wollongong (2009). *Engineering Workshop Safety Manual Guideline*. Retrieved 12<sup>th</sup> September, 2012 from <[http://www.uow.edu.au/content/groups/\\_safety\\_manual.html](http://www.uow.edu.au/content/groups/_safety_manual.html)>
- Warson, H. & Finch, C. A. (2001). *Applications of Synthetic Resin Latices: Fundamental chemistry of latices and applications in adhesives*. New York: John Wiley and Sons.
- Wood, N. T. & Solomon, M. R. (2009). *Virtual social identity and consumer behavior*. M.E. Sharpe.
- Yuniya, K. (2005) *Fashion-ology: An introduction to fashion studies: Dress body Culture*. London: Berg.
- Zieman, N. (2004) *Sew with Confidence: A Beginner's guide to basic sewing*. London: Krause Publications Craft.

## Appendix 1: Respondents' Questionnaire

### SECTION A: DEMOGRAPHIC INFORMATION

Gender                      Female                       Male

Institution type            TTI                       IST

Which of the following departments do you belong to?

Clothing technology                       Applied Sciences                       Electrical Engineering

### SECTION B: FACTORS INFLUENCING SELECTION OF PROTECTIVE CLOTHING

1. Do you think colour is important when selecting protective clothing?

Yes                       No

2. Is protective clothing affordable bearing in mind its price?

Yes                       No

3. Have you ever been hurt during a practical lesson because of lack of appropriate selection of protective clothing?

Yes                       No

4. Does appropriate selection of protective clothing increase safety during a practical lesson?

Yes                       No

Expound on your answer

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5. Give any other comment (s) on Selection \_\_\_\_\_

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**If you belong to Electrical Engineering department answer these questions before moving to section C otherwise skip to Section C now.**

6. Do you have boots with safety toecaps for use in workshops?

Yes  No

7. Do you have shock resistant gloves?

Yes  No

8. Do you have knee caps for use in workshop?

Yes  No

9. Do you have either an overall a dust coat?

Yes  No

10. Do you think the overall/ dust coats used in Electrical engineering have adequate resistance to fire

Yes  No

**SECTION D: FACTORS INFLUENCING SAFETY USE OF PROTECTIVE CLOTHING**

11. Do you think your workshop provides adequate training for people of their

service charge? Yes  No

12. Do you think your workshop provides adequate training for people of their

service charge? Yes  No

13. What is your main concern in wearing of the protective clothing?

**SECTION C: FACTORS INFLUENCING USE OF PROTECTIVE CLOTHING**

11. Please indicate whether you: Strongly agree (1), Agree (2) Neutral (3) Disagree (4) Strongly disagree (5)

I feel uncomfortable wearing protective clothing.	
I think the price of protective clothing is affordable	
I feel more confident because selection of protective clothing by the department was done appropriately.	
Wearing protective clothing makes it much more difficult to perform tasks.	
Use of protective clothing is very important	
I like wearing the protective clothing that is required in practical lessons in my course.	
Training on use of protective clothing at work is very important	
The protective clothing available in the institution is adequate.	
I do not understand why most of the protective clothing should be used during practical lessons.	
There are many other priorities that the institution should direct funds to other than protective clothing.	

12. Have you ever received any training on the use of protective clothing?

Yes

No

13. Give any other comment (s) on

Use \_\_\_\_\_  
\_\_\_\_\_

**SECTION D: FACTORS INFLUENCING MAINTENANCE OF PROTECTIVE CLOTHING**

14. Do you think each student need a lockable wardrobe for storage of their protective clothing?

Yes

No

15. Do you have access to cleaning services for protective clothing in your institution?

Yes

No

16. Who in your opinion should be involved in cleaning of the protective clothing?

Student Lab technician Dry cleaner Explain \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_17. What needs to be improved as far as storage facilities are concerned?  
\_\_\_\_\_  
\_\_\_\_\_

18. Do you have storage facilities for protective clothing in the department?

Yes No Comment on the facility adequacy or inadequacy  
\_\_\_\_\_  
\_\_\_\_\_

19. Are storage facilities adequate in your department?

Yes No Expound on your answer  
\_\_\_\_\_  
\_\_\_\_\_

20. In case of damage of the protective clothing, are the students made to replace the damaged item?

Yes No Comment  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

21. Give any other comment (s) on

Maintenance \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_**Thank you for taking your time to fill in this questionnaire**

**Appendix 2: Checklist on issues to be considered in the selection of protective clothing**

	<b>Type of protective clothing</b>	<b>Issues</b>
1	Respirator	<ul style="list-style-type: none"> <li>• Is the environment regularly monitored for hazardous substances</li> <li>• Are there other control measures in place to contain the hazard</li> <li>• Is respirator fit conducted</li> <li>• Respirator limitations considered</li> <li>• Training in the use, storage and maintenance of the respirators</li> </ul>
2	Eye protection	<ul style="list-style-type: none"> <li>• Does it offer adequate protection against the hazard</li> <li>• Does it distort the vision of the user</li> <li>• Does it limit peripheral vision</li> <li>• Are there gaps between the side shields and face which might allow particles to enter.</li> </ul>
3	Face protection	<ul style="list-style-type: none"> <li>• Does it offer adequate protection against the hazard</li> <li>• Is eye protection also needed</li> <li>• Does it distort the vision of the user</li> <li>• Does it limit peripheral vision</li> <li>• Are there gaps between the side shields and face which might allow particles to enter.</li> </ul>
4	Head protection	<ul style="list-style-type: none"> <li>• Does it offer protection against the hazard</li> <li>• Are liners, chin straps and sweatbands used to keep it in place</li> <li>• Will it fit properly</li> <li>• Does it affect movement of the head</li> <li>• Will it be too bulky</li> </ul>
5	Hearing protection	<ul style="list-style-type: none"> <li>• Does it offer adequate protection against noise</li> <li>• Are they comfortable to wear</li> <li>• Are they comfortable to wear</li> <li>• Are ear muffs adjustable</li> <li>• Any associated medical conditions with wearing ear protectors</li> <li>• Does it create pressure to the chin, head or behind the ears</li> <li>• Are there any other system in place to alert wearer of any emergencies</li> </ul>
6	Hand protection	<ul style="list-style-type: none"> <li>• Is it of adequate length to protect against the hazard</li> <li>• is it to the correct size</li> <li>• does it offer adequate protection or is it suitable to be used against the hazard.</li> <li>• Will it restrict hand movement or interfere with the task</li> <li>• Is it too slippery or too bulky</li> </ul>
7	Leg and foot protection	<ul style="list-style-type: none"> <li>• Does it offer adequate protection against the hazard</li> <li>• Is it too bulky</li> </ul>

		<ul style="list-style-type: none"><li>• Is it comfortable to wear</li></ul>
8	Body protection	<ul style="list-style-type: none"><li>• Is the clothing of the right size</li><li>• Does it offer adequate protection against the hazard</li><li>• Is it comfortable to wear</li></ul>
9	Fall protection	<ul style="list-style-type: none"><li>• Is the harness suitable for the task at hand</li><li>• Does it fit the user</li><li>• Will it interfere with the task</li></ul>

Source: University of St. Andrews 2008/ University of Wollongong, 2009.

**Appendix 3: Distribution of TTIs AND ISTs in Kenya**

Provinces	TTIs	ISTs	Totals
Coast	1	1	2
Western	4	3	7
Central	3	5	8
North Eastern	1	0	1
Eastern	3	2	5
Nyanza	0	3	3
Rift Valley	4	2	6
Nairobi	3	0	3
Total	19	16	35

Source: GoK, 2011

## Appendix 4: Map of Kenya showing study area



Source: <http://www.mapsofworld.com/Kenya/Kenya-political-map.html>

## Appendix 5: Budget

ITEM	UNIT	UNIT COST Kshs.)	TOTAL (Kshs.)
Lap top	1	60,000.00	60,000.00
Digital camera	1	10,000.00	10,000.00
<b>Printing of research instruments</b>			
Questionnaires	300	20	6,000.00
Flash disks	2	1,000.00	2,000.00
Compact Disc.	10	20.00	200.00
<b>Stationery,</b>			
Pens	10	20.00	200.00
Pencils,	10	10.00	100.00
Rubbers	6	20.00	120.00
<b>Proposal</b>			
Typing	500	20.00	10,000.00
Printing	500	10.00	5,000.00
Photocopying	1,000	2.00	2,000.00
Binding	8	50.00	400.00
Transport	-	-	12,000.00
<b>Thesis</b>			
Typing	500	20.00	10,000.00
Printing	500	10.00	5,000.00
Photocopying	1,000	2.00	2,000.00
Draft binding	10	100.00	1000.00
Final thesis binding	6	500.00	3000.00
Miscellaneous	-	-	12,000.00
<b>Total direct costs</b>			<b><u>129,120.00</u></b>
<b>Overheads</b>			<b><u>12922.00</u></b>
<b>Grand total</b>			<b><u>141,042.00</u></b>

**Appendix 6: University Research Authorization Letter**



**KENYATTA UNIVERSITY  
GRADUATE SCHOOL**

E-mail: [kubps@yahoo.com](mailto:kubps@yahoo.com)  
[dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)  
 Website: [www.ku.ac.ke](http://www.ku.ac.ke)

P.O. Box 43844, 00100  
 NAIROBI, KENYA  
 Tel. 8710901 Ext. 57530

Our Ref: H60/12138/09

Date: 17<sup>th</sup> December, 2010

The Permanent Secretary,  
 Ministry of Higher Education, Science & Technology,  
 P.O. Box 30040,  
**NAIROBI**

Dear Sir/Madam,

**RE: RESEARCH AUTHORIZATION FOR KIMEMIA MILLICENT WAMUYU  
 REG.NO H60/12138/09**

I write to introduce Kimemia Millicent Wamuyu who is a Postgraduate Student of this University. She is registered for a MSc degree programme in the Department of Fashion, Design and Marketing in the School of Applied Human Sciences.

Ms. Wamuyu intends to conduct research for a Proposal entitled, "Factors Influencing Selection, Use and Maintenance of Protective Clothing by Students in Technical Institutions in Central Kenya".



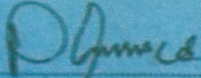
Any assistance given will be highly appreciated.

Yours faithfully,

**JOHN M ODONGI**  
**FOR: DEAN, GRADUATE SCHOOL**

JMO/rm

## Appendix 7: Research Clearance Permit

PAGE 2	PAGE 3
THIS IS TO CERTIFY THAT:	Research Permit No. <u>NCST/RRI/12/1/SS-011/95</u>
Prof./Dr./Mr./Mrs./Miss <u>MILLICENT</u>	Date of Issue <u>07/02/2011</u>
<u>WAMUYU KIMENIA</u>	Fee received <u>SHS 1,000</u>
of (Address) <u>KENYATTA UNIVERSITY</u>	
<u>P.O. BOX 43844, NBI</u>	
has been permitted to conduct research in <u>TECHNICAL INSTITUTIONS</u>	
<u>TECHNICAL INSTITUTIONS</u> District,	
<u>CENTRAL</u> Province,	
on the topic <u>Factors influencing</u>	
<u>selection, use and maintenance of</u>	
<u>protective clothing by Students</u>	
<u>in technical Institutions in</u>	
<u>Central Kenya.</u>	
for a period ending <u>31ST DECEMBER 2011</u>	
	 Applicant's Signature
	 Secretary National Council for Science and Technology

## CONDITIONS

1. You must report to the District Commissioner and the District Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed with-out prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) four(4) bound copies of your final report for Kenyans and non-Kenyans respectively.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice



REPUBLIC OF KENYA

RESEARCH CLEARANCE  
PERMIT

**Appendix 8: NCST Research Authorization Letter**

REPUBLIC OF KENYA

**NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY**

Telegrams: "SCIENCETECH", Nairobi  
 Telephone: 254-020-241349, 2213102  
 254-020-310571, 2213123.  
 Fax: 254-020-2213215, 318245, 318249  
 When replying please quote

P.O. Box 30623-00100  
 NAIROBI-KENYA  
 Website: www.ncst.go.ke

Our Ref:

**NCST/RRI/12/1/SS-011/95/4**

Date:

**7<sup>th</sup> February 2011**

Millicent Wamuyu Kimemia  
 Kenyatta University  
 P. O. B OX 43844  
 NAIROBI

**RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on "*Factors influencing selection, use and maintenance of protective clothing by students in Technical Institutions in Central Kenya*" I am pleased to inform you that you have been authorized to undertake research in Central Province for a period ending **31<sup>st</sup> December 2011**.

You are advised to report to the **District Commissioner in Central Province and the Principals of the selected Technical Institutions** before embarking on the research project.

On completion of the research, you are expected to submit **one hard copy and one soft copy** of the research report/thesis to our office.

A handwritten signature in black ink, appearing to read 'P. Nyakundi'.

**P. N. NYAKUNDI**  
**FOR: SECRETARY/CEO**

Copy to:

The District Commissioners  
 Districts in Central Province

The Principals  
 Technical Institutions in Central Province